Performance of Motor Imitation in Children with and without Dyspraxia

Korrawan Ruttanathantong PhD*, Wantana Siritaratiwat PhD**,
Sarinya Sriphetcharawut PhD***, Alongkot Emasithi PhD****,
Jiamjit Saengsuwan PhD*****, Jittima Saengsuwan MD******

** Faculty of Associated Medical Sciences, Khon Kaen University, Khon Kaen, Thailand*
*** Improvement of Physical Performance and Quality of Life Research Group, Faculty of Associated Medical Sciences, Khon Kaen University, Khon Kaen, Thailand*
**** Department of Occupational Therapy, Faculty of Associated Medical Sciences, Chiang Mai University, Chiang Mai, Thailand*
***** School of Physical Therapy, Faculty of Associated Medical Sciences, Khon Kaen University, Khon Kaen, Thailand*
****** Faculty of Public Health, Khon Kaen University, Khon Kaen, Thailand*
******* Department of Rehabilitation Medicine, Faculty of Medicine, Khon Kaen University, Khon Kaen, Thailand*

Background: *Motor imitation is truly essential for young children to learn new motor skills, social behavior, and skilled acts or praxis. The present study aimed to investigate motor imitation ability between typically-developing children and dyspraxic children and to examine the development trends in both children groups.*
Material and Method: *The comparison of motor imitation was studied in 55 typically-developing children and 59 dyspraxic children aged 5 to 8 years. The Motor Imitation subtest consisted of two sections, imitation of postures and imitation of verbal instructions. Typically-developing children and dyspraxic children were examined for developmental trends. The independent samples t-test was used to analyze the differences between both groups. Two-way analysis of variance (ANOVA) was used to analyze inter-age differences for each age group.*
Results: *The results revealed significant differences between dyspraxic and typically-developing children. Both typically-developing and dyspraxic children demonstrated age trends. The older children scored higher than younger children.*
Conclusion: *Imitation is a primary learning strategy of young children. It is essential that children with dyspraxia receive early detection and need effective intervention. Typically-developing children and dyspraxic children showed higher mean score on the Imitation of Posture section than the Verbal Instructions section. Motor imitation competency, therefore, changes and improves with age.*

Keywords: *Motor imitation, Dyspraxia, Typically developing children*

J Med Assoc Thai 2013; 96 (7): 794-800
Full text. e-Journal: *http://jmat.mat.or.th*

Motor imitation is defined as the capacity to acquire a new motor behavior through observation or duplication of a movement after seeing a demonstration[1]. This strategy is used to obtain many skills such as using objects and toys functionally and producing sounds for speech. This includes engaging in activities with a group and children use it throughout their lives to acquire new skills, social behavior, and praxis[2-4]. Children begin learning how to imitate at a very young age. Piaget suggests that motor imitation of others' behaviors begins at approximately 4-months old[5]. Hamlin et al[6] found that 7-month old infants would imitate another individual's choice of an object. Moreover, Jones[7] found that infants as young as eight months reproduce single gestures and actions directed towards objects.

Imitation is seen as a window into the sensorimotor, cognitive, and social abilities of both typically-developing children and those with atypical development[8]. In child development research, early studies have indicated that the motor imitation deficit is not due to motor impairment or an inability to display action sequences[9]. Poor motor imitation, referred to as dyspraxia, is commonly reported in children with autism spectrum disorder (ASD)[9,10], in children with intellectual disabilities, and in children with

