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Selected aspects of behaviour vs. the level of motor activity performance in children with autism spectrum disorders

ALEKSANDRA SADZIAK*, MARTA WIECZOREK**

Wrocław University of Health and Sport Sciences

Autism spectrum disorder (ASD) is the most destructive development disorder. Physical activity is an effective form of intervention that supports educational and therapeutic practice in persons with ASD. It regulates health behaviour and has a positive impact on, e.g., physical, mental and cognitive spheres. In persons with ASD, the sphere of movement cannot be separated from that relating to cognitive or social development. These areas overlap and interact with each other. The study was conducted on 18 persons aged 8–12 years. The research method was participant, direct, categorised observation. The research tool was the motor activity observation sheet developed by the authors of the present paper. 23 tasks based on the MATP Training Day were used for the purpose of assessing the selected variables. The greater the degree of participation in a motor activity, when subjects are able to take up the initiative and the duration of their concentration is simultaneously longer during the activity, the higher the motor activity performance level is. Specific educational and therapeutic activities aimed at developing attention and strengthening social skills can contribute to motor independence in children with ASD. At the same time, by achieving significant independence while performing motor tasks, it is possible for persons with ASD to achieve fuller mental and physical development.

KEYWORDS: autism, intellectual disability, physical education, special physical education, teachers

Zaburzenia ze spektrum autyzmu (ASD) to najbardziej destrukcyjne zaburzenia rozwojowe. Aktywność fizyczna stanowi skuteczną formę interwencji, która wspiera praktyki edukacyjno-terapeutyczne u osób z ASD. Reguluje ona zachowania zdrowotne i ma pozytywny wpływ m.in. na sferę fizyczną, psychiczną i poznawczą. U osób z ASD nie można oddzielać sfery ruchowej od tej związanej z rozwojem poznawczym czy społecznym. Obszary te przenikają się ze sobą i wzajemnie na siebie oddziałują. Badanie przeprowadzono wśród 18 dzieci w wieku 8–12 lat. Zastosowaną metodą badawczą była obserwacja uczestnicząca, bezpośrednia, skategoryzowana. Narzędziem badawczym był autorski arkusz obserwacji czynności ruchowych. Do oceny wybranych zmiennych posłużyły 23 konkurencje Dnia Treningowego MATP. Im większy stopień uczestniczenia podczas wykonywanej czynności ruchowej, kiedy to badany jest zdolny do przejęcia inicjatywy, a czas jego koncentracji jest jednocześnie dłuższy podczas aktywności, tym poziom wykonania czynności ruchowej jest wyższy. Określone działania edukacyjno-terapeutyczne mające na celu rozwijanie koncentracji uwagi oraz wzmacnianie umiejętności

* E-mail: aleksandra.sadziak@awf.wroc.pl
ORCID: 0000-0002-9939-3523
* E-mail: marta.wieczorek@awf.wroc.pl
ORCID: 0000-0003-3933-246X

społecznych mogą przyczynić się do usamodzielnienia motorycznego dzieci z ASD. Jednocześnie, dzięki osiągnięciu znaczącej samodzielności przy zadaniach motorycznych, możliwy jest pełniejszy rozwój psychofizyczny osób z ASD.

SŁOWA KLUCZOWE: autyzm, niepełnosprawność intelektualna, wychowanie fizyczne, wychowanie fizyczne specjalne, nauczyciele

Introduction

Autism Spectrum Disorders (ASD) are presented as the most destructive developmental disorders. They appear in early childhood and cover all areas of activity – from cognitive and communication deficits to behavioural disorders and social interaction problems (Skórczyńska,2010). In addition to the nosologic criteria contained in the DSM classification – V (communication and social interaction deficits, limited recurrent patterns of behaviour, interests and activities) (American Psychiatric Association, 2013) developed by the American Psychiatric Association, many authors extend ASD symptoms with motor hyperactivity or excessive tranquillity (Mundy, Sullivan and Mastergeorge, 2009) and existing aggression and self-aggression (Parikh, Kolevzon and Hollander, 2008). Persons with ASD show individual symptoms ranging from very intense to mild, where speech and communication disorders are the ultimate diagnostic criteria (Skawina, 2016).

