

Influence of educative game instrument on children's motor development in child day care

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Abstract

Background Child day care center is an institution functioning to help families to fulfil their child's need by providing stimulation with educative game instrument (EGI) while they work outside home.

Objectives To evaluate motor development of children at child day care center with EGI stimulation compared with that of children without stimulation.

Methods An experimental study using pretest–posttest control group design was carried out on children aged 2 to 5 years old, at Islamic Center Day Care Center (without EGI) and Tanah-Besi Day Care Center in Tebing Tinggi (with EGI for six months). Inclusion criteria: healthy, well-nourished children aged 2 to 5 years with informed consent, no developmental delay (confirmed by Denver-II developmental screening test). Exclusion criteria: preterm birth children. Forty subjects were selected by means of simple random sampling. Research data were taken with Cronbach's motor skills scale. Subjects consisted of 3 to 4 years old children, mostly four years old.

Results Motor skills scores (mean; SD) of the Islamic Center Day Care Center group and Tanah-Besi Day Care Center group before stimulation were 104.9; 10.37 and 104.7; 5.47 ($P=0.923$), respectively, and after stimulation 105.2; 9.56 and 135.3; 7.67 ($P<0.001$), respectively. Motor skills scores (mean; SD) of Tanah-Besi Day Care Center group before and after stimulation were 104.7; 5.47 and 135.3; 7.67 ($P<0.001$) respectively. Motor skill dimensions score (mean; SD) of Tanah-Besi Day Care Center group before and after stimulation: speed 28.9; 1.75 and 38.8; 2.79, stability 22.3; 1.02 and 30.6; 1.57, accuracy 20.3; 1.15 and 26.7; 1.63, strength 33.3; 1.55 and 39.1; 1.68, respectively with $P<0.001$.

Conclusions There is a significant difference in motor skills scores and motor skill dimensions of children who receive EGI stimulation compared to those who do not. [Paediatr Indones. 2008;48:315-21].

Keywords: *educative game instrument, child day care center, Denver-II developmental screening test, Cronbach's motor skills scale*

The change in the sociocultural order of society is characterized by the shift of roles and functions in the household.¹ One thing that signifies such change is the increasing number of mothers having children while at the same time they have to work for a living.² According to the statistical data in 2000 there were 101.6 million manpowers in Indonesia, and of which 40.6 million (40%) were women. That often result in various problems including limitation of time in caring for and looking after their children everyday.³ Accordingly, the day care center (DCC) is the institute implementing the effort of well-being for preschool, of which its existence is to seek and help family (parents) to carry out the function of caring and founding household for children who have important needs.⁴ In DCC the children must receive the three basic needs which are education (*asah*), love (*asih*) and care (*asuh*). One of the three basic needs, namely education, can be given by stimulation through play activities.⁵ Montessori, as quoted by Huges FP, suggests that playing is the work of children resulting in a preoccupation with adapting

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every play situation into a learning experience.⁶ Piaget, as quoted by Pulaski MAS, suggests that playing is necessary for the cognitive adaptation and contributing to development of children.⁷

Development is the improvement of skills and intelligence of children parallel with the increasing of age. The development of children begins at prenatal, the learning process begins at postnatal, and every child in the age group of 2 to 5 years old undergoes first rapid development phase.⁸ The rate of development occurs with the expected stage, and learning process occurs with the understandable stages, but the biggest variation exists in the individual in relation to the rate of development and their learning processes. There have been continuous development and learning that come from interactions with people, objects, and surrounding environment.⁹ A child is the active participant in the developmental process in her or his learning activities.¹⁰ The most important of developmental task in children is in preschool age and early years of school age which consists of motor development based on use of the different muscular groups that were well coordinated.¹¹ Goodway and Branta¹⁰ find that the strong influence of the motor skill intervention is further evidenced by only 3% of the experimental group at 50% for locomotor skills compared to 93% on post intervention measures of locomotor scores in six months of intervention.

Educative game instrument (EGI) is a playing device which can maximize the development of children. The device contains the element of education that its usage is in accordance with age and the development rate of children. Some EGI can stimulate the cognitive aspect of development through recognition of size, shape, and colour of the device.^{12,13} A child has for 6 – 8 hours daily in DCC,¹⁴ and in such fairly long time the expected stimulation through playing with EGI may be established, and her or his developmental needs of motor skill optimally are fulfilled with EGI. The objective of this study was to determine the difference of motor development between children who received stimulation using EGI and those who did not.

Methods

This study was conducted in May 2005 - November 2005. We included purposively Islamic Center Day

Care Center (without EGI), municipality of Tebing Tinggi, and Tanah-Besi Day Care Center (with EGI), subdistrict of Tebing Tinggi, district of Serdang Bedagai, Province of North Sumatera, Indonesia.

