BILATERAL TRANSFER IN THE MOTOR DEVELOPMENT OF CHILDREN BY USING GAMES AND PHYSICAL ACTIVITY: A SYSTEMATIC REVIEW

[1]Nebojša Ilić.
[1]Elementary School „Joca Milosavljević“, Bagrdan, Serbia.

ISSN 1840-152X
UDK: 796.012.1-053.2
https://doi.org/10.7251/SIZ2501017I
https://sportizdravlje.ues.rs.ba/index.php/sah
https://doisrpska.nub.rs/index.php/SIZ

REVIEW SCIENTIFIC ARTICLE

Abstract: Regular participation in physical activities, such as sports games and exercises that engage both extremities, plays a key role in the development of children bilateral transfer. Through such activities, children acquire the ability to transfer skills and movements learned by using both extremities, which can be vital for their motor coordination and performance in various activities. The goal of this systematic review was to determine, based on the previous researches, the effects of games and other types of physical activities on bilateral transfer in motor development of children. Research data were collected by taking inclusion and exclusion criteria into account on PubMed, Web of Science and Google Scholar. As a result of the evaluation carried out within these criteria, twenty (N = 20) original scientific studies were included in this research. The main findings of the research indicate that bilateral transfer programs, which include elementary games or programmed practice sessions, as well as programmed soccer exercises, have a positive effect on the bilateral transfer of children aged 3-12 years. These findings are in accordance with the results of the previous researches, done with adults, which were also analyzed, and suggest that short-term or long-term side-to-side transfer can be achieved in a wide range of age groups.

Keywords: bilateral transfer, improvement, motor skills, motor development, youth.

INTRODUCTION

The issue of motor development in preschool children is the topic often discussed, due to extremely low levels of physical activity that our society faces, which could soon turn into an epidemic. Movement is an important factor in healthy growth and development of the body (Graham, 1992), while games and physical activity allow preschool children to develop motor skills that will serve as a basis for future learning and development of complex motor skills (Shenouda et al., 2011). In the first six years of their lives, children explore their bodies and their surroundings through movements and activities. Previous research has confirmed that low physical activity results in reduced motor skills in children (Malina et al., 2004),

while higher levels of physical activity lead not only to improved physical fitness, but also to the improvement of intellectual abilities and emotional state (Malina et al., 2004), which is extremely important for the overall development of the child. Lateralization refers to one hemisphere tending to be more responsible for a particular function. The emergence of this concept dates back to the 1860s, when conducted researches proved asymmetric brain functions. In the related literature, the number of studies on lateralization of the lower extremities is significantly less extensive than those about lateralization of the upper extremities (Erdil et al., 2016). Regarding this, a research on the impact of different bilateral exercises can contribute to a better understanding of the children's overall motor development.

The ability of a person to learn or perform a particular skill with one limb, that has already been learned with the opposite limb, is generally called bilateral transfer (BT) (Ammons, 1958). Children show more or less expressed motor laterality, which is reflected in the preferred (dominant) part of the body (Bozkurt et al., 2020). Although the acquisition of motor skills is mostly performed with the dominant side of the body, situational action with both dominant and non-dominant side of the body is vital for many sports games (Bozkurt et al., 2020). The ability to learn a particular skill more easily with one arm or leg after the skill has been learned with the opposite arm or leg, is associated with what is called BT (Magill, 1993), as mentioned earlier. This is the most reasonable way to accelerate the process of individual success in learning. The fact that initial practice of a motor task with one side of the body leads to subsequent performance of the other, has been shown in many studies investigating upper and lower limb movements (Teixeira et al., 2003) However, only a few studies have investigated bilateral practice of sports skills related to lower limbs, nor they included experienced athletes, especially in team sports, and the few studies that were found indicate inconsistent results. Most studies investigate non-athlete populations (Byrd et al., 2000; Liu & Wrisberg, 2005; Akbari et al., 2009; Bellows et al., 2013; Erdil et al., 2016; Rajovic et al., 2016; Magalón et al., 2020; Hussain et al., 2022; Ljubičić et al., 2022; Chen et al., 2023). In this regard, although these studies do not investigate bilateral transfer in children who are already involved in sports, they can provide a picture of BT in children if they want to get involved in sports later, which can facilitate the process of learning certain technical elements. The mentioned studies (Byrd et al., 2000; Liu & Wrisberg, 2005; Akbari et al., 2009; Bellows et al., 2013; Rajović et al., 2016; Magallón et al., 2016; Bozkurt et al., 2020; Hussain et al., 2022; Chen et al., 2023;) showed that bilateral transfer programs, which encourage the use of dominant and non-dominant sides, have a positive effect on the bilateral transfer of children aged 3-12 years. Despite the obvious importance of bilateral transfer for the performance of some types of sports skills, researchers in sports science have so far have only sporadically investigated bilateral transfer. Studies investigating bilateral transfer of motor skills have generally involved a predetermined, fixed learning criterion for all subjects (Hicks et al., 1983). Most of these researches have used perceptual-motor tasks, such as mirror tasks and rotational tracking (Grignon, 1985). That is why this work has the advantage of systematizing the literature that investigates the effects of games and other types of physical activities on bilateral transfer in children's development. Therefore, the goal of this work was to determine, based on previous