The importance of physical activity is less appreciated in ASD therapeutic practice. It can be an effective form of intervention to support the implementation of educational and therapeutic practice. It regulates health behaviours and has a positive impact on many areas, including, e.g.: physical, mental and cognitive spheres (Lubans et al., 2016; Poitras et al., 2016; Lee, Harrington, Louie and Newschaffer, 2008). It entails favourable changes in behaviour and social skills (Tan, Pooley, Speelamn, 2016; Lang et al., 2010). The first of the studies on motricity in persons with ASD showed that the more motor abilities and skills are mastered, exploration tendencies based on better possibilities for perception of external stimuli (responding, perceiving, feeling, noticing) are more likely to occur (Gałkowski, 1991). Temple Grandin (Grandin and Panek, 2012), who herself is a high-functioning ASD person, finds that intensive physical exercise allows for reducing stereotypy and interfering behaviours that often take control over the functioning of persons with ASD.

The organisation of physical activity in persons with ASD needs to be adjusted and modified due to the specific nature of motor development. There is no single pattern of motor development that would be characteristic of people with ASD (Białas – Paluch, 2017). Children with ASD often find it difficult to coordinate their movements, to have manual dexterity and motor fitness, to have self-care skills. It is also difficult to imitate movements and to perform them intentionally, to plan them and manipulate objects (Dowell, Mahone, Mostofky and 2009). Many studies confirm balance skill deficits (MacNeil and Mostofsky, 2012; Sroka, 2012). These deficits are accounted for by the structural pathology relating to the cerebellum with the vestibular nuclei. Pisula (2015) states that this structure is too small and the grey or white matter volume is found to be reduced in most people with ASD. Neuromotor deficits are usually not manifested in serious neurological disorders. They are noticeable when good motor integration is required, for example, when riding a bicycle, throwing or catching a ball (Pisula, 2010). Wiśniewska (2011) points out that these are problems with visual–motor coordination, learning new activities, precision movements of the hand and construction play. These deficits constitute dyspraxia that affects daily functioning. This is because motricity

is a way to learn about reality and to find connection with the environment (Białas-Paluch, 2017). Jaste (2011) claims that motor deficits are correlated with behavioural, communication and social deficits, and they are also ASD diagnostic criteria. Motor deficits in persons with ASD may be due to the same reasons as disorders in social skills, cognitive development and difficulties in developing positive behaviours. These irregularities are constituted by sensory disorders, weakened central coherence, impaired executive functions, but also a lack of ability to recognize and understand the behaviour of others (theory of mind impairment) (Gowen and Hamilton, 2013; Garncarz and Rybka, 2012).

The area of physical health cannot be separated from cognitive or social development in people with ASD. These areas overlap and interact with each other. These assumptions are the basis for the research problem of this paper, which is to identify the status and dependencies that occur between selected aspects of behaviour: participation, attention, interfering behaviours and the level of independent performance of motor activities in children with ASD.

In order to verify the undertaken research problem, the following questions were formulated:

1. What is the level of selected aspects of behaviour: participation, attention, interfering behaviours of children with ASD when they perform certain motor activities?
2. What is the level of the independent performance of selected motor activities of children with ASD?
3. What is the relationship between the selected aspects of behaviour and the level of motor activity performance of children with ASD?

1. Materials and methods

1.1. Study group

The study was conducted on 18 children (13 boys and 5 girls) aged 8–12 years. The difference in the size of the group is due to the overall prevalence of ASD in boys compared to girls on a 4:1 scale (Fombonne, 2009). The selection of subjects to the study group was based on purposive sampling. The inclusion criteria were as follows: specialist diagnosis – infantile autism (according to the ICD – 10 classification applicable in Poland) and moderate or severe intellectual disability, followed by living on the similar level (low/medium) of functioning – according to the evaluation of 5 consultant physicians who had known and worked with the subjects and based on an analysis of data contained in individual education and therapeutic programs. The consent to participate in the study was given by all parents of the subjects.

1.2. Research method

The research method was participant, direct, categorised observation conducted by 5 competent judges. The research tool was the motor activity observation sheet developed by authors of the present paper based on the protocol for recording progress in the Knills' Activity Method and an achievement record card in the Motor Activity Training Program (MATP) of the Special Olympics.