Correspondence to:
Siritaratiwat W, School of Physical Therapy, Faculty of Associated Medical Sciences, Khon Kaen University, Khon Kaen 40002, Thailand.
Phone & Fax: 043-202-085
E-mail: wantana@kku.ac.th

developmental coordination disorders (DCD)[11,12]. The investigators found that children with ASD between the ages of eight and 12 years tend to exhibit partial imitation, related to viewing the examiner's body parts (hands, arms) as being separate from the rest of the body. Children with ASD have difficulty perceiving that parts are related as a whole in their mental images. Some investigators have reported findings emphasizing a primary impairment in imitation while other have documented impairments in performance of skilled motor gestures not only in imitation but also in response to verbal commands or during actual tool use[9,13,14]. Smith and Bryson[15] reported that young children and adolescents with autism had difficulty naming gestures and imitating unconventional use of objects. Rogers et al[16] found that children with ASD at a mean age of 34 months had more impairment in overall imitation abilities, oral-facial imitation, and imitations of actions on objects than children in all of the other age ranges. Furthermore, Hobson and Lee[17] found that children with autism with mean age of 13 years 9 months (range 9.01-18.10) showed more delayed motor imitation, including person focused, imitation of body movements, understanding relationships among various parts of the body, or recognizing social aspects of imitation.

Motor imitation is essential for young children to learn skilled acts. However, fewer studies have investigated the motor imitation abilities of children aged five to eight years. This range of age is an important age range for school-aged children to learn skilled activities daily at school and home. Poor motor imitation is referred to as dyspraxia. Children with dyspraxia often experience difficulties with physical education, handwriting, and self-care activities. Therefore, motor imitation is important to children with dyspraxia to let them receive early detection, which is needed for an effective intervention. The objectives of the present study were to compare motor imitation ability between typically-developing children and dyspraxic children and to examine the development trends in motor imitation performance in typically-developing children and dyspraxic children.

Material and Method

Participants

Between November 2010 and October 2011, two groups of purposive sample of children were recruited, 59 children with dyspraxia and 55 typically-developing children, aged five to eight years. Fifty nine children with dyspraxia were recruited from five collaborating sites located in different parts of Thailand, Saraburi Hospital, Chonburi Hospital, Buddhachinaraj Hospital, Khon Kaen Hospital, and Srinagarind Hospital. The inclusion criteria were age from five to eight years, able to understand and following commands, and having good cooperation during testing. All participants with dyspraxia were evaluated by two pediatric occupational therapists using the sensory integration approach. Clinical Observation based on Sensory Integration Theory, developed by Erna Blanche[18] was used to screen children's praxis abilities. Fifty-five typically developing children aged five to eight years were also recruited from two local elementary schools in Khon Kaen province. The inclusion criteria for typically-developing subjects included average intelligence level evaluated by his/her teacher, good cooperation during test, no motor and language problems, and normal hearing and vision. The present study was approved by Khon Kaen University Ethics Committee for Human Research (HE532080). Parents of all participants received information about the objectives and procedures of the study and gave informed consent before participating in the present study. Demographic data of all children are listed in Table 1.

Instrument

The Motor Praxis Ability Test is an objective and stable tool used to screen motor praxis ability in

Table 1. Characteristics of the participants

Characteristic	Dyspraxic children (n = 59)		Typically-developing children (n = 55)	
	n	%	n	%
Gender				
Male	46	78.0	27	49.1
Female	13	22.0	28	50.9
Age (years)				
5	9	15.3	14	25.3
6	19	32.2	12	21.7
7	14	23.8	17	31.3
8	17	28.7	12	21.7
Grade level				
Pre-elementary education	25	42.4	25	45.5
Elementary education				
Year 1	24	40.7	17	30.9
Year 2	10	16.9	13	23.6

children with dyspraxia and typically developing children, aged five to eight years. Motor Imitation Subtest (MI subtest) is one of seven subtests of MPAT consisting of two sections. The first section (items 1- 8) examines the ability of a child to mimic gestures after watching a demonstration. The second section (items 9-14) examines the ability of a child to reproduce gestures after receiving verbal instructions. Children can be scored between 0 and 3 on each of the 14 items. The total scores range from 0-28. Test-retest reliability with a 2-week interval of MI subtests was high (Intraclass correlation coefficient [ICC] = 0.82 for dyspraxic children; ICC = 0.86 for typically-developing children). Inter-rater reliability of MI between two different raters was 0.80 for dyspraxic children and 0.84 for typically-developing children. Internal consistency reliability was 0.882 for this highly heterogeneous test. The MI subtests demonstrating well-established content validity with the IOC at 1.00 were clarity, conciseness, and appropriateness of items greater than 80% in the extensive literature and expert panel discussion.