researches, the effects of games and other types of physical activities on bilateral transfer in children's motor development.

METHODS

This research was designed by using a technique of systematic literature review. Research data were collected considering the inclusion and exclusion criteria of the research which was published as a result of a search conducted using the keywords such as: bilateral transfer, development, motor skills, children, both in Serbian and English. The search was performed on the Web of Science, Google Scholar, PubMed, WoS, Scopus and MedLine databases in an electronic environment between April 4th and May 10th 2024, in accordance with the guidelines of Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) (Moher et al., 2009) (Figure 1).

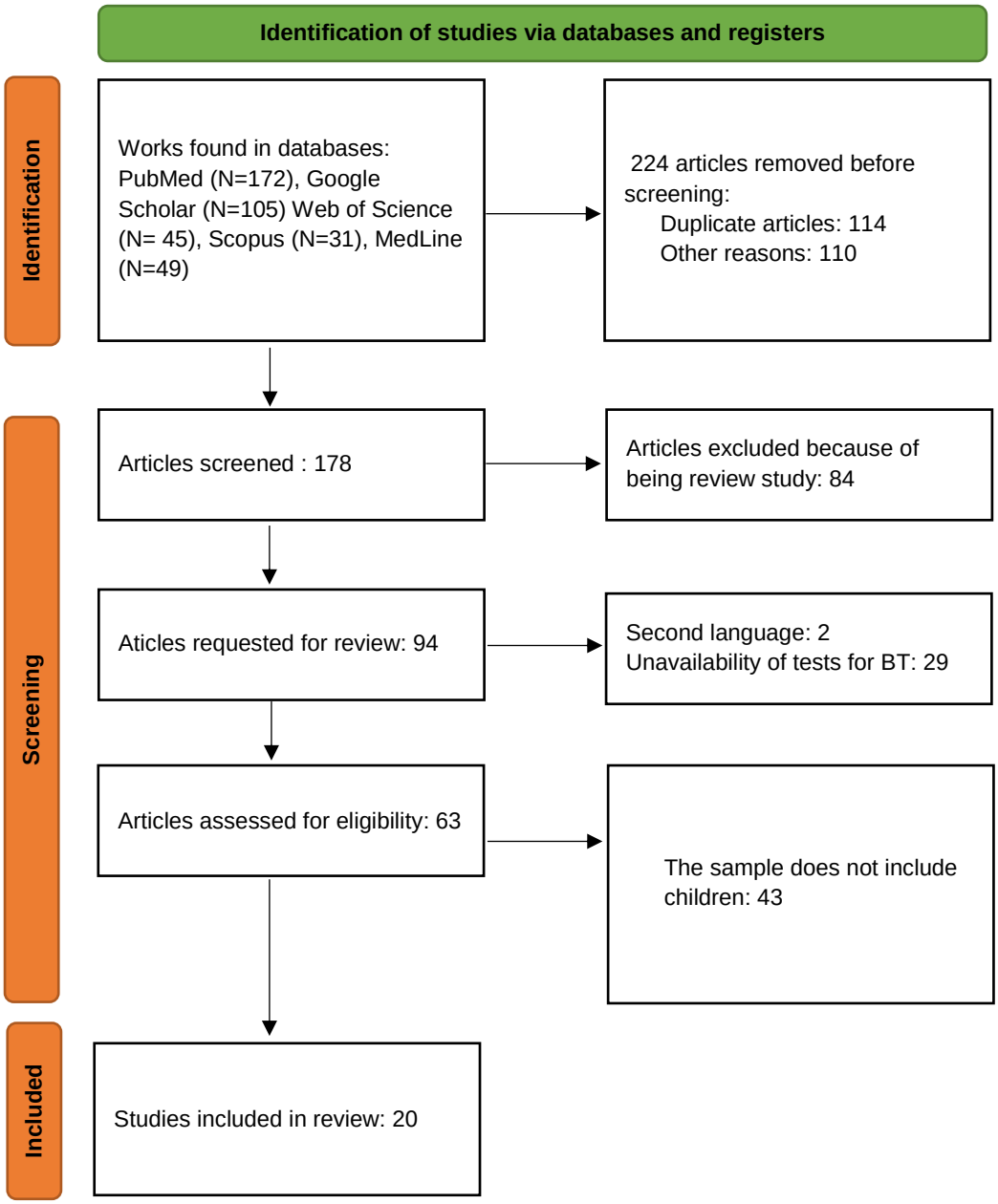
Inclusion criteria:

- The sample of examinees should consist of children;
- Research must apply a program of physical exercise or elementary games;
- Tests that evaluate bilateral transfer in children must be shown in research;
- Research should be published as an article in English or Serbian in the period between years 2011 and 2024;
- The research should be published as an original article entirely in English or Serbian.

Exclusion criteria:

- Sample of older adolescents or adults;
- The research does not include any form of physical activity/movement;
- The research does not include tests for bilateral transfer;
- It's published before year 2011;
- Articles where only abstracts or systematic reviews are available are not included in the research.

Chart 1. Selection proces (Origin: Prisma 2020 flow diagram for new systematic review[1])



[1] http://prisma-statement.org/prismastatement/flowdiagram.aspx?AspxAutoDetectCookieSupport=1

RESULTS

This part presents the results of previous research on the given topic. Researches are analyzed in detail and presented as follows: first author of the study and the year of publication; sample, ie. basic parameters of respondents participating in the research; experimental program (duration of the program and exercises that were applied during it); the results that the researchers reached during the research.

Table 1. Results

Author/Year	Sample	Experimental program	Research results
Stöckel et al. (2011)	N= 52 17 F 35 M EG=26 CG=26 11-12 years	6 weeks, 12 sessions of 45 min (exercises of technical elements performed with the non-dominant hand)	EG had improvements in BT, where they showed similar times to perform the test (task) with the dominant and non-dominant hand
Senff et al. (2011)	N=64 EG1=16 EG2=16 EG3=16 KG=16 11-12 years	40 sessions of performing the exercise with the dominant and non-dominant hand (exercises of switching objects - sliding task)	All EGs had better BT in terms of reduction in time required to perform the task with the non-dominant hand, whatever order of practice was used
Stöckel et al. (2012)	N=16 12 years EG= 16	4 weeks, 2 times a week for 45 minutes (precision exercises performed with the dominant and non-dominant hand)	The results indicate that BT is better if the same exercise is performed with the dominant and non-dominant hand
Bellows et al. (2013)	N= 201 3-5 years EG= 103 CG= 98	18 weeks, 4 times a week, 15-20 min, 72 sessions in total. Running, jumping, manipulative tasks, stabilization exercises, ball exercises	The intervention led to significant changes in BT in children in EG (p= .001) and was a strong predictor of good motor development
Rajovic et al. (2016)	N= 45 4-6 years EG= 23 CG= 22	6 months, 2 times a week (Elementary games that were applied in kindergarten)	Children from EG had better BT, (p= .004), while there were no differences in other MS on IT and FT (CG regular PA)
Erdil et al. (2016)	N= 80 11-12 years EG= 80	8 weeks. Elements in football (dribbling, juggling, passing, shooting, shooting over the live wall)	There were no significant differences in IT and FT among subjects. The authors hypothesize that previous participation in foodball training led to a good development of BT
Magallón et al. (2016)	N=90 6-12 years EG= 45 CG= 45	20 sessions of motor coordination tasks (10 with the dominant 10 with the non-dominant hand)	There were significant differences on the BT test in EG, indicating that bilateral exercises have a positive