The subjects of the study were randomly selected healthy children with good nutritional status between 3–4 years of age. We included healthy, well-nourished children between 2 to 5 years old of age without physical defect or developmental retardation, and excluded children born prematurely. Informed consent was obtained from parents. The Ethics Committee of University of North Sumatra and Directors of DCC approved this study. There were 40 children in the group receiving stimulation of EGI and 40 children in the group not receiving such stimulation.

The parents of subjects were asked to complete questionnaires concerning their demographic and socioeconomic characteristics. General physical examination was carried out, as well as anthropometrical examination for individual child in the two DCC. The head circumference was measured using Butterfly brand meter band®, by placing the band around head that passed through glabella in forehead, top of eyebrow, and area of occipital protuberance. Body weight was measured using Camry® scales, with accuracy level of measurement up to 0.1 kg, and the child only wore clothes that he or she put on without shoes. Body height was measured using Heigh® staturimeter, with the subject standing with both of their heels contacted one another and back of their head touched the measuring board which had 0.1 cm accuracy.^{15,16} Evaluation of nutritional status was carried out by plotting the results available and anthropometric examination by means of CDC developmental curve, and classifying the nutritional status of children according to the CDC NCHS WHO recommendation in 2000.¹⁵

We carried out Denver Developmental Screening-II test (Denver-II), a developmental screening for children between birth and six years of age, that contains 125 task items and includes all aspects of development, i.e., gross motor, fine motor, language, and social autonomy. The material used to examine the developmental screening for age groups of the subjects included Denver-II form, eight blocks of cubes 2.5 cm (red, blue, yellow, and green), a pencil, and a sheet of paper. The test lasted about 30-45 minutes

for each child and took place in a room provided for both groups receiving or not receiving EGI. The results interpretation of screening test was classified as normal if no delay and a maximum of one caution all of her or his ability (or according to the parents' report) in all percentile belong to her or his line age. Even though, it was still considered normal if ability or rejecting in doing it was in percentile 75-90. There was a suspicion of development delay if there was one or more failure in percentile > 90 , or two or more failure or rejection in percentile 75-90 belonged to her or his line age.¹⁷

The device used for data collections was a psychological scale using the measurable data. The psychological scale consisted of several statements, as a behavioral indicators and had been translated as item.¹⁸

Cronbach's motor skills scale was used to collect the quantitative data of motor development, including the four dimension of motor skill, which were: speed, accuracy, stability and strength. A certified psychologist who had five years of experience trained a research team consisted of five members to administer the Cronbach's motor skills scale. The device consisted of 52 question items describing the children's motor skills including the aspect of handicraft dimension. The individual item had the alternative answer showed the rate of speed, accuracy, stability, and strength. A child was categorized as speed, if he or she had effort to complete the task shortly. Accuracy, if he or she had effort to complete the task exactly and thoroughly. Stability, if he or she can complete the task without usage of unnecessary movement, steady and not wobbly. Strong, if he or she had effort to complete the task tenaciously, tightly and not gracefully.¹¹

This motor skills scale type is rating scale form. Rating scale is a symptom quotation according to its own level. Generally, rating scale consisted of stratified behavior list.¹⁹ As an example, the level of stability was classified as : (a) not stable, (b) somewhat stable, (c) fairly stable, (d) stable, (e) extremely stable. Score of the extremely stable answer was 5 and not stable was 1. The scale of survey for this gauge was in the term of ordinal scale. The material used for Cronbach's motor skills scale test was as follow: scale of motor skills blank, colour ball 5 cm in diameter, latching shirt, 5 blocks of cubes 2 ½ cm (red, blue, yellow, green). The

Cronbach's motor skills scale test was administered to both groups. There was no time limit in implementing the test, but most subjects completed the test in 20-25 minutes (for each child and administered in the room provided). The follow-up meeting was organized by the entire examiners completed by discussing the results of test.

The group with stimulation, by means of EGI, received six months stimulation, implementing the stimulation by using EGI every day (lasting for two hours), five days weekly. Stimulation was administered to every child, and guided by a trained-care giver that had been trained to guide using the EGI stimulation device. The primary instruction emphasized in cognitive objectives which was recognition of size, shape, and color based on movement and action.¹⁷ Motor objectives were part of the curriculum, but only fine motor skills, while gross motor skills were not given. The group which had not been given stimulation with EGI were free to play every day.

We analyzed data by using paired sample t-test for quantitative data with normal distribution to measure the change from baseline data. Independent t- test was used to compare the mean score of motor skills in the group receiving or non-receiving stimulation by using EGI. In this study, subject size of each group was 40 children.