It contained the following categories:

- participation: the degree of initiative presented by the subject. It specifies the support that the student requires in order to perform a motor task, rated on a scale of 1 to 6 (1 – passivity, 2 – interest, 3 – recognition, 4 – expectation 5 – co-operation, 6 – initiative);

- attention: defines the degree of concentration on the motor task, rated on a scale of 0 to 3, (0 – no concentration, 1 – being alert for some time, 2 – being attentive for most of the time, 3 – concentration at all times);
- interfering behaviours, such as stereotyped movements, self-aggression, aggression, withdrawal from the situation and others. The scope of their intensity is recorded on a scale of 0 to 3 (0 – indicates the intensity level which hinders the completion of the task, 3 – no interfering behaviours) (Knill and Knill, 1997).

These categories refer to aspects of behaviours, while there is another category: performance level, which determines the degree of the independent performance of the motor activity. It is assessed according to a three-point scale based on the MATP Program, i.e., level 1 – motor activity performed with the instructor's physical assistance; level 2 – allowable instructor's assistance; level 3 – motor activities performed completely independently (Olimpiady Specjalne, 2019).

The 23 tasks based on the MATP Training Day were used for the purpose of assessing the selected variables (participation, attention, interfering behaviours, motor activity performance level) (no tasks were used involving the use of a wheelchair or in an aqueous environment). The reason for this is the functionality and availability of the MATP Program, and the adaptation of its rules to the cognitive abilities of persons with ASD. It is intended for persons who are unable to attend official training and Special Olympics sporting events because of their inability to understand and comply with Special Olympics competition and sport rules, or they have motor disorders – which is often the case of persons with ASD.

1.3. Data analysis

The first step of data analysis was to assess the reliability of the decision made by the 5 judges competent in terms of consistency. The Cronbach's α coefficient was used to measure the reliability of the judges' opinion. On the basis of the analysis, the effect of percentage compatibility of all judges for each area was 90% and above. This enabled a mean value to be determined of the assessment made by the 5 judges for each of the 23 motor activities for all subjects. The calculated mean values were used for further statistical analysis conducted with the Statistica software package.

Spearman's rho correlation coefficients were calculated between the motor activity performance level and the three behavioural aspects (participation, attention, interfering behaviours) during the performance of the 23 assessed motor activities. Correlation results were interpreted with a scale by Ostasiewicz et al. (Ostasiewicz, Rusnak and Siedlecka, 2011).

2. Results

The observations show that each subject required assistance from the instructor during selected motor activities – at least in the form of verbal suggestions but also in the form of physical assistance. This can be determined based on the results obtained for the Performance level variable, where 3 indicates complete independence while performing the task (Table 1).

Table 1
Level of motor activity performance and selected aspects of behaviour in the study group of children with ASD

Subject	Performance level [1–3 points]		Participation [1–6 points]		Attention [0–3 points]		Interfering behaviours [0–3 points]	
	M	SD	M	SD	M	SD	M	SD
1	1.5	0.50	3.0	0.83	1.3	0.43	2.7	0.80
2	1.8	0.54	3.6	0.88	1.7	0.56	2.9	0.42
3	1.8	0.71	3.3	1.10	1.4	0.47	2.7	0.70
4	2.2	0.39	4.1	0.85	1.7	0.63	2.8	0.39
5	1.3	0.47	1.4	0.33	0.4	0.44	2.4	0.91
6	1.7	0.71	2.9	0.72	1.1	0.37	2.7	0.60
7	2.0	0.56	4.1	0.54	2.1	0.42	2.9	0.29
8	2.1	0.51	4.6	0.72	1.9	0.58	3.0	0
9	1.9	0.67	4.1	0.99	1.5	0.50	2.9	0.42
10	2.0	0.56	4.2	0.89	1.8	0.39	2.6	1.03
11	1.8	0.74	3.5	1.18	1.4	0.62	2.1	1.35
12	1.8	0.72	3.5	1.08	1.4	0.44	2.9	0.42
13	1.9	0.69	3.9	0.85	1.8	0.52	3.0	0.21
14	1.9	0.65	3.4	1.06	1.6	0.42	2.8	0.74
15	2.1	0.51	4.3	0.90	2.0	0.44	3.0	0
16	1.7	0.56	2.1	0.71	0.9	0.41	2.1	1.20
17	1.7	0.49	2.8	0.77	1.3	0.56	1.6	1.05
18	2.0	0.60	3.9	0.97	2.0	0.40	2.3	1.20

