

Review paper

IMPACT AND APPLICATION OF ADAPTED SPORTS ACTIVITIES IN WORK WITH PERSONS WITH DOWN SYNDROME¹

UDC: 796.011.1-056.26/36
616.899.6:796
<https://doi.org/10.18485/snip.2021.11.1.en.4>

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Abstract: The application of adapted sports activities has been increasingly prevalent and accepted with the aim of rehabilitation and occupational therapy of persons with developmental difficulties and disabilities. The importance, the positive effects and the wide spectrum of impacts on psycho-physical abilities are equally relevant for persons with disabilities, and the positive impact on social skills of this population is also beyond any doubt.

The subject of this paper is a theoretical review of the research concerning the impact and application of adapted sports activities on motor and social abilities of persons with Down syndrome. The aim of the paper is to point out the adapted sports activities that have essential importance and impact on the overall progress of persons with disabilities and developmental difficulties. Sport, physical activity, and any kind of rehabilitation based on movement and exercise, will undoubtedly have a positive impact on users. The bibliographic speculative method was used as a research method, various literature was consulted and data relevant to the work were collected.

Down syndrome as a genetic problem accompanied by many complications, from physical to intellectual ones, can be alleviated exactly by including sports activities in everyday life of persons with Down syndrome.

If an adapted sports activity is individually tailored to the psychosomatic abilities of a person, as well as towards the goal they should reach, positive effects will undoubtedly show, both in physical and social functioning of persons with Down syndrome, with the ultimate goal being to improve the life quality of this population. The paper includes some studies in the fields of sports, medicine and psychology, which prove that appropriately dosed, applied and adapted sports activity can have a positive impact on persons with Down syndrome and that its application is very much desirable throughout entire life of this population.

Key words: *adapted sports activities, social skills, Down syndrome*

INTRODUCTION

Down syndrome is one of the most common chromosome disorders in humans and can occur in any family, race or social group. The underlying genetic imbalance is the main reason of serious problems and deviations from physical and mental development. Ever since 1886, when this syndrome was recognized thanks to English physician J. L. Down, the interest of scientists of different professions (medicine, genetics, psychology, pedagogy) in this area has not ceased (Milićević, 2007).

Considering problems that arise already at birth, but also throughout the lifetime of persons with Down syndrome, it has been noticed that medical support alone is not enough, but that other support and assistance methods are to be included for these persons to improve their psycho-physical abilities and general health status.

¹ Paper received: 13 January 2021, edited: 29 January 2021, accepted for publication: 30 January 2021

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In reference to that, sport as a form of rehabilitation and occupational therapy plays an important role and is an irreplaceable method both in the improvement of motor abilities and social skills of this population.

Sport is an indispensable means and an important factor for overall psycho-physical and social integration and rehabilitation of people with developmental difficulties. Working with persons who are mentally insufficiently developed confirms the fact that there are more barriers in their life that hinder their development than in most people's lives (Pajić, 2004). Sports games encourage mental activity, determination, competitive spirit, self-awareness. Participation in a sport game also offers a possibility to disabled people and people with developmental difficulties to confirm their psycho-physical abilities, with a condition that the game is properly organized, adapted to the persons' personality, level and current possibilities, in which case it becomes a very useful tool of adjustment and self-affirmation. With their impact on the locomotor system, sports games are extremely valuable, because they affect the improvement of strength, flexibility, movement coordination, balance and strengthening of the whole body in general. The participation of disabled people and people with developmental difficulties in sports activities represents a special sensation and experience to these people, and they find it very joyful and satisfying. Together with medical rehabilitation, sports activities are one of the means and methods for permanent personality rehabilitation and socialization, and they also include disabled people and people with developmental difficulties in social activities, creating a sense of belonging to the community.

Starting precisely with that fact, the subject of this paper is a theoretical review of the research on the impact and application of adapted sports activities on the motor and social skills of persons with Down syndrome, with the aim to point to adapted sports activities that are immensely important and effective for the overall progress of disabled people and people with developmental difficulties. Sports, physical activity and any kind of rehabilitation with movement and exercise in its base, if properly created, adapted and adjusted to the relevant population, will doubtlessly have a positive impact on users.

There are studies about early interventions that include the application of adapted sports programs and precisely prove the previous statements.