The alpha coefficient was used in reliability test, using single administration form based on consistency of response to all question item.²⁰ The validity test used to determine item validity of Cronbach's motor skills scale was by means of product moment correlation technique. The validity and reliability tests were done by means of Cronbach's motor skills scale test which had a product moment correlation value of 0.423 ($P \leq 0.05$). It showed that Cronbach's motor skills scale was valid and reliable.²¹

Before that, 80 items of motor skills scale were tested to 30 simple randomly selected who had been screened with Denver-II in Dharma Asih Day Care Center and had EGI for six months. The trial was performed in March 2005. According to the result of validity analysis of children's motor skills scale which had 80 items, there were 52 valid items and 28 invalid items. A full calculation was completed by computer, using validity and reliability tests in statistical program of SPSS version 13.0.

Results

Table 1 shows that there was no significant difference in characteristics between the group receiving and that without stimulation. Most of the children were

Table 1. Characteristics of samples

Variables	With EGI stimulation without EGI stimulation	
	With EGI stimulation	without EGI stimulation
Age, yrs, mean (SD)	3.83 (0.30)	3.88 (0.3)
Sex		
Female, n (%)	14 (44)	18 (56)
Male, n (%)	28 (54)	22 (46)
Head circ., cm, mean (SD)	48.20 (1.28)	47.95 (1.30)
Mother's age, yrs, mean (SD)	28.18 (2.80)	
Mother's education		28.75 (3.05)
Elementary school, n (%)	13 (33)	8 (20)
Junior High School, n (%)	21 (53)	28 (70)
Senior High School, n (%)	6 (15)	4 (10)
Parent's income, rupiahs, mean (SD)	682,500 (135.7)	652,500 (115.4)
Number of children, mean (SD)	1.68 (0.47)	1.80 (0.207)

M = mean, SD = standard deviation, n = count

four years old. There was no significant difference of all demographic characteristics of the two groups.

Table 2 shows that there was no significant difference of the means in motor skills scale before intervention in both DCC groups but there was a significant difference of mean in motor skills scale after intervention in both DCC groups (**Table 2**).

Pretest and posttest showed that in Islamic Center DCC group, there was no significant difference of mean while in Tanah-Besi DCC group but there was a significant difference of mean (**Table 3**).

In four motor skills scale after having intervention, we got mean significant difference in Tanah-Besi DCC group, meanwhile the highest mean of motoric skills development was the speed and the lower mean of motoric skills development was strength (**Table 4**).

Table 2. Cronbach's motor skills scale before and after intervention

Motor skill score	Cronbach's motor skills scale		P
	Islamic Center group	Tanah-Besi group	
	Mean (SD)	Mean (SD)	
Before intervention	104.9 (10.37)	104.7 (5.47)	0.923
After intervention	105.2 (9.56)	135.3 (7.67)	0.001

Table 3. Pretest dan Posttest Cronbach's motor skills scale in Islamic Center DCC group and Tanah-Besi DCC group

Groups	Cronbach's motor skills scale		P
	Pretest	Posttest	
	Mean (SD)	Mean (SD)	
Islamic Center	104.93 (10.37)	105.20 (9.56)	P = 0.302
Tanah-Besi	104.75 (5.47)	135.28 (7.67)	P < .001

Table 4. Cronbach's motor skills scale test for each motor development dimension in Islamic Center DCC group and Tanah-Besi DCC group before and after intervention.

Motor development dimension in two groups	After intervention	Before intervention	P
	M;SD	M;SD	
Islamic Center			
Speed	29.20;2.76	29.33;2.12	0.554
Stability	22.55;2.04	22.63;2.01	0.083
Accuracy	20.10;2.31	20.15;2.30	0.160
Strength	33.08;3.26	33.10;3.13	0.800
Tanah-Besi			
Speed	28.90;1.75	38.83;2.79	<0.001
Stability	22.28;1.02	30.65;1.57	<0.001
Accuracy	20.28;1.15	26.70;1.63	<0.001
Strength	33.30;1.55	39.10;1.68	<0.001

M = mean, SD = deviation standard

Discussion

The Day Care Centers (DCC) selected for this study were Islamic Center DCC and Tanah-Besi DCC. Fifty children were nurtured in Islamic Center DCC by nurses who had been trained to use EGI stimulation device and implemented the EGI stimulation for six months. Sixty children were nurtured in Tanah-Besi DCC by nurses who had not been trained to use EGI stimulation device, so that children in this DCC were free to play every day. We randomly selected 40 children from each DCC for subjects of this study.

