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Effects of Bocce Game on Perceptual Motor Ability and Object Control of Adolescents with Mental Retardation

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Abstract

The study investigated the effect of the Bocce game on developing perceptual-motor ability and object control of adolescents with mental retardation. The subjects of the research were 15 adolescents with moderate Mental Retardation status (Age =16.4±1.59; IQ 54±.5). The study used a quasi-experimental method with a one-group pre-test post-test design. The analysis was conducted by using a T-test. The instrument used in this study was an observation employing an observation checklist adapted from Gallahue's (1982) assessment checklist to measure perceptual-motor ability. A test was also employed to measure object control, including an underhand roll ball (grounder) test on the target using a Bocce ball with a 4-meter distance. The intervention of Bocce Game was given for 12 sessions. Each session lasted for 2 hours, 3 days per week. The statistical analysis showed the significant effect of the Bocce game on developing perceptual-motor ability (2.73 > 2.145) and object control (22.85 > 2.145). For that reason, it concludes that there is a significant effect of the Bocce game on perceptual-motor ability and object control of adolescents with mental retardation.

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INTRODUCTION

Mental retardation or intellectual disability (ID) is a condition in which intellectual abilities are significantly below the normal average, where the day-to-day functioning is low (Green Paul & Flaro Lloyd, 2015). Bocce is a sport, which belongs to boule games, played with metal balls (Kao, 2014). The general aim of boule games is to throw or roll one or more heavy metal balls to a target, usually a jack or marble-sized ball. Bocce sport is deemed to be suitable for mentally retarded individuals since it does not need complex skills and abilities, which suits a person with moving disabilities (Luke and Wittmannova, 2010). The rule of the bocce game is simple; it also requires minimal equipment and physical strength (Marcu, 2012). The athletes participating in Boccia games are perhaps the most disabled athletes within the Paralympic games, but the sport requires a high degree of accuracy, muscle control, and tactics. Boccia players throw or roll balls within a court. The goal is to have their ball rest closest to the jack ball, also known as the target ball or white ball (Válková, 2015)

Bocce game requires the children to apply their perceptual abilities by activating their five sense abilities, particularly the visual sense by knowing and learning the environment, measuring the distance of the target, activating the perceptual process, and knowing the parts of the body that can support the throwing movement. Movement activities are grouped according to the perceptual-motor qualities they enhance, namely body awareness, spatial awareness, directional awareness, and temporal awareness.

There have been previous related researches carried out. Water exercises and swimming appear to be an available and effective way to improve the physical fitness capacity of children with mental retardation (Jesudoss, 2012). A specially adapted eight-week basketball training program produced an improvement in specific motor skills for all adolescents with mental retardation (Stanisic et al, 2012). Therefore, specially adapted basketball education and the nature of the basketball environment, which includes interaction among different individuals and a decision –making processes over a variety of situations and understanding of the game in all its constituent parts, can be the factors improving the interaction and promoting connections among members. There are significant influences of the straight and cone-shaped directing boards on down-syndrome child throwing abilities in Bocce game (Rosmiati, et al, 2013).

Physical educators assist retarded students in improving their cognitive and motoric capabilities. A few studies demonstrate that rest time and physical activity can improve the physical fitness of children with mental retardation (Horvat& Franklin, 2001; Faison & Porretta, 2004). The important benefit of balance training and postural training in individuals with mental retardation is that they can improve their body functions. This exercise can increase their daily activities. Physical Education specifically designed for disabilities can provide special benefits for children with special needs (İlhan, et al, 2011). Lack of financial supports for Sports and Physical Education in schools, lack of public knowledge about disabilities, and unsupportive facilities are obstacles for persons with disabilities to participate in sports (Patel & Greydanus, 2002).