Procedures

Nine licensed occupational therapists (OT) with four years of clinical experience in pediatrics were raters in the present study. Two of nine OTs worked at Saraburi Hospital, two worked at Chonburi Hospital, two worked at Buddhachinaraj Hospital, and the remaining three worked at Khon Kaen Hospital. At the beginning of the present study, all raters were intensively trained and had practice sessions regarding test administration and scoring criteria by the first author. Dyspraxic children completed the Sensory Processing Checklist, Clinical Observation Worksheet, and MI subtest. These children were tested by seven OTs. Typically-developing children completed the MI subtest and these children were tested by two OTs. All participants in both sample groups completed the MI subtest, which consisted of 14 items. Test administration was conducted in a quiet room, and each child was individually tested and seated in a chair across from the rater. Each child was asked to duplicate gestural tasks after seeing the demonstration such as "the fingertip of the right hand touches the palm of the left hand" and after receiving verbal command such as "put one elbow on the back of your hand" (see Appendix I for the complete list of items). The whole assessment lasted approximately 15 minutes.

Data analysis

The average scores and standard deviation of the Imitation of Posture and the Verbal Instructions were calculated for each group. Two-way analysis of variance (ANOVA) was used to determine differences between both groups and interage differences for each age range in both groups.

Results

The mean raw score of MI for the typically-developing group was 19.29 (n = 55, SD = 5.00). The mean score for the dyspraxic group was 13.59 (n = 59, SD = 4.78) which was significantly lower than that of the typically-developing group ($t = 6.22$, $p \leq 0.001$). The mean raw score of Imitation of Postures section was significantly higher than that of the Verbal Instructions section for both children groups (Table 2).

Two-way ANOVA found a significant main effect of typically-developing children group and dyspraxic children group, $F(1, 112) = 55.395$, $p < 0.001$, with typically-developing children group scoring higher than dyspraxic children group, and a significant main effect of age, $F(3, 110) = 8.793$, $p < 0.001$, with older children scoring higher than younger children. There was no significant group*age interaction, $F(3, 110) = 0.357$ $p = 0.785$ (Table 3). Post hoc t-test using a Bonferroni correlation for the total score of typically-developing children showed significant differences between the 5-year-old and 6-year-old groups, and the 7-year-old and 8-year-old groups, as

Table 2. Discriminative validity of the MI subscale for participants who were typically developing (TD) and children with dyspraxia

Motor imitation subscale	TD children (n = 55)		Dyspraxic children (n = 59)		Independent t-test results
	$\bar{X}$	SD	$\bar{X}$	SD	t
Imitation of postures	12.55	3.53	8.80	3.94	5.34***
Verbal instructions	6.75	2.66	4.80	2.12	4.34***
Total	19.29	5.00	13.59	4.78	6.22***

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

Table 3. ANOVA for Motor imitation score between age groups of children who were typically developing (TD) and children with dyspraxia

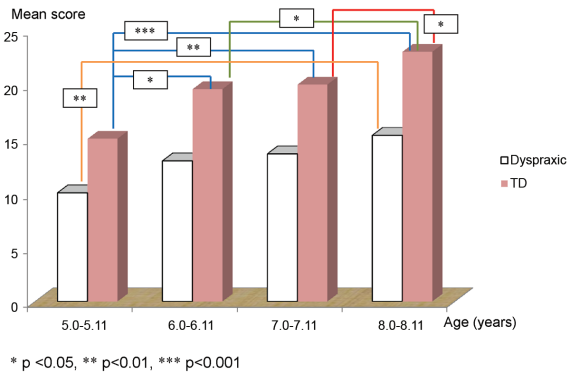
Source	SS	df	MS	F	p-value
Group	1,108.028	1	1,108.028	55.395	0.000
Age	527.630	3	175.877	8.793	0.000
Group*age	21.393	3	7.131	0.357	0.785