RESEARCH METHODS

The bibliographic speculative method was used, various literature was consulted and data relevant to the work were collected.

RESULTS AND DISCUSSION

Through affirmation and acknowledgment of this population's own values, sports activities assist in the adaptation and resocialization process. The application of other therapeutic methods is facilitated and the training process is accelerated by achieving positive effects on population receives through participation in a sports activity.

Motor skills represent a part of anthropological space of a human being and together with functional, conative, cognitive and other characteristics and features complement the functioning of the human "system". Ever since the first Olympic Games, when the first athletes (record holders) in certain events showed highly developed motor traits, it has been known that motor dimensions are a significant factor in the realization of sports activities (Kocić, 2007).

In addition to all the positive effects on the motor abilities of disabled people and people with developmental difficulties, one should not disregard the impact of sports activities on their social skills that are also of crucial importance for the overall development and improvement of this population. Inclusion could play one of the lead roles in the development of social skills of people with developmental difficulties.

The current relevance of inclusive approach to life (education, sport, recreation, daily activities, etc.), and especially the participation of disabled children in physical activities opens a new field in accordance with interdisciplinary approach in kinesiological studies (Romanov, 2010).

Persons with Down Syndrome

Intellectual disability is a condition with an onset in the developmental period and includes deficiencies in intellectual functioning that affect adaptive functioning in domains of conceptual, social and practical skills (American Psychiatric Association, APA, 2013).

L. Down syndrome, i.e. Down syndrome (hereinafter: DS) is one of the most common chromosome disorders in humans. There used to be a widespread use of an expression for this condition – “Mongolism”. Today, it is unacceptable since it refers to a race or specific condition towards certain Oriental people (Mongols). Actually, DS is a genetic disorder that is, above all, related to intellectual disability arising from trisomy 21 (Al-Kindi et al., 2012; Deakin, 2014).

DS can occur in any family, race or social group. Genetic imbalance, that is the base of DS, is the main reason of serious problems and deviations in physical and mental development. Since 1886, when an English physician J. L. Down, describing his child, noted 50 clinical signs of his illness (named after him), the interest of scientists of different professions (medicine, genetics, psychology, pedagogy) in this area has not ceased. Unfortunately, efforts to provide answers to numerous questions, such as causes, risks, prevention possibilities and treatment of people with DS, resulted only in partial answers. Contrary to other people with development difficulties, persons with DS feature a special combination of physical and mental characteristics that affect physical appearance of a person and their behaviour, and make them unique and easily recognizable (Novak, 1997).

With children with DS levels of mental retardation vary a lot. They are in range from more severe ones (IQ 30-40) to moderate ones (IQ 40-50) and mild mental disability (IQ 50-70). Rare are those (2-3%) that reach the category of borderline cases (IQ 70-80). The average intelligence in children with DS (measured by development scales and intelligence tests) by the age of 5 is in the range of 55-75 IQ units. With age, this result stagnates again, and then declines because they reach their intellectual development maximum early (between the age of 13 and 15). Medicine has recognized three types of Down syndrome: partial trisomy 21, mosaic Down syndrome and translocation Down syndrome. Each of the stated types has its own features, i.e. characteristics, as follows:

- a) Partial trisomy 21 – (children with 47 chromosomes), most children with DS (95%) with absolute trisomy 21 – i.e. triple chromosome doze on the 21st pair that is present in each cell in the body;
- b) Mosaic DS – it develops by a mistake in distribution of chromosomes that happens in the second or the third cell division. As a result of that, some of the cells are normal, and some are trisomic. Different variations are characteristic for children with mosaic DS: from intellectually normal symptoms to full symptomatology of absolute trisomy.
- c) Translocation DS – (children with 46 chromosomes) is an unusual cause of DS onset and occurs in 1-3% of children with DS.

People with DS are characterized by a flattened face, shorter stature, wider step width, hyper-flexible joints (Agullo & Gonzalez, 2006; Finesilver, 2002; Galli et al., 2013; Hazlett et al., 2010; Rigoldi et al., 2012), a flattened face and microcephalic head with flattened nape, eyes that slant upward, flattened bridge of the nose, small lips, short neck, ears set back (Korenberg et al., 1994). As for the cognitive development of these person, it is very slowed down and recognizable right after the birth, it becomes increasingly evident with age, and precisely this deficit in cognitive development affects their everyday functioning and mastering the simplest life skills. Authors (Maatta et al., 2006) state that there are individual differences in the cognitive abilities and skills of people with DS, which can be a result of genetic and environmental factors.

