Improving gross motor skill development through the Montessori method in children aged 3-5 years

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Abstract

Introduction: Montessori is a method of teaching children based on children activity. It can activate gross motor skill development in children.

Objectives: To assess the effect of the Montessori method on the gross motor skill development of children aged 3-5 years.

Method: This study used a quasi experimental research design with pre-test and post-test with control group. Purposive sampling was used. Sample size was 40 children consisting of 21 children in Nur Hidayah Early Child hood Education (ECE) Centre as intervention group and 19 children in Bina Kasih I ECE Centre as control group. Research instrument was Denver Development Screening Test (DDST) II. Statistical data analysis used was the Mann-Whitney test and the Wilcoxon test.

Results: Of the 40 children 23 (57.5%) were female, 32 (80%) were in the 49-60 month category and 25 (62.5%) were first children. In 35 (87.5%) the parental income was less than 795,000 Indonesian Rupiah. There was no difference in the development of gross motor skill development of children in control and intervention group before intervention. There was no difference of the development of the gross motor skill development in early childhood (3-5 years old) before and after intervention in control group. There was a significant difference of the gross motor skill development in early childhood (3-5 years old) before and after Montessori method in intervention group (p =0.014).

Conclusions: Montessori method is effective for improving gross motor skill development in children aged 3-5 years.

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(Key words: Children 3-5 years old, gross motor skill, child development, Montessori)

Introduction

The number of 0-6 years old children globally is around 33.5 million. However, around 24.2 million (72.2%) children of an early age are not served by various units of early age education2. The Baturaden II Health Centre in Banyumas Regency reported that the number of children aged 24-59 months was 11223. Early stages of brain development occupy the most vital position. The development of human brain when they are children reach 80%4. By the time the baby is born it has reached 25% of the brain development of adults. Brain development reaches 50% at 4 years of age, 80% at 8 years of age, and the rest is processed until children are aged 18 years5. Early age is also called the ‘golden age’ because of the extraordinary development of children so that it becomes an ideal time to maximize children's development.

The development of motor skills is a very important factor for personal development as a whole. Through motor development, children can entertain themselves, obtain feelings of pleasure through motor skills, and can play or get along with their peers6. If a child's motor abilities are not good, it will have an impact on children's development such as social activities, concentration skills, and poor motor planning abilities7. Therefore, appropriate learning and stimulation are needed.

A learning method which stimulates the development of children’s motor skills, whilst at the same time having fun, is the Montessori method. The basic principle of the Montessori method is activity (control), control of error (realizing its own mistakes), aesthetics (beauty), and limits (according to needs)8. It is a method of learning by playing9. The Montessori method emphasises activities by children, and the role of physical activity in absorbing the concept of learning, adaptation of the children's learning environment to the level of children development, and practical abilities9. The
Montessori method uses several visual aids, including puzzles and picture cards.

Based on a preliminary survey in Rempoah Village, Baturraden Subdistrict, Indonesia, there are three Early Childhood Education (ECE) centres, namely Nur Hidayah ECE, Bina Kasih ECE, and one ECE only established a month ago. Nur Hidayah ECE centre has a total of 45 children, has never conducted research on motor development, and has never used the Montessori method in carrying out classroom learning. Further, initial observations and interviews by the homeroom teacher and headmaster indicated that there are 2 children in Nur Hidayah ECE centre who experienced motor delays and are unable to imitate the writing of letters correctly. In addition, midwives working in the area recommend developmental screening for early childhood in ECE. This study aims to find out the effect of Montessori method on the gross motor skill development of children aged 3-5 years.

**Objectives**
To determine the effect of the Montessori method on the gross motor skill development of children aged 3-5 years.

**Method**

**Study area:** This research was done in two locations, namely Nur Hidayah ECE centre and Bina Kasih ECE centre in Rempoah Village, Baturraden Subdistrict, Indonesia.