well as the 6-year-old group and 8-year-old group. In addition, significant difference was found between the 7-year-old group and 8-year-old group (Fig. 1). Significant differences were found for the total score of dyspraxic children only between the 5-year-old group and 8-year-old group ($p = 0.007$) (Fig. 1).

Discussion

Results show that typically-developing children aged five to eight years had significantly higher MI subtest scores than children with dyspraxia ($p<0.01$) in the same age group. This agrees with Smith and Bryson's study that children with autism aged between seven and 19 years make less mirror-image imitations than the healthy control group[19]. Stone et al[20] also found that an autism sample (mean age of 31.3 months) showed poorer performance of this split in imitative skills than their developmentally delayed sample (mean age of 31.1 months), indicating an autism-specific difficulty. The possible explanations were that children with dyspraxia have difficulties in integrating information from different sensory systems into stable motor representations[21].

The present study showed that the mean score for the Imitation of Posture section was higher than that of the Verbal Instructions section for both groups. According to Zonia et al[21], better use could be made



* p <0.05, ** p<0.01, *** p<0.001

Fig. 1 Comparison of mean score between age groups for dyspraxic children and typically-developing children.

of visual information than verbal information for recalling correct gestural planning from motor memory. Furthermore, it was found that before 8 years of age, children perform gestures in response to visual stimuli more readily than to verbal commands. When gestures were required through the verbal modality, there was a specific deficit in using sensory-motor information and integrating it into a motor representation. The findings in children and adolescents with ASD are consistent with a more generalized impairment in praxis. Children with ASD in the previous study showed a pattern of impairment similar to that seen in adults with acquired ideomotor apraxia. They had the greatest difficulty with performing gestures to command and improved performance with imitation and with tool use[14]. Rogers et al[8] found that autistic children failed in both imitation of gestures and imitation of actions on objects trials compared with typically-developing and developmentally delayed control children. The reason that children with autism failed to imitate actions on objects could be they either manipulated the object incorrectly or failed to imitate all of the steps; therefore, they performed only the end result.

Moreover, results of the present study confirmed that the MI subtest properly detects developmental differences among age groups of typically-developing children. However, there was no significant difference between the adjacent age groups between the 6-year-old and 7-year-old groups, which was likely due to the greater variability in performance of the older children. These findings support the report of Mostofsky et al[14] that children with ASD and typically-developing children showed improvement in performance with age on gestures in all three modalities (verbal command, imitation, and tool use). Njiokiktjien et al[22] found that a group of typically-developing children developed a constant maturation of execution precision of motor imitation performances until the age of 6 years. The previous study also showed that typically-developing 4-year-old children mime on verbal command a transitive gesture with a body-part-as-an-object grip. Three-quarters of

8-year-old children use a symbolic grip with configuration errors. When a visual cue is given, 5-year-old children already use a symbolic grip to mime the transitive action. Nearly all 12-year-old children mime with a symbolic grip without configuration errors[22].

In the dyspraxic children group, a significant difference of the MI score was found between the 5-year-old group and 8-year-old group. Lack of significant differences between the adjacent younger age group (between the 5-year-old and 6-year-old groups) and older age group (between the 7-year-old and 8-year-old groups) may be due to smaller incremental changes between ages, which may reflect a ceiling effect for the group of dyspraxic child performance. These findings for children with dyspraxia are consistent with results from a study of Mostofsky et al[14] that children with ASD improved their gesture imitation performance with age. The correlation between motor imitation and age was significant for children with ASD. These findings support differences in performance among younger and older children, reflecting a developmental trend in typically-developing children and dyspraxic groups. Motor imitation competency, therefore, changes and improves with age.