The development of mental abilities in children with DS is significantly slowed down, which is in accordance with slow brain development. Limited potentials are mostly detectable in the knowledge and skills acquisition field, and for various reasons: the motivation to learn something new is low, visual and auditory attention is brief and superficial; the movement coordination eye-head-arm that is a base for reaching, catching and handling objects is significantly slowed down and with more difficulties; the generalization of something learned and transmission to new situations is scarce. They say children with DS think in colours, shapes and images, namely their thought process remains specific – perceptual and can assume a more complex form of opinion only with targeted assistance. What is learned is easily forgotten, especially if the content that has been learned is not in accordance with the child's needs, if it has no utility value for the child, namely if it does not represent a part of everyday life schedule. The ability to speak and speech comprehension is significantly late in children with DS. They form a sentence only after the age of 4. Speech rhythm is inconsistent, explosive, like they blow out all the air with the first word. As a rule, their vocabulary remains scarce. Speech intelligibility is impaired for a long time due to serious articulation disorders. Vocabulary increase and adoption of syntactic rules often result in stutter, which is of variable intensity.

A large percentage, above 40% of people with DS, have a heart condition, especially the children in whom this problem manifests at birth, and it conditions other problems, such as difficulties in nourishment, slow growth and other, and later in life this problem can limit them in participating in activities that request cardiorespiratory endurance, as well as lead to obesity, which most of these persons are prone to. During their whole life, people

with DS easily establish affective relationships full of warmth and intimacy with other people, they easily notice changes around themselves and adequately respond to them, they usually respond to laughter with laughter, and have appropriate reactions to their mother's emotions (Novak, 1997).

Motor development of children with DS is slowed down and thus considered a weakness of these persons (Burgoyne et al., 2012; Davis, 2008; Fidler, 2005; Hazlett et al., 2010; Lloyd et al., 2010; Peer & Reid, 2016), and it reflects in late reactions when reaching objects, rolling around, crawling, sitting on their own without support, standing, walking on their own, as well as in developing fine motor skills and visual perception. Also, people with DS have a very weak muscle tone, which is an important factor that leads to late development of appropriate motor skills, and which then results in other health issues. Besides medical rehabilitation, sports and sports-recreational activities play an important role in preventing this problem, and in assisting these children's faster progress.

Keeping in mind the features of the DS motor development, some authors suggest that children with DS need more time to master complex movements (Palisano et al., 2001). Konsuelo Talijan (2017) states that biological, cognitive factors and myelination (according to Horvat et al., 2016) affect the motor functioning of children with DS, and that the motor skills difficulties of these persons should be envisaged considering the connection of different functions of the central nervous system that are influenced by environmental factors.

Considering the overall psychomotor status of people with DS, as well as their functional characteristics, we conclude that a well thought-out, designed and adapted program that would target encouragement of motor improvement and functioning of people with DS, can improve physical performances of these persons.

Importance of adapted sports activities application in work with people with Down syndrome

Adaptive behaviour presents a set of skills necessary to adapt and perform the tasks required by physical and sociocultural surroundings. This concept includes practical, conceptual and social skills. However, the concept can also include similar life segments such as communication, functional literacy, self-care, health and safety, leisure activities, social skills and other different segments stated in the ICF classification (Anđelković, 2016). One of the acknowledged definitions of adaptive behaviour is that it is a level of efficiency in fulfilling a learning standard. Personal independence, maturing, social responsibilities are characteristic for a certain age of an individual or a cultural group they belong to (Nihira et al., 1993), while one of the more specific definitions explains this term as an adequate performing of everyday activities for smooth functioning of life and everyday responsibility for one's own needs (Metsiou et al., 2011; Anđelković, 2016). Also, another more specific definition is that adaptive behaviour is one of the developmental aspects in which all skills and characteristics of a person are intertwined, a profiling set of skills important for the adaptation to physical and sociocultural surroundings (Burchinal et al., 2008).