			acute effect on coordination (p= .01)
Stanley et al. (2016)	N= 62 3-5 years EG= 32 CG= 32	6 weeks, 2 sets of 20 min per week in kindergartens Jump exercises (6 types of jumps)	Children from the experimental group had significant BT after 6 weeks of practicing jump exercises
Land et al. (2016)	N=45 14-15 years EG=45	60 sessions with dominant and non-dominant hand (6 rounds of 10 repetitions with 3s pauses between repetitions). Taping exercises with dominant and non-dominant hand.	The findings suggest that visualization training may benefit BT primarily in the initial stages of learning, while prolonged training through physical practice leads to a greater impact on the same.
Bellows et al. (2017)	N=51 3-5 years EG= 26 CG= 25	25 sessions of motor coordination exercises, running, strength exercises, balance. Object control	After 25 sessions there were significant differences in the tested BT variables (balance, coordination) in EG (p= .05)
Bonney et al. (2017)	N=111 6-10 years EG= 56 CG= 55	5 weeks, 2 sets of 20 min per week. Slalom exercises, jumps, balance, running with a change of direction	After 5 weeks, children from EG had a significant improvement in BT compared to children from CG (p= 0.05).
Buchele et al. (2018)	N=116 10-11 years EG1= 31 EG2= 29 KG= 56	EG1 - 4 weeks, 5 times a week for 6 minutes (coordination exercises of the upper and lower limbs)	Children from EG1 had better BT in terms of coordination, reaction speed, compared to children from EG2 and KG who did not receive additional treatment
Wang et al. (2020)	N= 268 3-6 years EG= 134 CG= 134	Elementary games with a ball (various sports games with the aim of developing motor skills. EP – 4 weeks, 2 sets of 30 min.	There were significant differences on FT in children from EG to BT (coordination, dexterity)
Bozkurt et al. (2020)	N= 24 9-10 years EG= 12 CG= 12	16 weeks. Elements in football (dribbling, juggling, passing, shooting)	BT in children from EG was significantly higher compared to children from CG, which is very useful in football (especially with the mentioned technical elements)
Chen et al. (2021)	N= 695 9-10 years EG= 347 CG= 348	16 weeks, 2 times a week for 40 minutes (coordination exercises from football and basketball)	Better BT in children from EG, better cognitive results as well as cardiorespiratory fitness
	N= 314 9-10 years	8 weeks, 32 sessions of 40 minutes each (exercises	Better BT with EG, which reflected in better results on coordination

Chen et al. (2021)	EG=156 CG=158	involving lateral movement)	and technique tests
Hussain et al. (2022)	N= 103 7-10 years EG1= 26 EG2= 26 EG3= 26 CG= 25	3 EG (ball - overhead throw, underhand throw, catching and overhead or underhand throw). All participants were involved (4 × 20 = 80 per session). EG1: 10; EG2 – 15; EG3- 20 sessions	Group EG3 showed the best results on FT of BT, which indicates that the frequency of exercise in the development period is an important factor for improving BT
Ljubicic et al. (2022)	N= 74 7-12 years EG= 37 CG= 37	2 hours per week, 12 weeks (one-legged jumps, side jumps, hurdles, platform jumps, mat jumps, high jump, long jump...)	Children who were in EG had better results on BT (bilateral coordination) tests (p= .05). The authors indicate that the application of these exercises is essential for symmetrical neuromuscular benefits in children
Chen et al. (2023)	N= 174 3-6 years EG= 174	They followed the association between the use of ball games and bilateral transfer in Chinese children over a 6-month period	Children who participated more often in games (with or without a ball) had a higher degree of BT compared to children who were not involved in games (p= .05).
Shi et al. (2024)	N= 56 5-6 years EG=28 CG=28	12 weeks, 3 times a week for 35 min (elementary games and exercises based on specific football exercises)	A 12-week program improved the BT of EG children

Legend: N – number of respondents; EG – experimental group; CG – control group; IT – initial testing; FT – final testing; BT – bilateral transfer; EP – experimental program; MS - motor skills, PA - physical activity, EG - elementary games.