There are some limitations to the present study. Restriction of the age range of participants to five to eight years provided a more homogenous group, which limited ability to examine developmental trends on motor imitation in children with dyspraxia. Additionally, it is important to recognize that such experience can affect performance on motor imitation examination. It is possible that the dyspraxic children in the present study had less opportunity to learn and practice intransitive and transitive gestures. This aspect may be particularly true for intransitive gestures, such as waving good-bye, which are often used in social contexts. There is a clinical implication of the present study for diagnosis of children with dyspraxia. To expedite the early diagnosis of children with dyspraxia it would be interesting to assess motor imitation abilities in young children, which is needed for an effective intervention.

Conclusion

Imitation is a primary learning strategy for young children. It is essential that children with dyspraxia receive early detection, which is needed for an effective intervention. Both typically-developing children and dyspraxic children aged five to eight years showed higher mean scores of Imitation of Posture section than that of the Verbal Instructions sections. Performing motor imitation through verbal command is more difficult and it requires an assessment of a symbolic representation of the action. Furthermore, these findings support differences in performance among younger and older children, reflecting a developmental trend in typically-developing children and dyspraxic groups. Motor imitation competency, therefore, changes and improves with age in both typically-developing children and dyspraxic children.

Acknowledgement

The present study was financial supported by the Faculty of Associated Medical Sciences, Khon Kaen University, and the Graduate School, Khon Kaen University. The authors wish to thank children and their parents who participated in the study. The authors would like to thank the occupational therapists from the Saraburi Hospital, Chonburi Hospital, Buddhachinaraj Hospital, Khon Kaen Hospital, Srinagarind Hospital, and the kindergarten teachers of Anuban Khon Kaen school, and Suansanook school for their assistance with the data collection.

Potential conflicts of interest

None.

References

1. Tomasello M, Carpenter M, Call J, Behne T, Moll H. Understanding and sharing intentions: the origins of cultural cognition. Behav Brain Sci 2005; 28: 675-91.
2. Hallinan EV. The effect of social and causal information on children's imitation [thesis]. Ontario, Canada: Queen's University; 2008.
3. Hurley S, Chater N. Introduction: the importance of imitation. In: Hurley S, Chater N, editors. Perspectives on imitation: from neuroscience to social science. Cambridge, MA: MIT Press; 2005: 1-52.
4. Masur EF. Vocal and action imitation by infants and toddlers during dyadic interactions: development, causes and consequences. In: Roger SJ, William JHG, editors. Imitation and the social mind: autism and typical development. New York: Guilford Press; 2006: 27-47.
5. Owens RE. Properties of language. In: Owens RE, editor. Language development: an introduction. Boston: Allyn and Bacon; 1996: 14-27.
6. Hamlin JK, Hallinan EV, Woodward AL. Do as I