When it comes to sports activities, adaptive behaviour occupies an important position and represents an important factor in mastering new skills, hence the importance of giving attention to this segment, especially when it comes to disabled people and people with developmental difficulties. To that effect, adapted sports activity is closely related to the term adaptive behaviour. Adapted sports activity represents an individually adapted activity according to psychosomatic abilities of a person, and to the aim that should be reached (Bošković et al., 2013). Therefore, when we define the term adapted sports activity, we focus on movement, physical activity or a chosen sport focused on a disabled person and hers/his interest and the ability to smoothly participate in it. The term used today and that is increasingly present in literature, such as adapted physical activity, indicates that now more than ever importance is given to the scientific approach to this issue, also supported by the most important international institutions that place it in the focus of the society. The demands to master more complex skills, knowledge and behaviour rise with the age of a child. They will be easier to adopt, if:

- Each task is analysed as a series of simple steps, phases;
- It is learned by direct activity performance, followed by short and clear verbal instructions;
- There is encouragement and support to start an activity independently;
- The range of the things learned in everyday life is periodically checked.

During the 1960s and 1970s, the application of adaptive activity and medication of many sports has begun to develop to apply them in rehabilitation and include disabled people and people with developmental difficulties, regardless of the type of sports.

Barić (2011) states that in order for a person to react and act in a social environment, that person needs to possess developed adequate models of adjustment, considering that there is a continuous series of demands for motor responses placed on an individual at all times. Possessing these models is a part of the adaptive behaviour of

a person and developing models of adjustment of motor demands is a process of acquiring motor skills. Acquiring motor skills needed for relevant functioning in one's surroundings is enabled by motor skills learning.

Adapted sports activity is directly related to motor skills learning. Important determinants of motor skill learning are fully reflected in the process of motor skills adoption, accomplishment through repetition of a motor task, a certain dependence on motor abilities and total motor skills knowledge (with a possibility of realization and correction of mistakes during the execution of motor tasks) (Potić et al., 2016). Children with intellectual disabilities also show certain motor learning difficulties, considering that they adopt information non-selectively, while the process of the received information is slow and insufficiently efficient. Goal setting, planning the execution of a motor action and the organization of motor responses are not based on the analysis of the conditions in which motor activity is realized. Usually, children with intellectual disability do not possess optimal prior knowledge, appropriate forecasting strategies and memory capacity necessary to appropriately perform an expected motor task. At the level of performance and motor activity control that include individual movement components, children with intellectual disability show a problem in spatial-temporal order and their ability to see and correct mistakes during a motor activity performance is very limited most of the time. However, it is stated that children with intellectual disability can perceive motor skills, with certain adaptations, respecting their abilities and appropriate instructions, i.e. managing the process of motor skills learning (Nikolić et al., 2005).

In addition to its importance for the physical status of a user, every adapted sports activity vastly contributes to the socialization of disabled people and people with developmental difficulties, confirmation of their skills, which, above all, helps them establish mental balance and satisfaction, which then has an effect not only on motor skills development, but social skills too.

According to Nedović et al. (2010), adequate social skills mean understanding and respecting social rules in terms of people's relations to each other. For example, social skills mean that a person knows when he/she should make an adequate eye contact, and when not; how to start and finish a conversation in a suitable way; how to have a short conversation, and how to read nonverbal communication and how to respond to it. Considering that from their birth, people are participants in different social situations, they interact with others in numerous and various ways during their life, and these interactions considerably affect all parts of their development and life. Interactions with other people of a person at an early age are achieved in family, and later with friends, and are considered essential for their current and later development (Đević, 2015). Social acceptability represents one of more important indicators of successful functioning of an individual in a group, hence it is a social relations quality indicator. Social acceptance of students is most frequently defined as the degree to which peers seek to establish some form of social contact with a child, namely to participate with him/her in joint activities such as socializing, learning and the like (Krnjajić, 2007). We can use sports and certain sports activities that will assist us in the realization of set goals as a method and a tool for better integration and social acceptability of people with DS.

As it has been proven that adapted sports activities significantly contribute to better motor skills development and improvement of adapted behaviour in most of specialized institutions, physical education (adapted sports) is a mandatory part of the education program and curriculum. The greatest interest in disabled people's participation in adapted sports activities can be found in economically most developed countries (Robertson & Emerson, 2007). Unfortunately, according to certain research data (Pacić et al., 2010), most organizations in the Republic of Serbia have no adequate financial funds for children with developmental difficulties to exercise. The problem of poor financial conditions is becoming more and more important, especially considering the results of numerous studies that emphasize the rise of awareness in the society about the importance of inclusion of disabled people and increasing interest of parents, children, and grown-up users in everyday participation in adapted sports (Turner et al., 2009; Delić-Selimović et al., 2012; Salapura, 2013).