On the other hand, some previous researches showed different results. Contextual interference did not affect sport-based skill learning in older adults. As the parameter modifications, it may have negatively influenced the practice groups in the Bocce throwing task (De Souza Marina et al, 2015). The result of the study showed that there was a significant improvement on selected criterion variables, such as balance, learning, Bocce, Badminton, and Table Tennis skill performance of under 14-year age group due to calisthenics exercises. However, there was no significant difference among the groups. Another research showed that there was a significant improvement on selected criterion variables, such as balance, self-care, Bocce, and Table Tennis performance of under 14-year age group due to aquatics exercises. However, there were no significant differences among the groups. Therefore, it is essential to improve the perceptual-motor ability and object skills of adolescents with mental retardation to improve their quality of life. One of the physical activities to improve those skills is an interesting game for adolescents with mental retardation. The aim of the study was to examine the impact of the Bocce game on perceptual -motor ability and object control of adolescents with mental retardation.

METHODS

Participants

This study was set under a quasi-experimental method and employed a One-Group Pre-Test Post-Test design (Creswell, 2013). The study involved 25 students with mental retardation in a special secondary school, where the students were categorized into a moderate mental retarded category. Fifteen subjects (age ± 16.4 years, sd.= 1.59, mean IQ ±54, sd. = 4.5, weight ±56 kg, sd.= 2.1, height ± 1.58 cm, sd. 1.32) were selected through a non-randomly assignment (quasi-experiment) (Creswell, 2013).

Instrument

The observation employed an observation checklist adapted from Gallahue's (1982) assessment checklist. Perceptual motor ability was divided into the level of concentration, visual awareness, body awareness, space awareness, direction awareness, distance awareness, social awareness, temporal awareness, force awareness, problem-solving, and independence. The instrument included 27 components of perceptual inability to be observed and was set using the Guttman scale, the "Yes" or "No" answers. The results were analyzed quantitatively and accumulatively from the perceptual inabilities performed by students during playing the Bocce game. The instrument had been validated logically through expert judgment and empirically by administering a construct, content, and congruent instrument validity test to fulfill the requirement of a safe research instrument. An instrument to measure the student object control ability was the outcome measurement test, by testing students to throw underhand roll ball (grounder) to the target in 4 meters using a Bocce ball. The measurement was conducted by counting the total of 10 balls that were thrown accurately to the target (Morrow, et al., 2011).

Procedure

The data were collected through the pretest and posttest. The observation to collect perceptual-motor ability data was conducted three times. The pretest was conducted in the first meeting. The second data collection was carried out in the 6th week. The posttest was in the last meeting, the 12th meeting. The observation was conducted during the implementation of the Bocce game and involved two observers to observe each student's performance during the game. A video tapping instrument was also employed in the study to validate the findings gathered from observation. After conducting a pretest on the subjects, the treatment was given, namely the Bocce game, in 12 meetings within 3 months. The treatment was given once a week, every Friday for two hours, from 8 a.m. – 10 a.m. The game was set as a semi-competition system to enhance the student motivation to play. The students were divided into two groups, namely Group A that consisted of 8 students, and Group B that consisted of 7 students. They played in different fields. Every player in each group played Bocce game against each other in every round within 25 minutes. The winner of the game was the one collecting a higher score from every round. Before playing the game, the students were given 10 minutes to do warming up. Students were set in pairs and moved in a circle to take their turn to play.

Data Analysis

The gained data were then analyzed by using the Kolmogorov-Smirnov normality test. The normality test revealed that all data had a normal distribution. The data were further analyzed descriptively through the following steps: data recapitulation, data description, and data interpretation. Descriptive data were presented in tables (redundant table, bivariate table, and multivariate table), percentage (%), percentage deviation (% d), gain, mean (±), standard deviation (SD), and range. This data presentation was further displayed in a histogram. Meanwhile, inferential analysis was conducted by using the T-test, with the test of significance (α)= 0.05 for all variable analyses (Susetyo, 2012).