Looking at the reviewed and analyzed reseach in Table 1, it can be concluded that the number of respondents did not vary greatly from study to study. The smallest number of 24 respondents was in the study by Stöckel et al. (2012), while the largest number of respondents was in the study by Chen et al. (2021), 695 respondents. When we look at the age characteristics of the respondents, i.e. their age, it can be seen that the analyzed studies included respondents of different ages, in the range of 3-15 years. The youngest sample was present in the work of Bellows et al. (2013), only 3 years old, while an age group of 12 years old was observed in the studies of Erdil et al., 2016; Magallón et al., 2016; Ljubicic et al., 2022. The oldest samples were in the study of Land et al., 2016. with subjects aged up to 15 years. In four studies, the subjects comprised only the experimental group (EG)(Stöckel et. al., 2012; Erdil et al., 2016; Land et. al. 2016; Chen et al., 2023;), while the study by Hussain et al. (2022) had 3 EG and one control group (CG). The remaining 15 studies divided the respondents into EG and CG (Stöckel et al. 2011; Senff et al. 2011; Bellows et al., 2013; Stanley et al., 2016; Rajovic et al., 2016; Magallón et al., 2016, Bellows et al., 2017; Bonney et al., 2017; Buchele et al., 2018; Bozkurt et. al. 2020; Wang et al., 2020; Chen et al. 2021; Chen et al., 2021; Ljubicic et al., 2022; Shi et al.,

2024). Therefore, based on the research objective, a total of 20 original scientific studies on the given topic were collected and analyzed. Based on the results shown in the table (Table 1), it can be seen that bilateral transfer programs, which include elementary games or exercises that encourage the use of the dominant and non-dominant side, have a positive effect on the bilateral transfer of children aged 3-15 years.

DISCUSSION

The aim of this study was to review the literature that investigates bilateral transfer in the development of children's motor skills using games and other types of physical activities. Based on that, 20 original scientific studies closely related to the given topic were found and analyzed in detail. The main findings of this study suggest that bilateral transfer programs, which include elementary games or exercises that encourage the use of the dominant and non-dominant side, positively influence the bilateral transfer of children aged 3-15 years. The "recording" of current BT is consistent with the results of previous studies with adults (Chavez & Coker, 2000) and suggests that short-term limb-to-limb transfer can be achieved across a wide range of age groups.

Regular participation in physical activities, such as sports games and exercises that engage both limbs, plays a key role in the development of bilateral transfer in children. Through such activities, children acquire the ability to transfer skills and movements. learned with one limb, to the other one, which can be vital for their motor coordination and performance in various activities (Kohl & Roenker, 1980; Rouissi et al., 2016; Chen et. al., 2021). In this regard, all the works shown in the table (Table 1.) investigate the bilateral transfer itself in the development of children's motor skills due to the application of physical activities, physical exercise programs or children's games in order to improve motor skills in children aged 3-12 years. Stanley et al. (2016) implemented a 6-week program of jumping exercises in kindergartens and found that EG had significant BT after 6 weeks. Bonney et al. (2017) found that after 5 weeks of practicing slope, jumps, balance exercises and running with a change of direction and azimuth, children aged 6-10 years improved their BT. Bonney et al. (2017) found that after 5 weeks of practicing slope, jumps, balance exercises and running with a change of direction and azimuth, children aged 6-10 years improved their BT. Bellows et al. (2017) found that after 25 sessions of combined exercises (motor coordination, strength, balance, running and controlling objects) children had significant BT. Ljubicic et al. (2022) on a sample aged 7-12 years, applying a twelve-week program that includes: one-legged jumps, side jumps, hurdles, platform jumps, mat jumps, high jump and long jump, found that bilateral coordination improved. On the other hand, Magallón et al. (2016) applied 20 sessions of motor coordination tasks at the same age and found the same as Ljubicic et al. (2022). Hussain et al. (2022) applied: overhead throwing, underhand throwing, catching and overhead or underhand throwing in 3 EG and found that BT was significant, independent of the number of sessions in the range of 10-20 sessions, indicating an acute effect of these exercises on BT.

