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Effects of Kinesthetic Training on the Perception Abilities of Cerebral Palsy Children

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Abstract

Cerebral palsy children are presented with the complaint of atypical activity in the muscle that leads to their poor perception abilities. The said condition may lead to poor perception abilities in these children. The present research was conducted to measure the influence of kinesthetic exercises on the perception abilities of cerebral palsy children. The study was conducted in a physiotherapy center named DisAbilites in Faisalabad. The sample was composed of nine cerebral palsy children. The pretest-posttest design was employed. The kinesthetic skills of the students were assessed by using the perceptible abilities of the students suffering from cerebral palsy. An intelligence test was used to measure the perception ability of the cerebral palsy children before and after the intervention. The intervention consisted of exercises performed by an experienced physiotherapist to enhance the kinesthetic skills of the children. Prior to the intervention, the pretest was administered. After six weeks of the intervention, the posttest measured kinesthetic skills and perception ability again. Results indicated a statistically significant increase in the kinesthetic skills of cerebral palsy children. The increase in the score of the kinesthetic skills influences the perception abilities of the cerebral children positively.

Keywords: pre-school, proprioception, tactile.

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Introduction

Cognition refers to all that is related to knowledge. The gaining of information through learning and experience is referred to as cognition. According to Niesser (2010), cognition is the ability to learn new information and knowledge through perception and experience and integrate all this information in order to evaluate the worlds. Cognitive development refers to perception, thinking, and understanding of the world through the interaction of genetic and learned factors. Reasoning, intelligence, memory, and language development are information processing areas of cognitive development. Cognition includes the ability to adapt and process the information that is received from different sources and change them into knowledge. Decision making, attention, reasoning, language and learning are different cognitive processes that include cognition (Darowski, Helder, Zacks, Hasher, & Hambrick, 2008).

In addition, cognition is the intellectual process of knowing and has different dimensions such as perception, awareness, judgment and reasoning which emerge to be known through an individual's perception, awareness, reasoning and intuitive knowledge (McCloskey, 1978). This definition integrates the earlier aspect of product and process but also attaches one important factor. The most widely accepted definition of cognition is the intellectual progression of internal and external interaction, which is adapted and personalized, decreased, used and stored (Neisser, 2014). Cognition encompasses many roles including decision making, memory, reasoning, attention and perception.

Poor cognition is the result of impairment. Cognitive impairment generally refers to the developmental loss of cognitive abilities, which is particularly apparent in students with cerebral palsy due to their developmental issues. Cerebral palsy affects the student's ability to perceive, interpret and connect using the different sections of the brain. These difficulties may manifest in various ways such as difficulty in oral and written speech, coordination, attention or self-control (Bialystok & Viswanathan, 2009). As a result, the student may have issues learning to read, write or perform mathematical operations. The initial development of the child is greatly influenced by body manipulation and motor activities. A number of research studies indicate that many students with severe physical disabilities appear not to meet some age-specific

milestones or suffer from a delay in cognitive development (Sommer & Wurtz, 2004).

Kinesthetic sensitivity is the ability of the human body to manipulate the muscles, skin and joints in order to move and position the limbs. The knowledge of the environment received through sensory receptors in the joints, skin and muscles is called kinesthetic awareness (McCloskey, 1978). Somatic sensations are believed to attribute to high kinesthetic sensitivity. Armstrong, McNair and Taylor (2008) state that the use of body awareness is the most effective technique for developing kinesthetic skills. A sense of kinesthesia was established by the visual, tactile proprioception training including sensory and motor aspects (Vuillerme, Teasdale, & Nougier, 2001). Some researchers define kinesthesia as a functional amalgamation of sensory inputs found on three diverse sub-senses of a human being (Proske, 2006; Proske & Gandevia, 2009). The first sub-sense is the sense of position and orientation of a person's body and limbs. The second sub-sense facilitates the person able to identify the motions of the four limbs and the rest of the body. The three senses work together to allow human beings to identify efforts generated by the muscles along with forces knowledgeable during muscular forces that become active during the performance of the movement.

Kinesthetic indicators of the muscles, tendons, joints, and skin mechanoreceptors are vital for the integral neural control and organization of the limbs and body movements. Joint perception and awareness of body movement is another way to describe kinesthetic indicators as well as including the position of the body and its segments in the space (Armstrong, McNair, & Taylor, 2008).

