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Comparative Study of the Effects of Mental, Physical and Combined Exercises on the Reactions of Students with Visual Impairments

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ABSTRACT: The purpose of this quasi-experimental study was to compare the effect of the combination of mental and physical exercises on the reaction of the students with visual impairments. The subjects were 30 girls of 9 to 12 years old who had congenital blindness and were selected by the available sampling method and randomly divided into three groups of 10 mental exercise, physical exercise and combined exercise. Experimental work of the groups was 8 two sessional weeks in time duration of 45 to 60 minutes per session. Subjects' ability to react was measured through ruler testing. Statistical analysis of the data was done using descriptive statistics, one-way ANOVA, LSD post hoc test and paired t-test at a significance level of $P<0.05$. The results indicate the significant superiority of mental exercise techniques (24.1±7.7) relative to physical exercise (30.2±9.5) and combined exercise (28.6±8.9). According to these findings, the physical education teachers of blind children while working to develop the capabilities of their student's rate should benefit from specialized mental exercises in the components related to the reaction.

Key words: Mental Exercise, Physical Exercise, Mental - Physical Exercise, Reaction Capability, Visual Impairments

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INTRODUCTION

Vision as the most powerful source of the external world perception is responsible for the task of transferring 80 to 90 percent of the information to the brain. Thus, even mild abnormalities in its function cause severe distortions in the physical, mental and motor development (Krotsievich, 2003). Because of the importance of eyes in social relationships, visual impairment is more pronounced than the other disabilities and this creates a lot of panic in patients (Daniel Pink et al., 2007).

Studies have shown that movement as the most important physical education tool is a significant factor for the development of children's health with special needs.

Therefore, the development of physical education science and sports will improve the quality of life for people with disabilities (Joseph et al., 2007).

Movement is the primary and inherent form of all human activities, since all movement functions are driven by the central nervous system and associated transmission lines (Larsson and Frandin, 2006). Thus, the detection of the primary and secondary insufficiencies of abnormal growth is possible through the Movement Disorders assess.

Human movement reaction depends on function of the central nervous system (Schmidt and Richard, 1997). In this regard, the shorter the time between stimulus onset and response onset, the faster the reaction will be. This feature that plays an important role in many sports and motor activities has a close relationship with decision making rate (Kazemi, 1996). Blind children due to special problems and a low level of physical fitness, their reaction rate is slower than normal counterparts. Due to defects in their visual system, they have greater reaction time. Researchers believe that this additional time is spent more to plan and initiate movements (Rostami, 2000).

According to a theory of cognitive defects, any defect in the organism, will force it to eliminate defects and compensation. As a result, the influence of defects on the human organism is always dual and contradictory. Defect, on the one hand weakens the organs or injured sensory receptors and on the other hand, it stimulates and starts the compensative mechanisms. Consequently, according to the theory of sensory compensation, if conditions are favorable, defect negativity will change to compensation positivity. Such compensatory in blind children will be achieved through other senses, especially hearing sense (Shafie et al., 2006).

In recent years, the concept of mental exercise or as quoted from McGill, doing "cognitive exercise" rather

than overt physical movements, is considered by many experts. In this exercise method, human tries to recall the movements in his mind, without doing the activity or physical movement (Mulder et al, 2008). Mental exercises are suitable tools for human to achieve mental relaxation and fulfillment of learning. These exercises in general cause favorable changes in motor behavior (Rahmani-Nia, 2003). Several recent studies have shown that mental exercise as physical exercise can improve motor skills (Feltz et al., 1983). Such a reality is justifiable with commonality of mechanisms of mental and physical exercises in learning process (Chambers, 1991).

In the pre-operational level, mental images lead to reappearance of what that has been previously perceived. These images that are in three forms of static, moving (change of location) and converting (change in shape) are steadily appearing in human perceptual experiences. Usually, the devastating effects of child blindness eventually lead to the exclusion of his/her experience from mental images. In such circumstances, enhancement of hearing performance may be required to compensate for delays in cognitive developments (Sanders et al., 2004). According to the theory of sensory compensation, children who are deprived of visual experience and mental imagery can have mental imagination based on their auditory sense. When auditory imagination is addressed naturally full attention is drawn to stimuli and vocal - verbal patterns. In other words, the imagination of what that is auditory is the alternative of the imagination of what that is visual.