M – mean
SD – standard deviation

Differences were found in motor activity performance level among the subjects, e.g., between subjects 1 (M=1.5) and 5 (M=1.3), who required greater support during the motor activity performance and subject 4 (M=4.4) who exhibited the highest average level of independence.

The diversity of the participation level among the subjects is significant. It is characterised by both passivity – where subjects do not contact the instructor and do not show muscle tension, e.g., subject 5 (M=1.4). There are also subjects who recognize and "run" before the motor activity is about to start, such as 8 (M=4.6) and 15 (M=4.3). None of the subjects indicated active participation in motor activities or the ability to take the initiative during the proposed activities.

The results of the attention level observed in the subjects show that no one was able to focus during the entire time of performing the motor activity. The lowest attention level was shown by subjects 5 (M=0.4) and 16 (M=0.9). Most of the subjects focused their attention for some time or for most of the time during the activity being performed (achieving a level of attention above 1 point).

Interfering behaviours (e.g., stereotyped motor activities, self-aggression, aggression, withdrawal from the activity) in the course of the motor activity performance were referenced to the extent to which their possible existence hindered the performance of the motor activity. The level of intensity of interfering behaviours in most subjects ranges between 2.5 and 3 points. If these behaviours occurred during the observation, they did not substantially hinder the performance of the motor activity. However, there are cases among the subjects that are clearly divergent from this dependency, such as subjects 11, 16, 17, 18, for whom the intensity of interfering behaviours prevented the performance of any motor activity. This contrasts with subjects 8 and 15, where interfering behaviours did not occur at all during any of the motor activities performed (Table 1).

When combining the 23 motor activities, it can be seen that performance level varies. During such motor activities as no. 2 (plank), 16 (transitioning to kneeling), 20 (kicking the ball over an obstacle), 22 (jumping), 23 (jumping using a springboard), the subjects required the most assistance from the instructor, and this was mostly physical assistance. However, motor activities performed by the subjects in the most independent manner are as follows: 6 (Moving forward on an uneven ground), 7 (passing through tunnel), 12 (picking up objects), 18 (stacking circles), 19 (shooting at goal), 21 (Passing an obstacle course) (Table 2).

Table 2
Motor activity performance level and selected aspects of behaviour during the performance of 23 motor activities

Motor activity	**Performance level [1–3 points]**		**Participation [1–6 points]**		**Attention [0–3 points]**		**Interfering behaviours [0–3 points]**	
	M	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**
1. Lifting up one's head	1.7	0.47	3.3	1.11	1.3	0.77	2.5	0.99
2. Plank	1.3	0.47	2.6	0.98	1.1	0.63	2.4	1.25
3. Rollover	1.8	0.65	3.4	1.09	1.4	0.74	2.4	1.07
4. Spinning	1.8	0.62	3.5	1.00	1.5	0.46	2.8	0.64
5. Crawling	1.6	0.49	3.1	1.04	1.3	0.56	2.2	1.20
6. Moving forward on uneven ground	2.2	0.60	3.9	0.85	1.7	0.56	2.9	0.32
7. Passing through a tunnel	2.3	0.48	4.1	1.19	1.8	0.62	2.4	0.71
8. Moving on and along a wooden gym training bench only using the upper limbs (prone position)	2.0	0.59	4.1	1.16	1.8	0.65	2.6	0.73
9. Bench – balance beam	2.1	0.73	3.7	1.24	1.7	0.54	2.8	0.43
10. Baseball throw	1.9	0.56	3.6	1.14	1.6	0.56	2.4	0.98