Kinesthetic sensitivity plays a vital role in daily life. Individuals utilize it for eating, walking, dressing, waiting, etc. Kinesthetic sense is actually muscle memory. This sense depends on the awareness of joint position and allows the addition of information without looking (Jameel, 2016). For example, kinesthetic sensitivity enables a blind person to walk and interpret their environment accurately. They can walk without counting steps because they become familiar with the surroundings through kinesthetic sense.

Most individuals are aware of their body movement and limb position so kinesthetic training can be a very effective tool for improving

motor functions. Improving motor functions increases kinesthetic sensitivity, and a strong relationship exists between kinesthetic sensitivity and cognitive ability (Case-Smith, 2000). This strong relationship is due to the way the nervous system functions. The nervous system receives a signal from the brain and then transmits it to the spinal cord and other parts of the body. It acts to control and monitor the body movement of the limbs. Kinesthetic sensitivity is needed to judge direction, how heavy something will be to lift, and where to walk. Playing sports requires high kinesthetic sensitivity.

Based on the previous discussion from the review of literature, this research study was designed to analyze the perception of special education teachers about the kinesthetic training of children with special needs working in special education institutions. The further intervention was used to enhance the cognitive abilities of children with cerebral palsy. Intervention given in the experiment, proved helpful to the school teachers because it provided the necessary knowledge about valuable exercises and activities to improve cognition of the children with cerebral palsy (Bumin & Kavak, 2008). This study also provided new avenues through the use of exercise to enhance the cognitive abilities of the student. Directions were provided to the teachers to assist their students with cognitive deficits in order to improve kinesthetic sensitivity, which leads to increased cognitive ability (Jameel & Nabeel, 2017). Determining the effectiveness of kinesthetic exercises for the development of cognition in children with cerebral palsy was the main objective of the study.

This research study helps teachers and other educational and medical professionals gain beneficial information about kinesthetic sense and kinesthetic training. The study shows kinesthetic training can improve cognition and opens new doors for further research. The children with cerebral palsy who participated in this study displayed significant increases in cognitive development after the kinesthetic intervention. The participants were able to learn and express themselves effectively. This study helped teachers and parents of the children with cerebral palsy to use techniques that improve the children's cognition.

To address the purpose of this study, the following research questions were formulated:

1. What is the effect of kinesthetic training on the development of the tactile

sense of children with cerebral palsy?
2. What is the effect of kinesthetic training on the development of cognition of children with cerebral palsy?

Research Methodology

The study was designed as an experimental study. Pretest posttest one group design was used. The convenient sampling technique was used for the selection of participants. Nine diagnosed cases of cerebral palsy consisting of one female and eight males from DisAbilities, a physiotherapy and rehabilitation center in Faisalabad district, were selected for the experiment. The ages of the participants ranged from five to seven years and they belong to the class of KG I & II.

Kinesthetic sensitivity was measured by using tactile and pressure clues and the Slosson Drawing Coordination Test (SDCT) for the assessment of participants' cognition level. The details of the tools we're given as under:

The participants' tactile sense was measured by the ability to copy hand gestures when given cues. The child was asked to recognize the tactile clue with eyes closed. A word or digit was printed with the finger of the teacher on the hand of the student. The child was then instructed to say the written word or digit. A total of eight clues were given on a dichotomous scale of Yes or No. Eight dissimilar tactile clues were graded for accuracy on a scale of zero to eight. The sum of all attempts that gains a score of 8 is the tactile sensitivity score. The reliability was measured as 0.83 by using Cronbach alpha value.

The pressure score was explored by rating the maximum pressure applied to paper during writing. To secure this score, the child was provided with eight additional sheets of paper upon which the child had to write with carbon paper between each sheet. The number of the last sheet of paper that is still readable is the pressure score. Pressure consistency evaluates the consistency of darkness of the letters on the sheet of paper lying underneath the one on which the child has written. A dichotomous scale of YES and NO was used. The reliability was measured as 0.88 by using Cronbach alpha value.