RESULT

The objective of the study was to find the impact of the Bocce game on perceptual-motor ability and object control ability of students with mental retardation. Results of the investigation showed the student perceptual-motor ability based on its components. In measuring the impacts of the Bocce game on perceptual-motor ability in mentally retarded students, the study focused on 27 components describing their perceptual inability.

Table 2 shows the number of subjects and percentage of each component, in Yes and No Option, to measure student perceptual-motor ability from the 27 components. In the Yes option, it was shown that 60% of the subjects (15 students in the study) faced difficulties

in perceptual-motor ability during the Bocce game (Mean = 9), and 40% of the subjects of the study faced no difficulties in the perceptual-motor ability (Mean = 6). In Table 2, it can be viewed that only 27% of the students faced difficulties in their perceptual-motor ability during the Bocce game, based on the 27 components of perceptual-motor ability, (Mean = 4). This means that the percentage of students who faced problems in their perceptual-motor ability decreased from 60%, in the pretest result, to 27%, after intensive treatment of the Bocce game. In the posttest, 73% of students had no difficulties in their perceptual-motor ability in playing the Bocce game. This result increased from 40% in the pretest. However, it was also revealed that there were still 73 % of students who had poor body positioning. This problem can be understood since it had been carried from their childhood. Besides, there was also 53% of students faced problems in solving problems that were raised during the game.

Table 1. Score of Interpretation Criteria for Perceptual Motor Ability

Perceptual based Component	Interpretation Criteria	Perceptual based Subject	Interpretation Criteria
Score	Deficiency	Category	Explanation
27-22	Very deficient	80-100%	Most entirely
21-16	Deficient	60 -79%	Majority
15-10	Sufficient	40 - 59%	Partially
9-4	Almost no shorted	20 - 39%	Fraction
3-0	Very small weakness	0 - 19%	Very small portion

Table 2. Score Result of 1st Observation (Pretest) and 12th Observation (Posttest) on Student Perceptual Motor Ability based on Components in Bocce Game

	Pretest ($Observation_1$)		Posttest ($Observation_{12}$)	
	Yes	No	Yes	No
Total	27	27	27	27
N	15	15	15	15
Total Score	240	165	110	295
Mean	9	6	4	11
(%)	60	40	27	73
SD	1.48	1.24	1.37	1.27
Range	5 - 12	3 - 10	1 – 7	7 - 14

Table 3 presents the comparison of the percentage of each perceptual-motor ability measurement component in pretest and posttest. The table clearly shows that there is a decreased percentage of difficulties faced by students in almost all components. The highest decrease (53%) was in the student concentration when taking a turn in playing the game, only 7% of students were lack of concentration. This finding indicates that most of the students had given their enthusiasm to the Bocce game. The improvement of student perceptual-motor ability can also be seen in student attention to game instructions and ideal throwing distance (47%). This result implied that students were able to give their attention to the game instructions given and train their perceptual ability. Student awareness of throwing distance was found better since the students had been able to adjust their throws to the target or palina ball. Another improvement was on the student focus on the target to throw (46%). This result was confirmed by the observation finding that the student throwing was getting closer to the target. Meanwhile, other components of student perceptual ability were also found to improve, such as students were no longer looked confused when entering the field and had better awareness of throwing direction and speed (40%), which indicated that student efforts to make a good throw improved. It was also found that students still had poor body positioning (6%), but they had shown better performances on throwing body positioning (20%). They had been able to place the left leg at the front, but the right leg at the back, and use the right hand to throw.

Student object control ability showed that the Bocce game influenced student improvements in object control ability. Table 4 reveals that the total score of all subjects in the study increased from 45, in the pretest, to 69, in the posttest. Student object control ability scores improved from 5 to 8 for the highest score and from 1 to 7 for the lowest score (Mean = 3 in the pretest increased to Mean = 4.6 in the post-test). This result affected the percentage increase from 30%, in the pretest, to 46%, in the post-test, which also improved the category from less accurate to fairly accurate category. It indicated that student object control ability improved after the Bocce game treatment proven by student better able to shoot using underarm on the target.