Motor activity	Performance level [1–3 points]		Participation [1–6 points]		Attention [0–3 points]		Interfering behaviours [0–3 points]	
	M	SD	M	SD	M	SD	M	SD
11. Throwing a ball at a target	1.8	0.65	3.4	1.36	1.5	0.66	2.6	0.78
12. Picking up objects	2.2	0.55	4.0	1.13	1.7	0.59	2.6	0.81
13. Ball rolling	2.0	0.34	3.6	0.95	1.7	0.57	2.9	0.24
14. Catch and throw	2.0	0.49	3.7	1.02	1.6	0.51	2.6	0.75
15. Bowling	1.8	0.51	3.2	1.10	1.5	0.61	2.7	0.62
16. Transitioning to kneeling	1.4	0.50	2.9	1.13	1.3	0.68	2.8	0.64
17. Hitting a ball with a stick	2.1	0.54	3.8	1.32	1.7	0.74	2.7	0.83
18. Stacking circles	2.2	0.38	4.0	1.08	1.8	0.49	2.9	0.47
19. Shooting at a goal	2.2	0.62	3.9	1.04	1.7	0.63	2.8	0.73
20. Kicking a ball over an obstacle	1.2	0.38	2.8	1.16	1.3	0.58	2.4	1.09
21. Passing an obstacle course	2.3	0.57	3.9	1.16	1.8	0.54	3.0	0
22. Jump	1.2	0.38	2.6	0.85	1.1	0.51	2.5	1.20
23. Jumping on a springboard	1.4	0.50	2.9	1.05	1.3	0.65	2.6	0.98

M – mean
SD – standard deviation

A similar status to the performance level of motor activities was mirrored in two aspects of behaviour: participation and attention. There is a variation in the average levels of these behaviours depending on the type of motor activity performed. The same motor activities, such as nos. 2, 16, 20, 22, 23 have the lowest level of participation and attention, and motor activities such as nos. 7, 12, 18 and 21 showed the highest level, also for the two aspects of behaviours mentioned above.

When analysing interfering behaviours during the performance of the 23 motor activities, one can see that this is the aspect of behaviour that is characterised by the greatest intra-group diversity. This means that subjects showed the existence and extent of interfering behaviours on a very individual basis depending on the selected motor activity. It is possible to name those motor activities that were most affected by interfering behaviours during the performance, namely nos. 5 (crawling), 7 (passing through a tunnel – at the same time one of the highest average performance levels was achieved for this activity, followed by participation and attention. When entering the tunnel, the children with ASD did not want to leave it, they were reluctant to do so and inside the tunnel they often began to play stereotypically, for example), 10 (baseball throw) and 20 (kicking a ball over an obstacle). It is also important to

distinguish one of the motor activities – 21 (passing an obstacle course) during which none of the subjects showed interfering behaviours, and this was an activity that was performed at one of the highest average performance levels by the subjects with the highest degree of participation and attention at the same time (Table 2).

The correlation between the performance level of the motor activities and aspects of behaviour such as participation and attention proved to be statistically significant for most of the motor activities. This correlation is at least moderate (rho = 0,4 – 0,7; p <0,05), while for participation, major correlations are predominant for most of the motor activities performed (rho > 0,70; p < 0,05). It can be said that the greater the degree of participation and the length of time it takes to concentrate, the greater the motor activity performance level is. This means that these subjects are more autonomous and do not expect any form of assistance from the instructor.

The relationship between the motor activity performance level and the existence of interfering behaviours is not significant. It cannot be concluded that fewer or more interfering behaviours affect the motor activity performance level of the subjects. Behaviours that occur to varying degrees, such as screams, echolalias, stereotyped movement disorders, which could distract the attention of the subject from the task, are not relevant to how independent the subject is during the performance of such motor activity (Table 3).

Table 3
Correlation coefficient (Spearman's rho) between the motor activity performance level in 23 tasks and aspects of behaviour

Level of motor activity performance	**Participation**	**Attention**	**Interfering behaviours**
1. Holding one's head up	0.81*	0.84*	0.53*
2. Plank	0.80*	0.69*	0.37
3. Rollover	0.90*	0.72*	0.50*
4. Spinning	0.69*	0.66*	0.64*
5. Crawling	0.74*	0.72*	0.24
6. Moving forward on uneven ground	0.81*	0.56*	0.39
7. Passing through a tunnel	0.64*	0.52*	0.74*
8. Moving on and along a wooden gym training bench only using the upper limbs (prone position)	0.76*	0.61*	0.19
9. Bench – balance beam	0.73*	0.35	0.42
10. Baseball throw	0.59*	0.40	0.50*
11. Throwing a ball at a target	0.78*	0.75*	0.15
12. Picking up objects	0.87*	0.64*	0.50*