Because of its inventiveness, sports game encourages mental activity, determination, sports spirit, self-consciousness, etc. Children affirm their psycho-physical skills through sports games, and provided that the game is adequately selected, organized, adapted to the character, level and current abilities of the children, it becomes a very useful tool of adaptation and self-affirmation. Sports games have an extraordinary value because their impact on the locomotor apparatus influences the improvement of strength, flexibility, coordination of movement, balance and strengthening the whole body in general. Games like basketball, volleyball, football, handball can mostly be applied as great tools for general strengthening of the body or for achieving special impacts on certain parts of the locomotor apparatus.

People with DS manifest better achievements in tasks that require visual-motor skills of imitation compared to verbal skills of imitation (Elliott & Bunn, 2004; Wang 1996; Wang & Bellugi, 1994).

Football is a very attractive sports game for children. Due to relatively simple technique and rules, as well as the possibility to play it in any kind of surrounding, with numerous moves stimulating the development of basic psycho-physical characteristics, certain elements of football can be used in kinesitherapy treatment of certain damaged functions of the locomotor apparatus. Football, as a very energetic sport with many moves, can significantly improve bio-motor dimensions such as: the increase of leg muscle strength, speed, agility; and elements such as: running, kicking the ball and jumps, engaging muscles in the entire body, thereby acting preventatively on knee and feet deformities.

Past research studies have concluded that the direction and the extent of recorded changes of applied adapted program clearly indicate that motor task difficulty is a very important didactic element when treating people with DS. Also, the results of statistical analysis of the execution of motor tasks show that all changes are primarily the consequence of systematic training, and that they do not depend on the frequency of weekly training activities. Earlier research studies of similar adapted sports activities such as the research (Kocić et al., 2017) conducted with the aim to examine the impact of adapted basketball training program on cardio-respiratory fitness and sport on specific abilities of adolescents with intellectual disability, show that the exercise program stimulates the improvement of cardio-respiratory fitness and sport, i.e. specific abilities of adolescents with mild intellectual disability.

In terms of complex motor tasks that combine three different forms of movement (rectilinear, rotational and mono-structural acyclic), in people with DS it is not realistic to expect changes (due to biological limits). Former research studies show that physical activity can improve the functional status of people with DS and it is therefore recommended to include this population in various adapted physical activity programs (Cowley et al., 2011; Shields et al., 2008).

Jovanović et al. (2015) underline that sports activities initiate friendship and reinforce social skills. The fact that people can be born with developmental defects and disorders some of which were developed during their lifetime, indicates that it is necessary for them to be permanently encouraged, and to be provided with possibilities in which they could try different forms of physical activity and sports, since sports facilitate psycho-physical development of each individual. With the aim of improving social skills, it would be recommendable to apply inclusion and programs where both populations are included, namely both children with developmental difficulties and children from the "typical" population. With reference to that, a sports team, i.e. a sports organization can be seen as an education institution, a place for the implementation of inclusion.

Salapura (2018) conducted a very extensive research, where he applied adapted karate program in work with disabled people. The research study concerned the effects of adapted karate program, with results that showed significant positive effects on the psycho-physical development of the subjects. Statistically significant improvement of general physical development, social interaction and specific (karate) skills was recorded. When it comes to the subjects' sex and age, these elements had no statistically important impact on any of the changes that occurred during the experimental period. Also, there no changes were noticed in social interaction and specific (karate) skills of the subjects.

In their research, Bahrami et al. (2012) reached a conclusion that there had been a positive influence on the behaviour of children with autism, where stereotypical behaviour that was otherwise characteristic for children within the autism spectrum, had not increased even after 30 days of the karate program application.

It is a fact that the sport of karate is being increasingly applied in working with people with intellectual disability and that in 2003 the World Karate Federation (WKF) adopted the application of an experimental karate program in therapeutic purposes for people with disabilities, which resulted in the first international para-karate competition held in Paris in 2012 (WKF, 2012).