Table 5 presents T-Test results revealing that significant influence of the Bocce game was found in two

Table 3. Percentage of Dispute (% d) between Pretest and Posttest Results on Perceptual Motor Ability

			Pretest		Posttest		
No	Perceptual Motor Ability Component	∑	Yes	%	Yes	%	%d
1	Look confused when entering the field	15	10	67	4	27	40
2	Show not really good gesture	15	11	73	10	67	6
3	Look confused when the explanation is given	15	9	60	4	27	33
4	Lack of understanding on his body parts and function, left-right leg	15	7	47	4	27	20
5	Lack of understanding on his body parts and function, left-right hand	15	5	33	3	20	13
6	Lack of understanding on places in Bocce field	15	6	40	3	20	20
7	Lack of understanding on boundary areas to throw the ball	15	7	47	2	13	34
8	Lack of understanding on left, middle, and right sides when throwing the ball	15	10	67	4	27	40
9	Poor concentration when starting to play the game	15	10	67	5	33	34
10	Difficult to focus on the target	15	11	73	4	27	46
11	Poor eye-sight (visual)	15	5	33	3	20	13
12	Lack of understanding on distances of throwing: far, moderate, near	15	9	60	2	13	47
13	Lack of understanding on direction in throwing the ball: proper straight, diagonal, straight, skewed	15	10	67	4	27	40
14	Lack of understanding in setting the ball speed: slow, fast, and moderate	15	11	73	5	33	40
15	Weak arm power when throwing the ball onto the target	15	10	67	5	33	34
16	Poor of consideration before throwing the ball	15	9	60	4	27	33
17	Careless when throwing the ball	15	9	60	4	27	33
18	Poor of strategy in playing the game	15	12	80	7	47	33
19	Difficult to solve the problems coming up during the game	15	12	80	8	53	27
20	Lack of communication with the opponent	15	7	47	3	20	27
21	Always ask for help	15	8	53	2	13	40
22	Lack of understanding the game rules	15	8	53	2	13	40
23	Poor concentration on throwing turns	15	9	60	1	7	53
24	Lack of attention on the game instructions	15	9	60	2	13	47
25	Concentration can be easily distracted	15	7	47	4	27	20
26	Poor control of body positioning when throwing the ball	15	10	67	7	47	20
27	Lack of attention on the opponent performance in the game	15	9	60	4	27	33

Table 4. Results of Object Control

Measurement	**Accuracy**	
Test	Pretest	Posttest
N	15	15
∑ Skor	45	69
Mean	3	4.6
Sd.	0.93	1.22
Range	1 – 5	2 – 8
%	30 %	46 %
Category	Less Accurate	Fairly Accurate

Table 5. Result of T Test on Perceptual Ability and Object Control

No	Ability Component	T-crit	T-table	Sig.	Description
1	Perceptual ability	2.73	2.145	0.05	Significant
2	Object control ability	22.85	2.145	0.05	Significant

ability components, namely student perceptual-motor ability and object control ability. Student perceptual ability component gained T crit 2.73 and T table 2.145 with α= 0.05. T crit is higher than the T table with a level of significance of 0.05. It concludes that the Bocce game has significant influences on the perceptual-motor ability of students with moderate mental retardation. Student object control ability obtained T crit 22.85, higher than T table = 2.145 with α = 0.05. It concludes that the Bocce game had also significantly improved the object control ability of mentally retarded students by throwing the ball onto the target.