Blinds psychic affectivity of psychologically vocal - verbal patterns requires strong auditory sense. Thus, if blind children percept other persons' speech sounds properly and carefully, the image etched in their minds is properly formed (Chambers, 1991). Researchers believe that blind children are able to get a lot of information through hearing others' verbal patterns and to overcome the limitations imposed by the lack of visual information (Lowporet et al., 1997). Yousefi et al (2008) in a comparative research, considered blind motor imagery as compared to normal people as the same and found no significant difference between the two groups. But blinds in the mental imagery performed significantly in a lower level.

Ability to react as the human capability to respond more quickly to environmental stimuli is considered as one of the most important factors of human motor fitness (Schmidt and Richard, 1997). Rate is an important part of "movement abilities" that its quality depends on the performance of psychological, physiological and morphological elements set. In blind children lack of motor opportunities on one hand and closeness of the correlation between the rate and the nervous complicated processes on the other hand, cause slowness in rate performances. In addition, children with developmental disorders (generally) due to lower attention level (compared to healthy counterparts) need more time to react to stimuli. Therefore, the reaction ability development in blind children, on one hand increases central nervous system power of repartee in different situations of life, and on the other hand, assists their social independence in terms of doing daily homework and the ability to deal with the dangers of unexpected situations.

Therefore, searching for various ways to improve the response rate and the movement in the environment are the main conditions for learning academic skills in children who suffer from poor vision sensor (summer, 1997). Fear of injuries resulted from accident with people or things and worry about response to stimuli and motor motivelessness are considered as the limiting factors of the motor skills of blind children (Daniel Pink et al., 2007; Brouziyne and Molimaro, 2005). It must be mentioned that usually most of children with visual impairments (even in acute conditions) are not considered absolute blind, because they have the ability to detect light (the left sight), which is a valuable store for them. In this regard, some researchers knew such a left sight as the cause for their confusion in spatial orientation relative to the absolute blind children. For example, Corn and Wall (2002) concluded from their research that the perception of absolute blind people of audio sources is far more accurate than their counterparts with low vision (Corrn, 2002). Therefore, in order to design the physical education program for children with visual impairments carefully, the severity of their impairment should also be taken into considerations (Litosch, 2002).

Researchers of the present study after reviewing previous researches in the area of Physical Education of Exceptional Children found that few studies has been made about the effect of mental exercises on the rate capabilities of blind children.

Therefore, the aim of this study was to compare the effectiveness of three methods of mental exercise, physical exercise and combination of both of th1Dem on the reaction rate of children with visual impairments.

Obviously, the findings of such research will help to design an optimal program of physical education for blind children.

MATERIALS AND METHODS

The research is quasi-experimental research with three-group design that examines the effect of mental exercise, physical exercise, and their combination on the motor reaction ability of students with visual impairments. Subjects, selected from the population of Kermanshah special schools, were 30 girls of 9 to 12 years old who had congenital blindness and randomly were divided into three groups of 10 matched (in terms of sharpness of vision) physical exercise, mental exercise and combined exercise (mental- physical). Also, the criterion for entry into the study was the child not being affected by secondary

disorders caused by the primary defect (vision) in the skeletal and cardiovascular systems. Experimental work of the groups was 8 two sessional weeks in time duration of 45 to 60 minutes per session.

Exercise protocol of physical exercise group consists of three parts of basic (5-10 min), main (25-40 min) and cooling (5-10 min). The content of the exercise main part included:

1. Middle Game : This game is the same as middle game for sighted children, but to achieve tactile perception, auditory perception and spatial orientation of team members , leading lines (using ropes and tape) and the alarm ball will be used.

2. Playing with alarm balloons: An alarm is placed inside the balloon so that the blind child can orient the spatial situation of it in changing conditions of the play.

Notes: To prevent children from feeling jittery coach warns that there is the possibility of bursting balloons.

3. Play games on Trampling: In the side of the Trampling a batch was embedded in order to child be able to maintain balance while jumping.

Note: To protect the safety spongy cover was used around Trampling.

4. Playing with a yoyo: after yoyo full training the child was asked to play with both hands. For further motivation, the musical yoyos were used.

5. Hopping: to provide information to the blind children, the prominent lines were installed on the floor.

In addition, to consider the principle of individual differences, if the following symptoms (in each subject) were observed, the intensity of testing exercises was reduced:

- White or dark skin color
- Excessive sweating
- Rapid and shallow breathing.
- Lack of coordination due to fatigue
- Reduction of the attention level to orders due to fatigue
- The child complains of feeling tired

Exercise protocol of mental exercises group is researcher made and derived from Zhang Li's mental exercises model (1992) for blind children of 8-12 years old (Zhang et al, 1998)20.These exercises correspond to the number of sessions and duration of present study exercises (45 to 60 minute exercise for 16 sessions) and they were performed in a hierarchical order. Activities content in the sessions were as follows:

First session:

Topic: training the nature of mental exercise;

Methods: Getting familiar with children and describing the nature of mental exercise in the form of simple sentences in the form of a group through a lecture and question and answer;

Practical recommendations: examples are given regard to mental exercises importance in performing motor skills in daily life, for example, the basic perception of the totality of the objects with hands (to understand the volume, scope and size) and then noticing the details of the objects through the tactile sense (for the perception of roughness, softness, etc.).