Level of motor activity performance	Participation	Attention	Interfering behaviours
13. Ball rolling	0.24	0.08	0.73*
14. Catch and throw	0.75*	0.46	0.50*
15. Bowling	0.66*	0.61*	0.16
16. Transitioning to kneeling	0.88*	0.66*	0.31
17. Hitting a ball with a stick	0.62*	0.58*	0.39
18. Stacking circles	0.25	0.33	0.11
19. Shooting at a goal	0.70*	0.59*	0.63*
20. Kicking a ball over an obstacle	0.66*	0.64*	0.28
21. Passing an obstacle course	0.77*	0.53*	-
22. Jump	0.66*	0.39	0.20
23. Jump with a springboard	0.86*	0.68*	0.42

Note: *correlation coefficients are significant for $p<0.05$
Red colour indicates a correlation with an interdependence above 0.4 – at least a moderate degree.

3. Discussion

Data analysis enabled the authors of this paper to present the status of the independent motor activity performance level and simultaneous behaviour of subjects with ASD during the activity. On average, all subjects showed a low to medium level of motor activity performance, which indicates that physical or verbal assistance was required from the instructor. It is interesting to see the results obtained both from the perspective of motor deficits that occur in persons with ASD, but also in terms of their causes and relationship with the overall functioning of this group and the associated behaviours. Such verification of data was undertaken by MacNeil et al. (2012) and others, who conducted a broad motricity analysis of persons with ASD. In addition to identifying disorders in basic motor skills and their manifestations, they also showed disorders in recognition and understanding of social gestures (performed) by other people, as well as in motor imitation and the use of objects in their intentional action. The authors claim that children with ASD are not able to develop a coherent action plan based on visual information. In addition, they often do not sense where individual parts of the body are located in space and the mutual relationship between them. Among the reasons for these deficits there are brain structure abnormalities – poor connections of the parietal premotor centres, which are necessary for developing visual-motor coordination. In their research, Gowen and Hamilton (2013) noticed difficulties in performing complex gestures, increased response time and confirmed the presence of dyspraxia in persons with ASD. Researchers report that some children with ASD are able to perform individual actions correctly, albeit at a slower rate. However, difficulties arise mainly when performing multiple-step tasks. This effect may

be linked to weak central coherence. It causes people with ASD to concentrate on individual elements of information and they cannot create an integrated whole. This was also confirmed by Ohta's study (1987) that assessed imitation skills. It turned out that persons with ASD imitate in a fragmentary manner, that is – they observe the individual extremities of researchers as separate body parts. This proved that it is difficult for the study subjects to combine elements into one whole. Also, the difficulties in acquiring skills relating to independence do not just result from problems in imitation. They may be the result of poor central coherence and may be linked to disorders in the reception and integration of stimuli, poor knowledge of the body, poor patterns regarding motor activity performance, and irregularities in terms of executive functions. The latter are management control mechanisms, such as planning, flexibility of attention, or inhibition of intrusive reactions (Pisula and Strządka, 2014).

Among the well-known cognitive theories concerning the original deficits in persons with ASD, most studies were devoted to the relationship between executive functions and motor development (Berryman, Pothier and Bherer, 2017). Both the executive functions and their correspondence to operative memory enable engagement in information processing, addressing very difficult problems, planning, and applying the plan in real life situations (Baddeley, 2000). Most studies provide the context in which the motor activity itself has a positive impact on reducing executive function deficits. Donnelly et al. (2016) concluded that aerobic capacity and its increase through physical activity allows for achieving higher levels in tests requiring the high potential of executive functions (particularly inhibition and working memory). Brain structures and neural networks that support execution functions are particularly sensitive to the benefits of exercise and overall motor capability development (Chaddock et al., 2012; Niederer et al., 2011). Rajtar-Zembaty et al. (2015) showed that executive functions play a significant role in motor control. They play a key role in gait control when new activities are undertaken or when previously learned motor programmes are modified. Many authors who look at the link between executive functions and language skills and appropriate behaviours in social situations also point to their importance for the motor development of the group under discussion (Steele, Minshew, Luna and Sweeney, 2007; Yerys, Hepburn, Pennington and Rogers, 2007; Hala, Rasmussen and Henderson, 2005; Landa and Goldberg, 2005).