Stöckel et al. (2011) found that a 6-week program of practicing technical elements with the non-dominant hand can improve BT where EG subjects showed

similar times for performing the test (task) with the dominant and non-dominant hand, which was also observed in the study by Senff et al. (2011) after 40 sessions of performing activities with the dominant and non-dominant hand, with the difference that in this study only one task was present, object shifting. Also, Stöckel et al. (2012) showed that a 4-week program of precision exercises performed with the dominant and non-dominant hand resulted in better BT. Land et al. (2016) with 60 sessions of dominant and non-dominant hand (6 rounds of 10 repetitions with 3s pause between repetitions) of tapping exercises proved that this type of training contributed to the improvement of BT. Buchele et al. (2018) showed by applying a 4-week training with 5 trainings per week for 6 minutes each (coordination exercises of the upper and lower limbs) that children from EG had better BT in terms of coordination and reaction speed. Also, Chen et al. (2021) applied 16 weeks of training 2 times a week for 40 minutes of coordination exercises in football and basketball and showed improvements in BT in children from EG, and also better cognitive results as well as cardiorespiratory fitness. Also, Shi et al. (2024), with the help of a 12-week program of elementary games based on football exercises with 3 training sessions per week for 35 minutes, managed to improve the BT of children aged 5-6 years.

Regular participation in elementary games, such as running, jumping, ball games, and other activities that require the engagement of both limbs, plays an important role in the development of bilateral transfer in children (Wang et al., 2020). Through these games, children acquire the ability to transfer skills and movements learned on one limb to the other one, which contributes to the development of motor coordination and dexterity. Therefore, supporting children's participation in elementary games is crucial for their overall development of motor skills (Tousi et al., 2012). Several studies have analyzed the effects of elementary games on BT (Rajovic et al., 2016; Wang et al., 2020) on a sample of children aged 4-6 years. Bellows et al. (2013) applied, on a young sample of 3-5 years, a program of 18 weeks, 4 times a week, for 15-20 min (running, jumping, manipulative tasks, stabilization exercises, exercises with a ball), which led to a significant BT in of children from EG, Wang et al. (2020) showed that elementary ball games significantly affect BT in these children.

Football, Basketball and other sports

Participation in soccer programs can significantly contribute to the development of bilateral transfer in children, since this sport requires the use of both legs in different situations during the game. By practicing basic football skills such as dribbling, passing and shooting, children can improve coordination and dexterity on both sides of their body (Witkowski et al., 2011). Several studies in this review analyzed the effects of football programs on BT in children aged 9-12 years (Erdil et al., 2016; Bozkurt et al., 2020). Bozkurt et al. (2020) essentially found that a 16-week football program (dribbling, dribbling, passing, shooting) led to significant BT in children aged 9–10 years. On the other hand, Erdil et al. (2016) determined, on a sample aged 11-12 years, that an eight-week football program with similar elements led to an improvement in BT, which means that the results of studies done on this specific topic are in agreement, as is the case with the adolescent population

(Witkowski et al., 2011). Finally, Chen et al. (2023) monitored the association between the use of ball games and bilateral transfer in Chinese children over a 6-month period and found that children who participated in the games more often (with or without a ball) had a higher degree of BT. This research has several shortcomings that are worth mentioning. First, there are few studies examining bilateral transfer using different programs, to our knowledge. Second, the inhomogeneity of the used programs did not allow us to perform a meta-analysis and determine program-specific effects.

CONCLUSION

The aim of this research was to review the relevant literature that deals with the research of bilateral transfer in the development of children's motor skills through the application of games and other physical activities. Based on the literature review, 20 original scientific studies closely related to this particular area of research were analyzed. The main conclusions of this research indicate that bilateral transfer programs, which include basic games or exercises that encourage the use of both sides of the body, have a positive effect on bilateral transfer in children aged 3 to 15 years. These findings are in accordance with the results of earlier studies with adults, and suggest that short-term limb-to-limb transfer can be achieved in different age groups.

