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Effects of Traditional Games on Age Equivalent Scores of Locomotor and Manipulative Skills among Early Stage School Children

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Abstract

Purpose: The development of gross motor skills are fundamental to advanced movements and specific skills in sports. Gross motor skills development that are in line with chronological age allows children to master locomotor and manipulative skills well through physical activities. This study aims to determine the effect of physical activity (traditional games) to increase the level of age equivalent locomotor scores (AEL) and age equivalent manipulative scores (AEM) among FELDA's school children. **Methods:** This study uses two different modules as the instruments to measure their level of age equivalent. The study involves two phases: (i) descriptive analysis to determine the level of age equivalents and (ii) MANOVA and MANCOVA analysis. Gross motor development data were determined using the Test of Gross Motor Development (TGMD) obtained from video recordings of locomotor and manipulative skills. **Findings:** The findings of the first phase of the study showed significant delay among Year Three students by 2.13 years of age equivalent locomotors scores (AEL) as compared to Year One and Year Two students who showed delay in their age equivalent manipulative scores (AEM) by 2.62 years. MANOVA analysis showed a significant difference in the mean GMDQ for pretest [$F(3,60) = 3.39$; $p < 0.05$, $R^2 = .145$] and post-test [$F(3,60) = 40.28$; $p < 0.01$, $R^2 = .668$] between control and treatment groups. Furthermore, F univariate analysis showed significant differences for the three dependent variables during the post-test on their GMDQ [$F(1,62) = 116.16$; $p < 0.001$, $R^2 = .65$], AEL [$F(1,62) = 36.53$; $p < 0.001$, $R^2 = .37$], and AEM [$F(1,62) = 48.76$; $p < 0.001$, $R^2 = .44$]. MANCOVA analysis showed a significant difference for mean of gross motor development [$F(4,58) = 29.80$; $p < 0.001$, $\eta^2 = 0.673$] for both groups even though the pre-test scores were controlled. The researchers deduced that Traditional Games explained 67.3% variance in the mean for gross motor development. **Conclusion:** Intervention programs that utilise traditional games can improve the age equivalent locomotors scores (AEL) and age equivalent manipulative scores (AEM) among Felda school children .

Keywords : Gross motor skill; locomotor; manipulative; traditional game

Introduction

The study of motor development is defined as a study on the changes of human behavior throughout their life cycles, including the processes that cause these changes and factors that influence these changes (Payne & Isaacs, 2005). Motor development involves gross and fine motor skills. Gross motor skill refers to the ability to use main muscles involving the organization of joint movement when completing certain tasks or doing basic activities (Bruininks, 1978, & Williams, 1983). Gross motor skills are the basis of more advanced movements and specific skills in sport (Gabbard, 2000; Haywood & Getchell, 2005; Payne & Isaacs, 2002). Gross motor skill development is important to be studied as it can be a good indicator explaining cognitive development skills (Thomaidis et al., 2000; Payne & Pink, 1997) of children. Previous studies show close relationship between motor cognitive dominants in individuals with a typical development by using exercise training program (Alesi, Battaglia, Roccella, Palma, & Pepi, 2014).

The gross motor development levels, such as mastering the locomotor and manipulative skills, of children can be gathered through their participation on physical activities. The children's abilities to master these locomotor and manipulative skills represent their gross motor abilities. When children move during playing usually they are running and jumping. Running and jumping are common skills and children also use other gross motor skills in their daily activities. Running is the easiest gross motor skill and starts to develop at the early stage of childhood. Jumping is rather more complex since it involves movements such as series of leaping and landing. It is important for children at the early stage of schooling to practice jumping and landing within various variations to achieve maturity stages (Winnick, 2005). Research on the impact of physical training on the gross motor development at the early stage of schooling years shows that it is only being done at the basic level.