A well-nourished child is full of energy. A playful child stimulates her mother and other members of the family to talk and play. Play is not just for fun, but also to entertain a child while growing up. Play helps children to learn and develop normally. Normal development is another sign of well nourished child.²²

Most of the parents were workers. Their average income were Rp.600.000/month. It was under the average of the Indonesian minimum wage therefore they were classified as lower income family. Greg stated out that a family with lower social economy protracted

for a long period of time has a strong correlation with lower cognitive development of children.²³ Those children from lower income family had not received any education for years before entering elementary school. The influence of additional education in preschool period with intervention was studied persistently. Many studies supported that there is a positive influence on cognitive sphere of those children from lower income family.²⁴

Both groups on this study were from low social economy and groups with parents working outside of house. We conducted a screening test for children development, adapted from Denver-II, in order to know any deviation on children development on both DCC and avoid any deflection. We did not find any deviation of development on both groups. Parents put their children in DCC so their children would still be taught, loved and cared. In fact, DCC may become an alternative way in taking care their children.

Garey and Arendel found that there was no bad influence of working mothers on children's development. However in general, mothers who work (and so do the fathers) have a guilty feeling of not giving their care.²⁵

Sensory motor stage takes place from postnatal period until the age of two years old. In this period, babies shall build their own understanding on their sphere by coordinating sensory experiences with physical motor actions.²⁶ They will study about environment through the ways available for them. The sensory and motor experiences of children are very important to study. This Piaget idea leads an approach to preschool education and gives guidance concerning stimulation program on preschool children.²⁷

Motor development is a development which includes controlling the physical movement through the activity of nervous centre, nervous system, and muscle coordination. Motor development based on using different muscle mass in coordination is highly important in preschool period and in early years of school. Motor skill may not be developed through a maturing process but the skill itself must be studied. A study in motor skill found that there are eight important conditions i.e. studying readiness, studying opportunity, practicing opportunity, properly aid tool, counseling and motivation. Those are conditions that should be studied individually, while skill should be studied one by one.¹¹ The studying

process may take place by watching the aid tool and coding the information about its performance to become a cognitive outcome.²⁸ In this case, EGI is a playing device designed specifically for the purpose of education and known as manipulative device. The size, form, and colour are provided in certain design, therefore if children are doing in a wrong way he or she will immediately be aware of it and correct the mistake.²⁹

Barrow IM, who examined the effect of colours, found that children named colour drawing with significantly higher accuracy rates than black and white line drawing. Colour may have provided information that more closely resembled the actual object, thus making the image more concrete and easily recognized. Further, a preference for colour in attending tasks has repeatedly shown to correspond with both mental age and intelligence, especially in the preschool years when children prefer to attend tasks in colour that require forced-choice matching.³⁰

We found that the group having EGI showed a large motor skills development significantly different compared to the group having no any EGI after intervention. The findings of this study confirms the results of other research that the increasing motor skills development may be obtained by having intervention.⁶ The result of this study also support research done by Newel that the development of motor skill is based on the interaction between the duties given, individual potency, and environment. In the perspective of dynamics theory, it is said that many factors will influence the development of motor skills namely the sorts of toys to use, previous experiences and way of teaching.³¹ This result of this study also confirms the research conducted by Ramey³² as quoted by Caldwell.

The result of pretest – posttest motor skills scale development in Islamic Center DCC and Tanah-Besi DCC group is shown before and we got increase of motor skill posttest result in Tanah-Besi DCC group.

Smaller muscles should play greater roles in a motor well coordinated skill. Lee J. Cronbach proposed that a skill may be classified as automatic, speed and accuracy. Each time performing a trained activity, it perhaps coordinates hundreds of complicated muscle involving different signals and correction of faultness continuously. While developing the motor

skill, they also increase the rate of speed, accuracy, strength and stability.^{11,32} Skill training must always be ordered in such form so that the children could find information immediately and accurately about the successfulness at the practice so that they become familiar with additional directing clues and reacts faster in coordinating actions.³²

The result of this study showed that there was a significant difference on the score of the four dimensions of Cronbach's skills scale between the group having EGI stimulation and the group having no any stimulation of EGI (**Table 4**). The result of this study confirms the finding of Thomas JR and Yan JH that a train may trigger stimulation on central control to result a hand movement quickly and purposely.³³ Thomas JR also found that children's poorer motor control is associated with lack of practice or due to limited movement experiences to develop the underlying mechanism.³⁴ Elliot found that there is association between motor learning and the speed and accuracy achievement of an intention movement/activity.³⁵

This research is expected to contribute information on the usefulness of stimulation with EGI in improving the motor development of children, directed to: (1) Parents who work outside the house should know and understand more about development of their children; (2) Organizer of DCC, is expected to provide stimulation with EGI to achieve optimal development of children; (3) Pediatricians and psychologists should use EGI not only for well developed preschool children but also for retarded children. In conclusion, there is a significant difference in motor development between the group stimulated with EGI and the one without EGI. It is also found that there is a significant difference in each score of the four dimensions of motor skill between the group stimulated with EGI and without EGI. Further research using EGI is needed not only for preschool children with normal development but also preschool children with developmental delay. Child day care centers optimize the development of children whose parents working outside home.

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