Second Session:

Topic: Describing the benefits of mental exercise;

Methods: Reviewing the first session exercises with the students in the form of a group through questions and answers about the definitions and benefits of mental exercise in daily life and summing up. Explaining the nature of mental exercise in the form of simple sentences in the form of a group through a lecture and question and answer;

Practical recommendations: various objects are presented to the children and the manner of their correct touch perception (according to the first session) is reviewed. In addition, concepts related to spatial orientation, including left, right, up and down are explained.

Third session:

Topic: training relaxation skills;

Methods: describing the negative effects of muscle tension on motor skills. relaxation exercises derived from Jacobson technique with hierarchical order of being in a comfortable position, making initial tension, and then mental focus for relaxing the muscles of different parts of the body, including face, right and left hands, trunk, right and left foot. Notes: Performing mental exercises of relaxation will be continued in next sessions, but it was controlled in order to not lead to sleepy feelings.

Fourth session:

Topic: How to use mental exercise on motor coordination capabilities;

Methods: individual and group training of lesson plan using provided examples of motion in everyday life such as getting, tying the shoelaces, buttoning up, walking, running, etc. The subjects were advised that while relaxing the muscles, review all phases of the training exercises and imagine their practical implement in their mind.

Sessions 5 to 15

Topic: Practical use of mental exercise in motor coordination capabilities;

Methods: Initial relaxation of muscles; spending 5-10 min mental exercise for routine movements separately, addressing the details verbally.

Final session (XVI)

Subject: Review of previous sessions exercises, briefly;

Methods: Hierarchical implementation of previous sessions exercises (with priority of muscle- relaxation);

Notes: The subjects were announced that in the coming week, their motor coordination capabilities will be tested.

Exercise protocol of combined exercises group in terms of duration (45 to 60 minute exercise for 16 sessions) and content was the same as the mental exercise group, with the difference that the subjects in addition to imagery practically implemented the trained movements.

MATERIALS AND METHODS

The pre- and post-test, the subjects reaction rate was measured using a ruler. This test is performed in a standing position so that the elbow is bent (90 degree angle) and premier forearm is in neutral state and perpendicular to the trunk (palms facing the body). In this case, the ruler zero point is placed tangent with the lower level of palms. Experimenter unexpectedly presents the audio signal and simultaneously releases the ruler and subjects will be required to grab the ruler which is falling under the influence of gravity, at the least possible time. Then the observed number on the ruler (on the point of tangency with the lower level of palms) in centimeters is recorded (Figure 1).

Figure 1. How to record ruler test results

The test is performed three times and the average results are recorded. Statistical analysis of the data was done using descriptive statistics, one-way ANOVA, LSD post hoc test and paired t-test at a significance level of $P < 0.05$.

RESULTS

In Table 1, the average of the student's reaction rate before the start of experimental work in the mental exercise group was (33.3±7.3), physical exercise group was (35.6±9.6) and mental - physical exercise group was (32.7±7.9). The ANOVA test results indicate the lack of significance and homogeneity between groups at pre-test ($P = 0.186$). However, the observed difference in the post-test was statistically significant ($P = 0.024$).

Therefore, LSD post hoc test was used to determine the source of differences (Table 2). As can be seen, the difference between mental exercise group and physical exercise group (sig =0.007) and mental exercise group and mental - physical exercise group (sig =0.014) is significant. However, the difference between physical exercise group and mental - physical exercise group is not statistically significant (sig =0.190).

Also, to determine significant differences of reaction rate averages in each group in pre-and post-test, paired t-test was used. Results showed that the noted difference is significant in the mental exercise group ($p < 0.05$). This indicates the occurrence of an improvement of 37 percent (from 33.3 to 24.1) in the reaction rate (Table 3).