CONCLUSION

Adapted sports activities imply the improvement of social behaviour (increased independence, improved communication, perception and mood), and the review of the stated research studies in this paper shows that collective sports particularly affect the improvement of motor and social characteristics of people with Down syndrome.

Motor skills development and the effect on the potentials of people with developmental difficulties who practice an adapted sports activity depend on both their genetic potential and the environment where the activity

takes place, as well as on the quality of the developed program. Sport is a special phenomenon that enables each person to demonstrate their own skills and “hidden potentials”, while simultaneously providing importance and spirit of life to each human being, despite their “difference”. That is why sport is a phenomenon that proves possibilities are limitless.

Most results of the aforementioned research studies in this paper suggest positive effects of exercise on the body composition level of people with DS, which can implicitly also contribute to the improvement of their psycho-social status. Also, the paper lists the studies that have explicitly focused on the improvement of social skills of people with Down syndrome, which proves that adapted sports activity must be a part of everyday life of this population. The positive effects of the interventions that implied adapted sports activities have been established in all mentioned studies.

The general conclusion is that the application of adapted sports activities in people with Down syndrome is a fundamental need and that much more attention needs to be dedicated to these persons, creating more suitable conditions for them, and thus giving them an opportunity to satisfy their needs within the field of sport, with the final goal being the improvement of their psycho-social and motor skills in order to improve their life and add to its quality.

REFERENCES

1. Agulló, I. R. & González, B. M. (2006). Factors influencing motor development in children with Down syndrome. *International Medical Review on Down Syndrome*, 10(2), 18-24.
2. Al-Kindi, S. G., Al-Juhaishi, T. & Al-Saffar, A. J. (2012). Community attitudes towards people with Down's syndrome: A sample from Iraq. *Public Health Research*, 2(4), 102-105.
3. American Psychiatric Association. APA (2013). *Diagnostic and statistical manual of mental disorders* (5th ed). Arlington, VA: Author.
4. Anđelković, M. (2016). *Adaptivno ponašanje osoba sa oštećenjem vida*, Doktorska disertacija. Beograd: Fakultet za specijalnu edukaciju i rehabilitaciju.
5. Bahrami, F., Movahedi, A., Morandi, S. M. & Abedi, A. (2012). Kata techniques training consistently decreases stereotypy in children with autism spectrum disorder. *Research in Developmental Disabilities*, 33, 1183-1193.
6. Barić, R. (2011). Motoričko učenje i poučavanje složenih motoričkih vještina. U: I. Jukić & sar. (Ur.), *Zbornik radova 9. godišnje konferencije „Kondicijska priprema sportaša: Trening koordinacije”* (str. 63-76). Zelina: Tiskara Zelina.
7. Bošković K., Potić Gava, B., Grajić, M., Madić, D., Obradović, B. & Tomašević Todorović, S. (2013). Adaptirana fizička aktivnost u prevenciji i lečenju osteoporoze. *Medicinski pregled*, 66(5-6), 221-224.
8. Burchinal, M. R., Roberts, J. E., Zeisel, S. A. & Rowley, S. J. (2008). Social risk and protective factors for African American children's academic achievement and adjustment during the transition to middle school. *Developmental Psychology*, 44(1), 286-292.
9. Burgoyne, K., Duff, F., Clarke, P., Smith, G., Buckley, S., Snowling, M. & Hulme, C. (2012). *A reading and language intervention for children with Down syndrome – teacher's Handbook*. Down Syndrome Education International.
10. Cowley, M. P., Ploutz-Snyder, L. L., Baynard, T., Heffernan, S. K., Jae, S. Y., Hsu, S., Lee, M., Pitetti, H. K., Reiman, P. M. & Fernhall, B. (2011). The Effect of Progressive Resistance Training on Leg Strength, Aerobic Capacity and Functional Tasks of Daily Living in Persons with Down Syndrome. *Disabil. Rehabil*, 33(23-24), 2229-36.
11. Davis, A. S. (2008). Children with Down syndrome: Implications for assessment and intervention in the school. *School Psychology Quarterly*, 23(2), 271-281.
12. Deakin, K. A. (2014). *Perceptions of Down syndrome: A growing awareness? Investigating the views of children and young people with Down syndrome, their non-disabled peers and mothers*. Doctoral dissertation, University of Glasgow.
13. Delić-Selimović, K., Mandić, P. & Mujić, N. (2012). Uticaj treninga na poboljšanje efikasnosti u sportskim igrama i socijalni status lica iz specijalnih ustanova u BiH. *Sportske nauke i zdravlje*, 2(2), 137-146.