**Study design and sampling:** This was a quasi experiment with a non-randomized design pre-test-post-test with control group. Nur Hidayah ECE centre was used as the intervention group (21 respondents) and the Bina Kasih ECE centre as the control group (19 respondents). Purposive sampling was used. Sample size was determined based on results of Denver Development Screening Test II (DDST II) with caution and delayed interpretation. DDST II has 4 categories, advanced, normal, caution, or delayed. The cases and controls were selected using simple random sampling.

Items are in sub-sample categories including race, less educated parents, and place of residence. There are 125 performance-based and parent reported items in the following four areas of functioning: fine motor-adaptive, gross motor, personal-social, and language skills. Scoring per item is rated as follows: P: pass - child successfully performs item or caregivers report that the child can do item. F: fail - child does not successfully perform the item and/or the caregiver reports that the child cannot do item. NO: No opportunity - the child has not had the opportunity to perform the task due to restrictions, R: Refusal - the child refuses to attempt and the parent cannot report. These items are scored to a normative age line with notation to caution, advanced and delayed items. These lines represent the normative data and the percentile ranks. Percentile ranks include: 25th, 50th, 75th, and 90th. Ages should be adjusted for prematurity as needed. Some items for the youngest ages do not have percentile ranks. Items involve 90% performance rate for inclusion in the screen. The number of scores a child received below the normal expected range classifies the child as within advanced, normal, caution, or delayed. Scores are recorded per item through direct observation of the child and in some cases what the parent reports. The test is interpreted to place the child into two categories: normal or suspect. If the child is suspect it is recommended that rescreening occur in 1-2 weeks. One of the new editions to the DDST-II was the addition of a behavioral scale. The DDST-II also increased language items by 86%, included two articulation items, a new category of item interpretation to ID milder delays, and new training material.

**Data Collection:** The data were collected through questionnaire and observation which was done on respondents 3-5 years old. The implementation of Montessori was done in 20 minutes for 2 weeks. The instrument used in Montessori method such as puzzle, pictures cards, and DDST II forms. Kinds of games which done including puzzle 123, puzzle ABC, puzzle red yellow green lights, geometry cards and imitate walking animal cards. The games stimulated gross motor combining engklek method. Engklek is a traditional game of jumping on a flat plane drawn on the ground by drawing squares, then jumping with one foot from one box to the next. The scoring of this game done if the respondent could pass the end of game.

**Data analysis:** Data was analysed using computer program. Univariate data was cited to present variables of each variable and respondent characteristic through presentation table. Bivariate data analysed to know the effect of free variable with bond variable using Wilcoxon Signed Ranks Test and Mann-Whitney.

**Results**
The total number of respondents in this study was 40 children, 21 children in the intervention group in Nur Hidayah ECE centre and 19 children in the control group in Bina Kasih ECE centre. The respondents’ characteristics are shown in Table 1.
Table 1: Respondents’ characteristics in Nur Hidayah ECE and Bina Kasih ECE centres (n=40)

| Respondents’ characteristics | Control group | Intervention group |
|------------------------------|---------------|--------------------|
|                              | Number (%)    | Number (%)         |
| Gender                       |               |                    |
| Male                         | 07 (17.5)     | 10 (25.0)          |
| Female                       | 12 (30.0)     | 11 (27.5)          |
| Age (months)                 |               |                    |
| 36-48                        | 06 (15.0)     | 02 (05.0)          |
| 49-60                        | 13 (32.5)     | 19 (47.5)          |
| Child’s position in family   |               |                    |
| First child                  | 12 (30.0)     | 13 (32.5)          |
| Second, third child etc.     | 05 (13.5)     | 02 (05.0)          |
| Youngest child               | 02 (05.0)     | 06 (15.0)          |
| Parents’ income (IDR)        |               |                    |
| <795,000                     | 18 (45.9)     | 17 (42.5)          |
| ≥795,000                     | 01 (02.5)     | 04 (10.0)          |

IDR: Indonesian Rupiah

Table 2 shows the difference in gross motor development of children between control group and intervention group before intervention.