The Slosson Drawing Coordination Test (SDCT) was used to assess the cognition of the students with cerebral palsy. It is used to screen individuals with serious forms of brain damage. The objective of the test is to monitor individuals with forms of severe brain damage. Individuals with emotional or mental disturbances, those lacking motivation, or those with vision impairments may show unusual results and/or an abnormal degree of distortion on this test. Some brain dysfunctions do not involve

eye-hand coordination so the SDCT should be used in coordination with the SIT. Strengths and weaknesses may be determined from the analysis of the scatter plot. The qualitative validity of the research involved testing individuals who were known to have brain damage. The reliability coefficient was 0.96 for test-retest reliability on a sample ranging from 4 to 52 years; this was tested at the beginning and the end of the same session. Inter-scorer reliability is high, as scoring rules have been simplified. This test does not cover the coordination of eye-hand due to dysfunction of the brain so SIT may be used in conjunction with SDCT to account for limitations and flaws may be detected during the analysis of scatter plot.

After pre-testing, the exercise-based treatment was provided in six sessions a week for 30 minutes per session. A total of 36 sessions were conducted with the participants. At the completion of 36 sessions, a post-test was administered to reevaluate the participant's cognitive ability. The results of the pretest and posttest were compared to observe the effect of kinesthetic training on the development of cognition of children with cerebral palsy. The participants were treated for 30 minutes for six days a week for six weeks.

All the exercises and activities were conducted in individual and group forms. Exercises and activities were selected from the books and literature developed for the improvement of kinesthetic skills. Treatment was provided by the second author who is a registered special educationist with the help of physiotherapists and their assistants. Fidelity of the treatment and evaluation was ensured. Treatment was designed to develop the cognition in students. Kinesthetic training was provided to enhance cognition by using the literature developed for the improvement of these skills of the students. This research intervention used different exercises but focused on following kinesthetic exercises.

To improve balance, exercises that strengthen the feet muscles were employed. Foot exercise helps to increase feet muscles, which increases feet muscle control, strength and movement. Foot exercise helps to overcome the weakness of the foot. Feet are used to walk, stand and balance. If the feet are weak, the strength and control might be compromised. Practicing foot exercise keeps a person flexible, strong and improves overall foot health. To strengthen the feet muscles and toes, try the following exercise. Sit in a chair, and put your feet flat on the floor. Spread a hand towel on the floor. Place the toes on the end of the towel closest to you, and scrunch toes to pull the towel toward you. Repeat the exercise ten times with both feet. Hand exercises are essential for making the hand muscles strong and improving grip. Hand and wrist exercises are

specially designed to address the gripping muscles, which includes the hand, wrist and fingers. To strengthen the gripping muscles, practice the following exercise.

- Hold a hammer in the hand and turn the wrist palm up and then palm down.
- Place two shoeboxes one on top of the other and grasp a peg with the index finger and thumb.
- Place each peg one by one with the two fingers.
- Using playdough or clay, make a ball. Now, use a small jar to roll the playdough or clay with starting with the palm of the hand and rolling to the fingers and back.

The process of perceiving sensory messages from the environment and the body is known as sensory processing. After receiving these communications, useful responses are extracted, determined and systemized so forecasting can take place.

In addition to these communications, feelings or sensations are received and relayed through the Central Nervous System (CNS) as well as from nerves throughout the spinal cord and the brain during the entire process of communication. Some information is added from the external environment through the peripheral nervous system. Consequently, a constant process of sensory intake is happening in the body during all daily activities. Each and every single delivery of contributions and input help individuals make sense of their world by the means of poignant, tasting, smelling, hearing, seeing, protective or tactile senses, gravity and movement received through the vestibular senses and position of body through kinesthetic nerves of the body. All senses act as an amalgamation of other senses as well as independently in order to launch sensory messages from our body and surroundings.

As a result, individuals comprehend this whole process of sensing happening in the body repeatedly when marching up the stairs with a cup of coffee. The eyes watch the stairs and the foot lifts to take a step, which involves the kinesthetic senses as well as vestibular senses. People observe the smell of coffee, hear voices of friends, feel the sensation of clothes, make contact with the stair railing and avoid spilling the coffee while continuing to walk up to the stairs. Therefore, all these senses are acting altogether without any interruptions, which allow everyone to proceed productively throughout the day.