DISCUSSION

The findings show that the Bocce game has significant effects on improving student perceptual ability. This conclusion is proven by the facts from the investigation process. Students, at the very first time, were lack of concentration and had difficulties focusing on the target before throwing the ball to the target. In addition, students seemed to face a lot of difficulties in body positioning, how to make a good position, and how to set the direction and power to throw the ball. These facts were consequences of their cognitive or mental disabilities. Students with mental or intellectual retardation will have some difficulties in cognitive aspects, such as perception, memory, development of ideas, evaluation, and reasonings (Somantri, 2007). The improvement began to rise after the 4th meeting, where students started to give their attention, focused on the game, and had a strategy to hit the target. They also showed better body positioning. They were able to position their body in the throwing area and the boundary line before throwing the ball. Besides, they were able to perform better body positioning in adjusting to the ball location and in setting the ball's direction and speed. After the 8th meeting, the student's perceptual ability kept improving. The students managed to set a strategy and tactic to play the game. For example, they tried to keep the opponent ball away from the palina ball and they used walls of side barriers to make the ball glide straightly. At the same time, accuracy on the target also got better.

Changes included motor behavior, cognitive abilities, affect and attention, self-confidence, and social interaction. Improvement was observed in the areas of coordination and stamina. There was an increase in their cognitive ability to employ purposeful strategies of behavior, understand, and competently use time and space. One unique study, which focused on the impact of exercise on problem-solving skills, reported that moderate-intensity exercise (55 to 60 percent VO2max) for 20 minutes resulted in an increase of problem-solving speed in teenagers with an average IQ score of 60 (Auxter David, et al. 2001).

Bocce game was also found significant in improving the object control ability of students with mental retardation. The findings gained from observation showed that students who showed lack the ability in controlling the object eventually showed a better performance. In the beginning, when the palina ball lied near the boundary line, the students threw the ball too far that made the ball location too far from the palina ball. This finding is in line with Morya (2019) who believes that the combination between the game and the body movements in the Bocce game is useful for stimulating the nerves and motor movements. To sum up, when an individual with mental retardation is given appropriate practice opportunities and guidance, they will demonstrate high levels of fitness and motor performance (Auxter, et al, 2001).

The activities of throwing Bocce balls to the target include arm movement activities that can support arm

muscle power and handgrip power. The 12-week sports program conducted for mentally retarded students showed that there were significant improvements in their perceptual-motor ability from the weak category, in the pretest, to the medium category in the posttest. The same improvement was also raised in the mentally retarted student object control ability from the less accurate category, in the pretest, to a fairly accurate category, in the posttest. After implementing Bocce game activities to students with mental retardation, some pedagogical implications were summarized. First, Bocce game activities had a significant role in improving the perceptual and motor ability of students with disabilities, particularly students with mental retardation.

The implementation of the Bocce game in school sports education allows mentally retarded students to have useful physical activities and even recreation in their environments. Accordingly, in the school context, it is needed to facilitate and provide Bocce field and adequate tools to put and implement this game activity in the learning program. For sports teachers, the Bocce game for adolescents with mental retardation needs to be implemented since it suits their characteristics and allows them to improve their perceptual-motor ability and accuracy on object control ability. Hence, sports teachers are suggested to introduce the game activity and train the student's various skills in Bocce game so that they are be able to play the game well, which would lead them to improve their physical power abilities, mental and social abilities, and their personality. Further, the improvements of student abilities may lead to the improvement of their motivation to practice Bocce games in a larger and more prestigious scope, such as the paralympic game.

However, the study has limitations. In investigating the case issued, the study did not involve a control group, only involved one level category of the subjects of the study (moderate category), and lasted limitedly (12 weeks). Therefore, future researchers are highly recommended to involve a control group to conduct the investigation, involve more level and more challenging student ability, for example, heavy retarded category or different gender, and give a longer time to investigate the case being discussed to have more comprehensive results.

CONCLUSION

Based on the findings gained after investigating the effects of the Bocce game on the improvement of perceptual-motor ability and object control ability in mentally retarded adolescents, the conclusion can be drawn. Bocce game, as a manipulative target game, has a more dominant effect on cognitive activities, particularly on perceptual-motor ability.

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