Table 2: Differences in gross motor development of children between control group and intervention group before intervention (n=40) based on DDST II interpretation

| Gross motor development | Control group | Intervention group | α   | p value |
|-------------------------|---------------|--------------------|-----|---------|
|                         | Pre (%)       | Post (%)           |     |         |
| Delayed                 | - (-)         | - (-)              | 0.05| 0.052   |
| Caution                 | 14 (73.7)     | 9 (42.9)           |     |         |
| Normal                  | 05 (26.3)     | 12 (57.1)          |     |         |
| Advanced                | - (-)         | - (-)              |     |         |
| Total                   | 19 (100)      | 21 (100)           |     |         |

Table 3 shows the difference of children’s gross motor development before and after conventional method intervention in control group.

Table 3: Differences of children’s gross motor development before and after conventional method intervention in control group based on DDST II interpretation

| Gross motor development | Control group | α   | p value |
|-------------------------|---------------|-----|---------|
|                         | Pre (%)       | Post (%) |     |         |
| Delayed                 | - (-)         | - (-)  | 0.05 | 0.083   |
| Caution                 | 14 (73.7)     | 12 (63.2)|     |         |
| Normal                  | 05 (26.3)     | 06 (31.6)|     |         |
| Advanced                | - (-)         | 01 (05.2)|     |         |
| Total                   | 19 (100)      | 21 (100)|     |         |

Table 4 shows the difference of gross motor development in early childhood (3-5 years old) before and after Montessori method in intervention group.
Table 4: Differences of gross motor development in early childhood (3-5 years old) before and after Montessori method, in intervention group (n=21)

| Gross motor development | Intervention group | α   | p value |
|-------------------------|--------------------|-----|---------|
|                         | Pre (%)            | Post (%)      |       |
| Delayed                 | - (-)              | - (-)         |       |
| Caution                 | 09 (42.9)          | 04 (19.0)     | 0.05  | 0.014 |
| Normal                  | 12 (57.1)          | 13 (61.9)     |       |       |
| Advanced                | - (-)              | 04 (19.0)     |       |       |
| Total                   | 19 (100)           | 21 (100)      |       |       |

The analysis result using Wilcoxon statistical test with the level of confidence 95% (α = 0.05). Based on this test result, it was gained score p-value which was 0.014 so that p value < α (0.014<0.05), therefore there was the difference of the development of gross motoric in early childhood (3-5 years old) before and after intervention in intervention group.

Table 5 shows the development of children’s gross motor development between control group and intervention group (after intervention)

Table 5: The children’s gross motor development between control group and intervention group (after intervention) (n=21)

| Gross motor development | Group | α | p value |
|-------------------------|-------|---|---------|
|                         | Control | Intervention |       |
|                         | Post (%) | Post (%)      |       |
| Delayed                 | - (-)    | - (-)         |       |
| Caution                 | 12 (73.7) | 04 (19.0)     | 0.05  | 0.005 |
| Normal                  | 06 (26.3) | 13 (61.9)     |       |       |
| Advanced                | 01 (-)   | 04 (19.0)     |       |       |
| Total                   | 19 (100) | 21 (100)      |       |       |

The analysis result from Mann Whitney statistical test at the time after intervention obtained p-value score in amount of 0.005 dengan α=0.05 so there was the difference of the development of children’s gross motoric in control group and intervention group after being treated.

Discussion

Of the children aged 3-5 years in Nur Hidayah and Bina Kasih ECE centres, 23 (57.5%) respondents were female and 17 (42.5%) were male. The gross motor development of males was more than in females. The research respondents were in the age range of 36-60 months. Most (80%) were in the age range of 49-60 months. Older children will have more experience so that they will think more maturely and logically.

The position of children in the family was dominated by the first child. Twenty five (62.5%) children, comprising 12 in control group, and 13 in intervention group, were first children. In general, intellectual abilities are more rapidly developed in the first or single child, because they often interact with adults. However, motor development was sometimes late, because of the absence of stimulation by his/her siblings.