- Sit on a therapy ball with the hip and knee at a 90-degree angle while bouncing for balance
- Lie down and roll therapy ball with pressure

- Lay on the ball in prone position roll back and forth on the ball. This exercise uses eye and hand activity to improve kinesthetic and visual motor activity
- Catch the balloon and hit, lay on the ball in the prone position
- Bounce the ball against the wall and catch

In the end, a final evaluation—posttest-- was completed in order to investigate the effectiveness of kinesthetic training. The researcher worked as a facilitator and observed the performance of each individual with the assessment tool. Results were compared with pretest scores. The evaluation was analyzed. Significance of the treatment was measured by using paired sample t-test on the pretest and posttest scores, tactile clues, pressure clues and cognitive skill scores of the participants.

Results and Interpretation

The primary purpose of the study was to measure the effects of training related to kinesthetic skills on cognition of the children with cerebral palsy. The participants received the intervention for the development of kinesthetic skills for the duration of six weeks. Pretest posttest experimental design was used.

The kinesthetic skills encompassed the combination of tactile and pressure senses of the participants. The tactile and pressure senses scores indicated improvement of the kinesthetic ability of the students. A paired sample t-test was applied to measure the effects of training on these skills. To see the effects of training on the visual sense, a paired sample t-test was applied (Table 1).

Table 1 shows that the students had a higher score on tactile sense on the posttest assessment (Mean = 7.14, Standard Errors = 0.53) compared to the pretest assessment (Mean = 2.42, Standard Errors = 0.26), $t(6) = 6.93$, $p < 0.001$. This indicated the improvement of the tactile sense of the children with cerebral palsy.

Table 1
Paired sample t-test on pre-test post-test scores

Skill	Description	Pre-test Score	Post-test Score	t-value	Significance Level
Tactile Sense				6.93	p< 0.001
	Mean	2.42	7.14		
	Standard Deviation	0.69	1.40		
	Standard Error	0.26	0.53		
Pressure Score				4.58	p < 0.005
	Mean	2.86	3.56		
	Standard Deviation	0.69	0.33		
	Standard Error	0.26	0.14		
Cognition				2.72	p < 0.05
	Mean	47.13	54.38		
	Standard Deviation	12.54	4.43		
	Standard Error	4.43	3.86		

Total score for Tactile = 8, Pressure = 8, Cognition = 100

Overall, the students showed a higher score on pressure sense on the post-test assessment (Mean = 3.56, Standard Errors = 0.14) compared to the pretest assessment (Mean = 2.86, Standard Errors = 0.26), t (6) = 4.58, p < 0.005. This measurement indicated an improvement of the pressure sense of the children with cerebral palsy. On an average, the students showed a higher score on the cognitive ability on the posttest assessment (Mean = 54.38, Standard Errors = 4.43) compared to the pretest assessment (Mean = 47.13, Standard Errors = 4.43), t (39) = 4.46, p < 0.005 (Shaphiro & Wilk, 1965). The tactile perception of the students increased as a result of the intervention provided to the students. The pressure sense of the students also increased as a result of the intervention provided to the students. The cognitive ability of the students increased as

a result of the intervention provided to the students. A similar finding has been observed in a study in which an exercise plan improved the pressure sensitivity of the children (Vuillerme et al., 2001). This study represented the overall improvement in the perception sense of the students. However, the specification of a strategy to improve the perception abilities of students could not be determined by this study.

Conclusions

The interventions proved helpful for the increase of tactile sense in the students with cerebral palsy. The intervention also proved useful for the increase of pressure sense of the children with cerebral palsy. The training was effective for the development of the cognitive ability of children with cerebral palsy. The kinesthetic training played a positive role in the development of cognitive ability in students with cerebral palsy. This study could identify the measurements off the specific training for the improvement of perception

Recommendation

The following recommendations were derived based on the study:

- The exercises may be continued for the betterment of the children with cerebral palsy.
- The exercises may be continued for the application of repeated measured designed for future researchers.
- The exercises may be conducted in a similar way with alternative tools of the same construct.
- The teachers may use the exercises to enhance kinesthetic and cognitive abilities.
- School administrators and policy makers may use these techniques for the development of the perception abilities of the students as a part of the plan for rehabilitation.

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