do: 7-month-old infants selectively reproduce others' goals. Dev Sci 2008; 11: 487-94.
7. Jones SS. Imitation in infancy: the development of mimicry. Psychol Sci 2007; 18: 593-9.
8. Roger SJ. Studies of imitation in early infancy: findings and theories. In: Rogers SJ, Williams JHG, editors. Imitation and the social mind: autism and typical development. New York: Guildford Press; 2006: 3-26.
9. Reavis SB. Social orienting as a construct underlying joint attention and imitation skills deficits in preschool children with autism [thesis]. North Carolina: University of North Carolina; 2003.
10. Vanvuchelen M, Roeyers H, De Weerdt W. Objectivity and stability of the Preschool Imitation and Praxis Scale. Am J Occup Ther 2011; 65: 569-77.
11. Macedoni-Luksic M, Greiss-Hess L, Rogers SJ, Gosar D, Lemons-Chitwood K, Hagerman R. Imitation in fragile X syndrome. Implications for autism. Autism 2009; 13: 599-611.
12. Green D, Baird G, Barnett AL, Henderson L, Huber J, Henderson SE. The severity and nature of motor impairment in Asperger's syndrome: a comparison with specific developmental disorder of motor function. J Child Psychol Psychiatry 2002; 43: 655-68.
13. Williams JH, Whiten A, Singh T. A systematic review of action imitation in autistic spectrum disorder. J Autism Dev Disord 2004; 34: 285-99.
14. Mostofsky SH, Dubey P, Jerath VK, Jansiewicz EM, Goldberg MC, Denckla MB. Developmental dyspraxia is not limited to imitation in children with autism spectrum disorders. J Int Neuropsychol Soc 2006; 12: 314-26.
15. Smith IM, Bryson SE. Imitation and action in autism: a critical review. Psychol Bull 1994; 116: 259-73.
16. Rogers SJ, Hepburn SL, Stackhouse T, Wehner E. Imitation performance in toddlers with autism and those with other developmental disorders. J Child Psychol Psychiatry 2003; 44: 763-81.
17. Hobson RP, Lee A. Imitation and identification in autism. J Child Psychol Psychiatry 1999; 40: 649-59.
18. Blanche IE. Observations based on sensory integration theory [Internet]. 2010 [cited 2010 Feb 10]. Available from: http://portal.wpspublish.com
19. Smith IM. Gesture imitation in autism I: nonsymbolic postures and sequences. Cogn Neuropsychol 1998; 15: 747-70.
20. Stone WL, Ousley OY, Littleford CD. Motor imitation in young children with autism: what's the object? J Abnorm Child Psychol 1997; 25: 475-85.
21. Zoia S, Pelamatti G, Cuttini M, Casotto V, Scabar A. Performance of gesture in children with and without DCD: effects of sensory input modalities. Dev Med Child Neurol 2002; 44: 699-705.
22. Njiokiktjien C, Verschoor CA, Vranken M, Vroklage LM. Development of ideomotor praxis representation. Dev Med Child Neurol 2000; 42: 253-7.

Appendix 1. Motor Imitation items

Item	Description
Imitation of posture	The examiner demonstrates a position and asks a child to do the same, like a mirror.
Item 1	The fingertips of the right hand touch the palm of left hand which is parallel to the floor.
Item 2	The back of the left hand touches the right cheek and the right hand touches the left upper arm.
Item 3	With wrists crossed, the palms of both hands touch each other.
Item 4	The tip of the right thumb touches the left index fingertip and the tip of the left thumb touches the right index fingertip.
Item 5	With arms straight out in front, the left palm rests on the back of the other, all fingers of both hands interposed.
Item 6	Index and middle fingers of both hands form a linked shape.
Item 7	The right hand touches the left elbow, the left hand touches the right elbow, and the right foot is placed on the left foot.
Item 8	The right ankle is placed on the left knee, the right hand touches the right knee, and the left hand holds the right ankle.
Verbal instructions	The examiner ask a child to move his/her hand and body.
Item 9	Put one elbow on the back of your other hand.
Item 10	Put both hands behind your head and turn your head to the side.
Item 11	Put one hand on your opposite shoulder and the other hand on the opposite knee.
Item 12	Stand with your knees and feet together and bend your knees.
Item 13	Kneel on the chair and place both hands on the back rest of the chair.
Item 14	Stand in a tandem position and stretch one arm to the front and the other arm to the back.