The parents’ income was <795.000 IDR, the regional minimum wage, in 87.5% respondents and above it in 12.5%. In previous research, too, the family’s income was under the regional minimum wage in 80.5%. Good income of family will support the growth of children because parents can provide all the children’s needs, both primary (food, cloth, health) and secondary (education, course, recreation). With good parental education, it will be easier to receive information from outside, especially related to good ways to nurture children and maintain healthy. Generally, children who come from upper middle class families receive more guidance and good guidance from their parents.

The results of the research of increasing gross motor development of children after receiving the Montessori method were strengthened by the Montessori statement. Sensory teaching aids allow children to receive knowledge of the physical world and make decisions about various qualities. Sensory refinement was the ultimate goal, when children touch, see, feel, listen and taste, will create a category in the brain for each new sensory input.

The Montessori method prioritizes motor skills in children so that children can understand the principles or skills that are designed according to their abilities, which are not burdensome so that the preschooler will always be enthusiastic and happy. The results of the research of increasing gross motor development of children after receiving the Montessori method were strengthened by the Montessori statement that the Montessori method was for preschoolers. Montessori method provides
effective learning methods for preschoolers, providing stimuli for children's motor skills, sharpening their intellectual and control abilities and preparing children to enter more complex exercises. Montessori method emphasizes the importance of motor, sensory and language education for pre-school children. Motor education directs children's movements into more meaningful movements that will make children more calm, happy, and satisfied.

Research showed that the therapeutic values contained in traditional kris games include the values of early detection, good physical development, good mental health, problem solving, and social value. The value of physical development was good for exercise, increasing coordination and balance of the body, and developing skills in the growth of children. In problem solving, children learned to solve problems so that these abilities could be transferred in real life. Social values, namely children learning social skills that would be useful for provision in real life.

Conclusions
Montessori method is effective for improving gross motor skill development in early childhood (3-5 years old).

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References

1. Ministry of Education and Culture. No Title. Ministry of Education and Culture. Jakarta; 2017;

2. Naim A, Setiawan A, Cahyono BA, Handiyatmo D, Susilo D, Handayani PS, et al. Indonesian Children's Profile 2015. 2015; 246 Available from: http://www.kemenpppa.go.id/v3/index.php/download-book/profil-anak?download=510:profilanak2012

3. Banyumas DKK. Profile of Early Childhood. Purwokerto; 2018.

4. Rocio PL, Vicente M, Irene C, Inmaculada JD, Rosa R, Noelia CC, et al. Exposure to bisphenol A and behaviour in school-age children. *Neurotoxicology* 2016; 53:12–19. https://doi.org/10.1016/j.neuro.2015.12.001

5. Pojednic R, Peabody S, Carson S, Kennedy M, Bevans K, Phillips EM. The effect of before school physical activity on child development: A study protocol to evaluate the Build Our Kids Success (BOKS) Program. *Contemporary Clinical Trials* 2016; 49:103–8. https://doi.org/10.1016/j.cct.2016.06.009 PMid: 27339866

6. Adams KD, Rios Rincón AM, Becerra Puyo LM, Castellanos Cruz JL, Gómez Medina MF, Cook AM, et al. An exploratory study of children's pretend play when using a switch-controlled assistive robot to manipulate toys. *British Journal of Occupational Therapy* 2017; 80(4): 216-24 https://doi.org/10.1177/0308022616680363

7. Burke RM, Meyer A, Kay C, Allensworth D, Gazmararian JA. A holistic school-based intervention for improving health-related knowledge, body composition, and fitness in elementary school students: an evaluation of the HealthMPowers program. *International Journal of Behavioural Nutrition and Physical Activity* 2014; 11:78. https://doi.org/10.1186/1479-5868-11-78 PMid: 24969618 PMCid: PMC4079644

8. Stavreva-kostadinova P. Training concept of fathers whose children participate in the Montessori method curriculum. 2016; 92–100.