The study described in this paper showed that the selected aspects of behaviours and their low level may determine the lower level of motor activity performance. One can also look at this problem from a different perspective, owing to the correlation-based scheme. This higher level of motor activity performance may determine a higher level of controlled aspects of behaviour, such as participation and attention, which constitute the area of social development and communication. Bremer et al. (2014) showed that motor development in children with ASD contributed to positive changes in social skills of this group, but also a reduction of unwanted behaviours. In these studies, there are not many correlations between the motor activity performance level and the interfering behaviour as in other aspects of behaviours (participation and attention). The leading hypothesis in the literature is that persons with ASD are too tired to engage in unwanted behaviours while performing their motor tasks at the same time (Bremer and Lloyd, 2014). However, there are studies that do not indicate such a cause. Kern et al. (1982) or Nicholson et al. (2011) demonstrated that the positive behaviours of persons with ASD (e.g. adequate response, increased focus) improved and strengthened after physical activity. Conversely, if this fatigue is to reduce stereotyped behaviours, it should also reduce the occurrence of positive behavioural reactions. It is therefore likely that other factors are playing a significant indirect role in changing aspects of behaviour.

Another aspect of behaviour that was observed during this study was attention. It is defined as the ability to notice and link events occurring over a period of time. It is important that the ability to focus on a given task lasts as long as possible. With this dependency, the objectives of the activities undertaken can be positively achieved (Knill and Knill,1997). There was a positive correlation between the level of attention and the level of motor activities. It can therefore be assumed that without sufficient attention brought to the task, subjects with ASD would not be able to achieve sufficient independence during the undertaken activities. The literature on the existing cognitive deficits of persons with ASD often mentions the lack of attention (Talarowska, Florkowski, Gałecki and Zboralski, 2010). It covers various features, such as scope, degree of concentration, persistence, and alternating attention. Casey et al. (1993) showed that children with ASD have particular difficulties in focusing on a subject and alternating attention, as well as keeping it for a longer period of time. Excessive fixation on a specific stimulation was also found. This limits the information coming from the environment and the perseverance of the activity initiated by children, limiting their attention only to the objects that are consistent with their preferences (Pierce, Glad and Schreibmman, 1997). Therefore, focus (attention) is very valuable to persons with ASD. This has a positive impact on the motor activity undertaken and may be the basis for mastering new motor activities, but social skills as well (Talarowska, Florkowski, Gałecki and Zboralski, 2010).

In addition to autism, moderate and severe intellectual disabilities occur in the group of subjects, and there are coexisting difficulties in verbal communication (a supportive and alternative communication system was implemented in most cases). For this reason, it was difficult to obtain feedback from the subjects about their interest in the undertaken activity. The value of the present study is that its process was closely monitored by five competent judges. However, the recording of the participation level in particular may provide information about the willingness of the study group to participate in the proposed activities. Its high level also signified a higher level of motor activity performance. Having the subjects themselves initiate the activity was an experience on the basis of which one may infer that the subjects are not only independent in their motor activities, but also want to perform the given activity. Such knowledge may be the basis for developing educational and therapeutic programs for children and adolescents with ASD. By knowing what activities subjects are more likely to engage in, one can set goals that go beyond the development of motricity and achieve cognitive or social development.

4. Conclusions

The results may be helpful for educational and therapeutic activities. On the basis of the authors' own scientific studies and literature reviews, it was shown that if the aim is to make children with ASD independent in terms of their motricity, attention and social skills should also be developed. What is more, it seems that the greater the degree of participation in a motor activity, when subjects are able to take the initiative and the duration of their concentration is simultaneously longer during the activity, the higher the motor activity performance level is. At the same time by achieving significant independence while performing motor tasks, it is possible for persons with ASD to achieve fuller mental and physical development.

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