การเลียนแบบท่าทางการเคลื่อนไหวในเด็กที่มีและไม่มีความบกพร่องด้านการวางแผนการเคลื่อนไหว

กรวรรณ รัตนธารทอง, วัณทนา ศิริธราธิวัตร, สรินยา ศรีเพชราวุธ, อลงกต เอมะสิทธิ์, เจียมจิต แสงสุวรรณ, จิตติมา แสงสุวรรณ

ภูมิหลัง: *การเลียนแบบท่าทางการเคลื่อนไหวมีความจำเป็นอย่างยิ่งสำหรับเด็กเล็กในการเรียนรู้ทักษะการเคลื่อนไหวใหม่ พฤติกรรมทางสังคม และทักษะการทำงาน หรือ การคิดและการวางแผนการเคลื่อนไหว*

วัตถุประสงค์: *การศึกษานี้มีวัตถุประสงค์เพื่อเปรียบเทียบความสามารถในการเลียนแบบท่าทางการเคลื่อนไหวระหว่างเด็กที่มีพัฒนาการปกติและเด็กที่มีความบกพร่องด้านการคิดและการวางแผนการเคลื่อนไหว และเพื่อศึกษาแนวโน้มพัฒนาการของความสามารถในการเลียนแบบท่าทางการเคลื่อนไหวในเด็กทั้งสองกลุ่ม*

วัสดุและวิธีการ: *การเปรียบเทียบการเลียนแบบท่าทางการเคลื่อนไหวได้ศึกษาในเด็กที่มีพัฒนาการปกติจำนวน 55 คน และเด็กที่มีความบกพร่องด้านการคิดและการวางแผนการเคลื่อนไหวจำนวน 59 คน ช่วงอายุ 5 ถึง 8 ปี แบบประเมินการเลียนแบบท่าทางการเคลื่อนไหวประกอบด้วย 2 ส่วน คือ การเลียนแบบตามท่าทางการเคลื่อนไหว และการเลียนแบบตามคำสั่ง การศึกษานี้ได้ศึกษาแนวโน้มพัฒนาการของความสามารถในการเลียนแบบท่าทางการเคลื่อนไหวในเด็กที่มีพัฒนาการปกติและเด็กที่มีความบกพร่องด้านการคิดและการวางแผนการเคลื่อนไหว การเปรียบเทียบกลุ่มตัวอย่าง 2 กลุ่มซึ่งเป็นอิสระต่อกันถูกนำมาวิเคราะห์เพื่อศึกษาความแตกต่างระหว่างเด็กสองกลุ่ม และการวิเคราะห์ความแปรปรวนแบบ 2 ทางถูกนำมาวิเคราะห์เพื่อศึกษาความแตกต่างของช่วงอายุสำหรับแต่ละกลุ่มอายุ*

ผลการศึกษา: *ผลการศึกษาพบว่า ความสามารถในการเลียนแบบท่าทางการเคลื่อนไหวของเด็กทั้งสองกลุ่ม มีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ เด็กที่มีพัฒนาการปกติและเด็กที่มีความบกพร่องด้านการคิดและการวางแผนการเคลื่อนไหวมีแนวโน้มพัฒนาการของความสามารถในการเลียนแบบท่าทางการเคลื่อนไหวไปในแนวทางเดียวกัน คือ เด็กที่มีอายุมากมีค่าคะแนนสูงกว่าเด็กที่มีอายุน้อย*

สรุป: *การเลียนแบบท่าทางการเคลื่อนไหวเป็นการเรียนรู้ขั้นแรกของเด็กเล็ก ซึ่งมีความจำเป็นอย่างยิ่งที่เด็กจะได้รับการประเมินในช่วงต้นและจำเป็นสำหรับการบำบัดรักษาที่มีประสิทธิภาพในเด็กที่มีความบกพร่องทางการคิดและการวางแผนการเคลื่อนไหว เด็กที่มีพัฒนาการปกติและเด็กที่มีความบกพร่องด้านการคิดและการวางแผนการเคลื่อนไหวมีค่าคะแนนเฉลี่ยของส่วนการประเมินการเลียนแบบตามท่าทางการเคลื่อนไหวสูงกว่าส่วนการประเมินการเลียนแบบตามคำสั่ง นอกจากนี้ความสามารถในการเลียนแบบท่าทางการเคลื่อนไหวมีการเปลี่ยนแปลงและพัฒนาตามอายุในเด็กทั้งสองกลุ่ม*