9. Freeman S, Pickering A, Dalli C, Polytechnic O. Montessori early childhood education in NZ: Re-discovering the spirit of reflection and inquiry through recent policy changes. 2016; 41(2). https://doi.org/10.1177/183693911604100210

10. Grant E. The Pink Tower Meets the Ivory Tower: Adapting Montessori Teaching Methods for Law School.

11. Buenaño T, Guerreiro F, Iêda I, Cavalcante C, Costa EF. Psychomotor development screening of children from kindergarten units of Belém, Pará, Brazil. *Journal of Human Growth and Development* 2016; 26(2):181–9. https://doi.org/10.7322/jhgd.119262
12. Notoatmodjo S. Health promotion and health behavior. Jakarta: Rineka copyrighted; 2012.

13. Kusumawardani LH, Mulyono S, Fitriyani P. Improving diarrhoeal preventive behaviour through therapeutic sociodramatic play in school-aged children. *Enfermería Global* 2018; 51: 519-27. https://doi.org/10.6018/eglobal.17.3.30470

14. Ward JS, Duncan JS, Jarden A, Stewart T. The impact of children’s exposure to greenspace on physical activity, cognitive development, emotional wellbeing, and ability to appraise risk. *Health and Place* 2016; 40:44–50. https://doi.org/10.1016/j.healthplace.2016.04.015 PMid: 27179137

15. Kusumawardani LH, Mulyono S, Fitriyani P. Parental knowledge influenced the effectiveness of therapeutic sociodramatic play on diarrhoeal preventive behaviour in school-age children. *Comprehensive Child and Adolescent Nursing* 2019; 42(sup1):122–34. https://doi.org/10.1080/24694193.2019.1578433 PMid: 31192736

16. Kusumawardani LH, Jauhar M, Rasdiyanah R, Desy Rohana IGAP. Pojokbelia: The Study of Smart Phone Application Development as Communicative, Informative and Educative (KIE) Media Innovation for Adolescent Reproductive Health. *Jurnal Keperawatan Soedirman* 2018; 13(3):125–7. https://doi.org/10.20884/1.jks.2018.13.3.8

17. Sari N, Marsaulina I, Chahaya I. Hygiene Sanitation Food Management and Food Handlers Behavior in Public and Private High School Canteens in the North Rantau District of Labuhan Batu Regency in 2012. *Environmental and Work Environment* [Internet]. 2013: 2 (1): 1–11. Available from: http://202.0.107.5/index.php/lkk/article/view/1095

18. Marshall C. Montessori education: a review of the evidence base. *npj Sci Learn* [Internet]. Springer US; 2017; (September):1–10. Available from: https://doi.org/10.1038/s41539-017-0012-7 PMid: 30631457 PMCID: PMC6161506

19. Schools PM, Method M. Predominantly Black Institutions and Public Montessori Schools: Reclaiming the “Genius” in African American Children. 2017;1–8.

20. Kao C, Lin L, Wu S, Lin K, Liu C. Effectiveness of different memory training programs on improving hyperphagic behaviors of residents with dementia: a longitudinal single-blind study. 2016;707–21. https://doi.org/10.2147/CIA.S102027 PMid: 27307717 PMCID: PMC4887047

21. Brown K, Lewis CW, Carolina N. Montessori and Other Magnet Schools. 2017; 86(4):439–48. https://doi.org/10.7709/jnegroeducation.86 .4.0439

22. Md-yunus HPS. Do children in Montessori schools perform better in the achievement test? A Taiwanese Perspective. 2014; 299–311. https://doi.org/10.1007/s13158-014-0108-7

23. Folkmanis V. Efficiency of multisensoric therapy in autism spectrum disorder patients. 2018; 72(3):193–5. https://doi.org/10.2478/prolas-2018-0022

24. Iswinarti I. Values of Problem Solving Traditional Engklek Games. 2017; (October 2016).

25. Mathematics K, S, Ridho Kindergarten, Thursday P. The use of the traditional crank game for the introduction of simple mathematical concepts on Thursday ridho Thursday. 2018; (May): 0-20.

26. Bahiyati A, Putri U, Hasyim N, Saputro GE, Design J, Visual K, et al. Introducing the traditional Chinese game