14. Đević, R. (2015). *Socijalna interakcija učenika sa smetnjama u razvoju u osnovnoj školi*. Doktorska disertacija, Filozofski fakultet, Univerzitet u Beogradu.
15. Elliott, D. & Bunn, L. (2004). Motor disorders in children with intellectual disabilities. In D. Dewey & D. E. Tupper (Eds.). *Developmental motor disorders: A neuropsychological perspective* (pp. 137-151). New York: Guilford Press.
16. Fidler, D. J. (2005). The emergence of a syndrome-specific personality profile in young children with Down syndrome. *Down syndrome: Neurobehavioural Specificity*, 139-152.
17. Finesilver, C. A. (2002). *A new age for childhood diseases: Down syndrome*. Retrieved 3 June 2016, from: <http://www.modernmedicine.com/modern-medicine/content/new-age-childhood-diseases-down-syndrome>
18. Galli, M., Cimolin, V., Rigoldi, C., Pau, M., Costici, P. & Albertini, G. (2013). The effects of low arched feet on foot rotation during gait in children with Down syndrome. *Journal of Intellectual Disability Research*, 58(8), 758-764.
19. Hazlett, H. C., Hammer, J., Hooper, S. R. & Kamphaus, R. W. (2010). Down syndrome. In S. Goldstein & C. R. Reynolds (Eds.). *Handbook of Neurodevelopmental and Genetic Disorders in Children* (pp. 362-381). New York & London: Guilford Press.
20. Horvat, M., Croce, R. & Fallaize, A. (2016). Information processing and motor control in Down syndrome. *Journal of Down Syndrom & Chromosome Abnormalities*, 2(107), 2-7.
21. Jovanović, J., Lazarević, S. & Lazarević, P. (2015). Faktori koji utiču na sportsku inkluziju osoba sa invaliditetom. Zbornik radova naučno-stručnog skupa Univerziteta Singidunum: *Značaj fizičke kulture za osobe sa smetnjama i poremećajima u razvoju*, 47-50.
22. Kocić, M. (2007). *Uticaj programiranog trenažnog programa na razvoj motoričkih i situaciono-motoričkih sposobnosti mladih košarkaša*, Doktorska disertacija, Fakultet sporta i fizičkog vaspitanja Univerziteta u Nišu.
23. Kocić, M., Bojić, I., Aleksandrović, M., Ignjatović, A. & Radovanović, D. (2017). Physical Activity in Adolescent with Mental Retardation: Is Adapted Basketball Training Adequate Stimulus to Improve Cardiorespiratory Fitness and Sport Performance? *Acta Facultatis Medicae Naissensis*, 34 (2), 159-168.
24. Konsuelo Talijan, B. (2017). *Promena stavova prema učenicima sa Daunovim sindromom primenom programa indirektnog kontakta*. Doktorska disertacija. Fakultet za specijalnu edukaciju i rehabilitaciju, Univerzitet u Beogradu.
25. Korenberg, J. R., Chen, X. N., Schipper, R., Sun, Z., Gonsky, R., Gerwehr, S. & Yamanaka, T. (1994). Down syndrome phenotypes: The consequences of chromosomal imbalance. *Proceedings of the National Academy of Sciences*, 91(11), 4997-5001.
26. Krnjajić, S. (2007). *Pogled u razred*. Beograd: Institut za pedagoška istraživanja.
27. Lloyd, M., Burghardt, A., Ulrich, D. A. & Angulo-Barroso, R. (2010). Physical activity and walking onset in infants with Down syndrome. *Adapted Physical Activity Quarterly*, 27(1), 1-16.
28. Määttä, T., Tervo-Määttä, T., Taanila, A., Kaski, M. & Iivanainen, M. (2006). Mental health, behaviour and intellectual abilities of people with Down syndrome. *Down Syndrome Research and Practice*, 11(1), 37-43.
29. Metsiou, K., Papadopoulos, K. & Agaliotis, I. (2011). Adaptive behavior of primary school students with visual impairments: The impact of educational settings. *Research in developmental disabilities*, 32(6), 2340-2345.
30. Milićević, B. (2007). *Sportsko rekreativne aktivnosti za decu sa Daunovim sindromom*. Diplomski rad. Fakultet sporta i fizičkog vaspitanja, Univerzitet u Beogradu.
31. Nedović, Č., Odović, G. & Rapaić, D. (2010). *Razvoj socijalnih veština kod osoba sa smetnjama u razvoju*. Beograd: Društvo defektologa Srbije.
32. Nihira, K., Leland, H. & Lambert, N. (1993). *AAMR Adaptive Behavior Scales – Residential and Community* (2nd ed.) Austin, TX: PRO-ED.
33. Nikolić, S., Ilanković, V. & Ilić-Stošović, D. (2005). *Motoričke sposobnosti učenika sa mentalnom retardacijom*. Beogradska defektološka škola, 3, 149-161.
34. Novak, J. (1997). *Dete sa Down sindromom*. Beograd: Save the Children.
35. Paci, S., Eminović, F. & Nikić, R. (2010). Material conditions for realization teaching content physical education to students with disabilities. In: S. Stojković (ed). *Physical activity for everyone, Conference proceedings*. Belgrade: Faculty of physical education and sport (pp. 175-181).
36. Pajić, D. (2004). *Novine u tretmanu umereno mentalno retardiranih osoba*. Beograd: Zadužbina Andrejević.