REFERENCES

Akbari, H., Abdoli, B., Shafizadeh, M., & Ziaee, V. (2009). The effect of traditional games in fundamental motor skill development in 7-9 year-old boys. *Iranian Journal of Pediatrics, 19*(2), 1-7.

Ammons, R. B. (1958). *Cussent psychological issues*. Human Kinetics.

Bellows, L. L., Davies, P. L., Anderson, J., & Kennedy, C. (2013). Effectiveness of a physical activity intervention for Head Start preschoolers: A randomized intervention study. *American Journal of Occupational Therapy, 67*(1), 28-36.

Bellows, L. L., Davies, P. L., Courtney, J. B., Gavin, W. J., Johnson, S. L., & Boles, R. E. (2017). Motor skill development in low-income, at-risk preschoolers: A community-based longitudinal intervention study. *Journal of Science and Medicine in Sport, 20*(11), 997-1002.

Bonney, E., Jelsma, L. D., Ferguson, G. D., & Smits-Engelsman, B. C. (2017). Learning better by repetition or variation? Is transfer at odds with task specific training? *PLoS One, 12*(3), e0174214.

Bozkurt, S., Çoban, M., & Demircan, U. (2020). The effect of football basic technical training using unilateral leg on bilateral leg transfer in male children. *Journal of Physical Education, 31*, 1-10.

Buchele Harris, H., Cortina, K. S., Templin, T., Colabianchi, N., & Chen, W. (2018). Impact of coordinated-bilateral physical activities on attention and concentration in school-aged children. *Biomed Research International, 2018,* 2539748.

Byrd, R., Gibson, M., & Gleason, M. H. (2000). Bilateral transfer across ages 7 to 17 years. *Perceptual and Motor Skills, 62*(1), 87-90.

Chavez, J. N., & Coker, C. A. (2000). Effect of practice sequence on the bilateral acquisition of a novel motor skill. *Research Quarterly for Exercise and Sport, 71*(1), A-55.

Chen, J., Song, W., Zhao, X., Lou, H., & Luo, D. (2023). The relationship between fundamental motor skills and physical fitness in preschoolers: A short-term longitudinal study. *Frontiers in Psychology, 14*, 1270888.

Chen, J., Wang, X., & Chen, W. (2021). Impact of bilateral coordinated movement on manipulative skill competency in elementary school students. *Children (Basel), 8*(6), 517.

Chen, W., Wang, X., Gu, X., & Chen, J. (2021). The impacts of coordinated-bilateral ball skills intervention on attention and concentration, and cardiorespiratory fitness among fourth-grade students. *International Journal of Environmental Research and Public Health, 18*(21), 11634.

Erdil, G., Yorulmaz, H., Olcucu. B., & Bülbül, A. (2016). Effect of 8 weeks bilateral football training program for 11-12 age group children over learning transfer and permanency of the learning transfer. *International Journal of Academic Research, 8*(5), 1-10.

Graham, G. (1992). Developmentally appropriate physical education for children. *Journal of Physical Education, Recreation & Dance, 63*(6), 29–30.

Hicks, R. E., Gualtieri, C. T., & Schroeder, S. R. (1983). Cognitive and motor components of bilateral transfer. American Journal of Psychology, 96, 223–228.

Hussain, B., & Cheong, J. P. G. (2022). Improving gross motor skills of children through traditional games skills practiced along the contextual interference continuum. *Frontiers in Psychology, 13*, 986403.

Kohl, R. M., & Roenker, D. L. (1980). Bilateral transfer as a function of mental imagery. *Journal of Motor Behavior, 12*, 197–206.

Land, W. M., Liu, B., Cordova, A., Fang, M., Huang, Y., & Yao, W. X. (2016). Effects of physical practice and imagery practice on bilateral transfer in learning a sequential tapping task. *PLoS One, 11*(4), e0152228.