Table 1. Descriptive information and the results of subjects' ANOVA test

Group	Subjects' Characteristics			Pre-Test Reaction Rate	Post-Test Reaction Rate
	Number	Age Average		Average ± Standard Deviation	Average ±Standard Deviation
Mental exercise	10	9		33.3±7.3	24.1 ±7.7
Physical exercise	10	8.5		35.6±9.6	30.2 ±9.5
Mental - physical exercise	10	9.9		32.7±7.9	28.6 ±8.9
F				1.79	6.51
				0.186	0.024*

*P<0.05

Table 2. Results of LSD post hoc test regard to the paired comparisons of the study groups

Test	Comparison of groups					
	Mental exercise group with physical exercise group		Mental exercise group with mental-physical exercise group		Physical exercise group with mental-physical exercise group	
	MD	Sig.	MD	Sig.	MD	Sig.
Reaction Ability	-6.1	0.007*	-4.5	0.014*	1.6	0.190

MD=Difference between averages

Table 3. Comparison of pre-test and post-test average reaction rate for all three groups

Groups	Pre-test	Post-test	T amount	Freedom Degree	Standard Deviation	Sig
Mental exercise	33.3	24.1	3.07	9	5.17	0.013*
Physical exercise	35.6	30.2	2.17	9	4.08	0.057
Mental -physical exercise	32.7	28.6	1.27	9	6.4	0.131

DISCUSSION

Studies have shown that blind children due to some factors such as the tactile performance development in the exploration procedure of objects and events in the life activities, in comparison with their normal counterparts, are more successful in the mental positioning (Cornoldi and Vecchi, 2005). But in the field of physical education, the studies about the effect of mental exercises on motor actions have been mostly devoted to healthy individuals and athletes (Adams, 1987).

But study results of Mulder et al. (2008) and Nowicki (1995) indicated the lack of effect of mental exercises on learning a motor task (Nowicki, 1995). The findings of this study showed that in the development process of reaction ability of children with visual impairment, the use of mental exercises is more effective than the other two methods. These findings are consistent with the research results of Yousefi (2008) that examined the effectiveness of mental exercise training on blind students' motor ability. Studies have shown that there is no significant difference between blind students and normal students in terms of motor imagery, and approximately they had acted in the same level (Noordzij, 2008).

The possible explanation that can be expressed for this finding is that in motor imagery the discussed cases are applied and tangible and blind subjects have a relative mastery over these cases. In this kind of imagery, imaginations are often in control and in relation to their body imagination. So in this kind of imagery, a blind person is also able to be at their normal peers' level. For example, when a blind person is asked to imagine his/herself walking or standing, it is easier to imagine than to be asked to imagine a summer.

Probably because the discussed children basically live in the world of mind, the use of absolute mental exercises is more effective than the use of methods of physical and compound exercises (mental - physical). On the other hand, perhaps in order to develop the reaction rate, duration of eight weeks of exercise is not sufficient to benefit better from the physical exercises and combined exercises. Therefore, future researchers, in addition to defect intensity, should notice the previous movement experiences of children which depend on the factors such as knowledge level, financial affording of the parents and so on to provide an environment full of movement for the child. The findings of this study can be indicative of the fact that the coaches during physical activities design to enhance rate capabilities of children with visual impairments, and to develop the rate component of the reactions, should concentrate on the mental exercises method more.

In other words, in physical education and sports in special schools, it is better to use specialized methods of verbal communication with children with visual impairments. This means that in relation to the rate of the motor reaction, physical education of the discussed children has a great dependence on the development of cognitive abilities of through the provision of verbal information (Litosch, 2002). Perhaps as Lowporet et al. (1997) stated it is due to the fact that blinds due to deprivation of visual experience, are able to obtain much information from others' verbal patterns which is a kind of compensatory mechanism against deprivation of visual information. Noordzij and Zuldhoek research (2008) have shown that children with visual impairments in terms of auditory imagery are the same as their counterparts, and the main difference between them is related to the visual imagery.

In this respect, Chambers (1991) and Lowporet et al. (1997) have noted the importance of auditory imagery in rehabilitation, learning, motivation, movement and mobility of children with visual defects. From the findings of this study it can be concluded that in the reaction rate development process, auditory receivers and imagery through the words are the most important canals of compensation of visual receivers defect. Admittedly, the present study had some limitations. So exceptional physical education teachers are recommended when lesson plan is considered as development of reaction rate, to fulfill mental imagery benefit it is better the expertise speech be used rather than running (by the child). Through the mental exercise and imagery training to the blinds, many contributions are given to them in their everyday life problem solving. One of the ways of coping with the environment by the blinds is mobility and orientation. Through motor imagery training, and informing them of the issue, blinds can be helped. Expressing real and concrete imaginations of the environment seems important and essential for the Blinds.

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