37. Palisano, R. J., Walter, S. D., Russell, D. J., Rosenbaum, P. L., Gémus, M., Galuppi, B. E. & Cunningham, L. (2001). Gross motor function of children with Down syndrome: Creation of motor growth curves. *Archives of Physical Medicine and Rehabilitation*, 82(4), 494-500.
38. Peer, L. & Reid, G. (2016). *Special educational needs: A guide for inclusive practice* (2nd edition). London: SAGE.
39. Potić, S., Nedović, G. & Macanović, N. (2016). Koncept motoričkog učenja i njegova primenjivost u radu sa osobama sa invaliditetom. *Beogradska defektološka škola*, Vol. 22, No 3, 73-89.
40. Rigoldi, C., Galli, M., Cimolin, V., Camerota, F., Celletti, C., Tenore, N. & Albertini, G. (2012). Gait strategy in patients with Ehlers-Danlos syndrome hypermobility type and Down syndrome. *Research in Developmental Disabilities*, 33(5), 1437-1442.
41. Robertson, J. & Emerson, E. (2010). Participation in Sport by People with Intellectual Disabilities in England: A Brief Report. *Journal of Applied Research in Intellectual Disabilities*, 23, 616-622.
42. Romanov, R. (2010). Kineziološke karakteristike ometenog deteta. *TIMS Acta*, 4(1) 68-72.
43. Salapura, S. (2013). Odnos roditelja prema inkluzivnom programu u sportskim školama. *TIMS Acta*, 7(1), 59-66.
44. Salapura, S. (2018). *Efekti adaptiranog karate programa u tretmanu osoba sa smetnjama u razvoju*. Doktorska disertacija. Fakultet za sport i turizam, Univerzitet Edukons.
45. Shields, N., Taylor, F. N. & Dodd, J. K. (2008). Effects of a Community-Based Progressive Resistance Training Program on Muscle Performance and Physical Function in Adults with Down Syndrome: A Randomized Controlled Trial. *Arch Phys Med Rehabil*, 89(7), 1215-20. doi: 10.1016/j.apmr.2007.11.056.
46. Turner, A. P., Kivlahan, D. R. & Haselkorn, J. K. (2009). Exercise and quality of life among people with multiple sclerosis: looking beyond physical functioning to mental health and participation in life. *Arch Phys Med Rehabil*, 90(3), 420-428.
47. Wang, P. P. & Bellugi, U. (1994). Evidence from two genetic syndromes for a dissociation between verbal and visual-spatial short-term memory. *Journal of Clinical and Experimental Neuropsychology*, 16(2), 317-322.
48. Wang, P. P. (1996). A neuropsychological profile of Down syndrome: Cognitive skills and brain morphology. *Mental Retardation and Developmental Disabilities Research Reviews*, 2(2), 102-108.
49. WKF (2012). World Karate Federation, <http://www.wkf.net>