Liu, J., & Wrisberg, C. A. (2005). Immediate and delayed bilateral transfer of throwing accuracy in male and female children. *Research Quarterly for Exercise and Sport, 76*(1), 20-27.

Ljubičić, S., Antekolović, Lj., & Petrić, V. (2022). Integration of bilateral coordination in children's motor learning process. *Journal of Elementary Education, 15*(3), 285-299.

Magallón, S., Narbona, J., & Crespo-Eguílaz, N. (2016). Acquisition of motor and cognitive skills through repetition in typically developing children. *PLoS One, 11*(7), e0158684.

Magill, R. A. (1993). *In motor learning concepts and applications.* Brown and Benchmark.

Malina, R., Bouchard, C., & Bar-Or, O. (2004). *Growth, maturation, and physical activity (2nd edition).* Human Kinetics.

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). The PRISMA Group. Reprint—Preferred reporting items for systematic reviews and meta analyses: The PRISMA statement. *Physical Therapy, 89*, 873–880.

Rajović, R., Berić, D., Bratić, M., Živković, M., & Stojiljković, N. (2016). Effects of an "NTC" exercise program on the development of motor skills in preschool children. *Facta Universitatis, Physical Education and Sport, 14*(3), 315-329.

Rouissi, M., Chtara, M., Owen, A., Chaalali, A., Chaouachi, A., Gabbett, T., et al. (2016). Effect of leg dominance on change of direction ability amongst young elite soccer players. *Journal of Sports Science, 34*(6), 542-548.

Senff, O., & Weigelt, M. (2011). Sequential effects after practice with the dominant and non-dominant hand on the acquisition of a sliding task in schoolchildren. *Laterality, 16*(2), 227-239.

Shenouda, L., Gabel, L., & Timmons, B. W. (2011). Preschooler focus-physical activity and motor skill development. *Child Health & Exercise Medicine Program, 1*, 1–2.

Shi, Z., Yang, X., Zhang, X., Zhu, W., Dai, Y., & Li, J. (2024). An empirical study of the flag rugby game programme to promote gross motor skills and physical fitness in 5-6 year old preschool children. *Heliyon, 10*(8), e29200.

Stanley, R. M., Jones, R. A., Cliff, D. P., Trost, S. G., Berthelsen, D., Salmon, J., & Okely, A. D. (2016). Increasing physical activity among young children from disadvantaged communities: Study protocol of a group randomised controlled effectiveness trial. *BMC Public Health, 16*(1), 1095.

Stöckel, T., & Weigelt, M. (2012). Brain lateralisation and motor learning: Selective effects of dominant and non-dominant hand practice on the early acquisition of throwing skills. *Laterality, 17*(1), 18-37.

Stöckel, T., Weigelt, M., & Krug, J. (2011). Acquisition of a complex basketball-dribbling task in school children as a function of bilateral practice order. *Research Quarterly for Exercise and Sport, 82*(2), 188-197.

Teixeira, L. A., Silva, M. V., & Carvalho, M. A. (2003). Reduction of lateral asymmetries in dribbling: The role of bilateral practice. *Laterality, 8,* 53-65.

Tousi, M. M., Emami, T., & Hoseini, S. M. (2012). The effect of initial practice with dominant and non-dominant hand on acquisition, retention and transfer of a complex motor task. *Bioscience Biotechnology Research Asia, 14*(3), 1067-1074.

Wang, H., Chen, Y., Liu, J., Sun, H., & Gao, W. (2020). A follow-up study of motor skill development and its determinants in preschool children from middle-income family. *BioMed Research International, 2020*, 6639341.

Witkowski, Z., Lyakh, V., Gutnik, B., Lipecki, K., Rutowicz, B., & Penchev, B., et al. (2011). Corrective effects of different options on development and maturation of professional motor skills from dominant and non-dominant legs of young soccer players. *Journal of Physical Education and Sport Management, 11*(3), 291-299.

Received:24.02.2025.
Accepted:02.04.2025.

Correspondence:
Nebojša Ilić
Elementary School „Joca Milosavljević", Bagrdan, Serbia
E-mail: nebojsa.ilic962@gmail.com