Children in Malaysia, such as those in the FELDA settlements, were exposed to the Health and Physical Education syllabus with three main thrusts: i) fitness, ii) skills and iii) sports. This particular research focuses on the first thrust (fitness) which consists of instructions on basic movement that involve locomotor and manipulative skills in which Children aged between 7 to 9 years old are trained with these two skills. At the same time, Year two primary students are also taught skills in playing soccer, hockey, basketball and other games which apply all locomotor and manipulative skills that were learned previously in Year one classes. In reference to the development phases described in the Physical and Health Education curriculum (PPK, 2001), it is believed that Malaysian children, such as those in the FELDA settlements, can achieve the gross motor development at the early stage of their schooling years especiall though the use of Malaysian traditional games. Traditional Malaysian games have been played since our ancestral times (Kamus Dewan, 2002) and they are easy, uncostly and very fun to do as main activities at the early motor development of school children. Furthermore, through traditional games, the students are indirectly introduced to basic skills, such as running, jumping and hitting and rolling the ball. For example, in the traditional game known as 'ketinting' there are two types of locomotor skills which can be trained simultaneously, which are the abilities to jump on one foot and to do a long jump by standing. Another example will be a game of rounders, where three skills are mastered at the same time, such as the abilities to throw, strike and run.

There exists a relevant connection between traditional games with vital skills in gross motor skills development which attracts the interest of researchers to get insight on how these traditional games could contribute to the gross motor development of FELDA children at their early school years. In Malaysia, there is yet any research being done on the effects of traditional games to the level of gross motor development of FELDA school children. However, previous research that were done overseas has shown the impacts of applying and adapting traditional game elements, such as how Greek traditional dance can give impact on the motor proficiency of preschool children (Venetsanou & Kambas, 2004). There is also an earlier research on the impact of traditional games activities on the gross motor skills of male children age from seven to nine years old (Akbari, Abdoli, Shafizah, Khalaji, Hosseine & Ziaee, 2009), as well as a study on the impact of 10 weeks of traditional dance on the control of dynamic balancing act among a group of youths (Sofianidis, Hatzitaki, Douka, & Grouios, 2009).

Taking into the consideration of all the studies and reports described above, the main objective of the research focuses on identifying how far are the effects of physical activities (traditional games) on the levels of gross motor development of FELDA school children at the early stage of schooling years. Meanwhile, the specific objectives are as followed;

- i) To determine the age equivalent of locomotor skills and manipulative skills of FELDA children at the early schooling years
- ii) To identify the impact of physical training (traditional games) on the gross motor development, locomotor age equivalent skill, and manipulative age equivalent skill of FELDA children

In conducting the study, the researchers will focus on age equivalent of locomotor skills (AEL), and age equivalent manipulative skills (AEM). The meaning for AEL is the chronological age equivalent locomotor scores compared to crude sub-test locomotor scores. AEM is the chronological age equivalent manipulative score compared to crude sub-test manipulative scores. In this study, AEL and AEM scores will reflect the actual level of locomotor and manipulative skills of the subjects during the test.

Methodology

The research involves two levels of study. The first phase of the study is on the level of gross motor development, locomotor and manipulative skills age equivalence. This phase is important because it provides basic data and determines the group of children that need to be given intervention due to the deficit on locomotor and manipulative skills. The second phase of the study is on the impact of traditional games on the locomotor, manipulative and gross motor skill at the level of age equivalence. The second phase of the study is done through Quasi-experimental approach which involves pre-test, series of treatments and post-test which were done within a period of 12 weeks (Apache, 2005). In this approach, the researchers used a pair of sample groups (a treatment group and a controlled group) to measure the impact of traditional games on the development level of gross motor skills among the FELDA children at the age of nine years.

The Malaysian traditional games modules were used in the treatment group whereas the controlled group was given the existing Physical Education modules. All the traditional games that were used in the study, like side long pole run, and applying the skills motorized jumping on one leg and standing long jump, were suitable for children at the level of basic transition between basic skill and early skills for games (Gellahue, 1995).

The Sample Size

The first phase of the study comes in the form of descriptive approach that describes and explains the characteristic variables using mean and standard deviation. In order to carry out the research, a total number of 192 students were involved as subjects representing three age levels (Cohen, 1992). In the 2nd phase of the study, a group of students aged nine years old were recruited as subjects. The group was chosen due to the fact that they had the most difficulty in their performance scores of AEL, AEM, and GMDQ. For the purpose of the study, a number of 32 students were selected as subjects in treated group and 32 students in controlled group (Cohen, 1992).

Research Instruments and Data Collection Procedures

The research instruments and tools used in the study were i) 4 sets of Samsung DVD Camcorders (VP-DC163i) with zoom capability of 33X, ii) 4 SteinZeiser SZ-01 tripods, iii) 9 Pinnacle Studio Application Software, iv) 2 Acer Computer, v) 6.5 Adobe Premiere Software, vi) measurement tape, vii) bean bags, viii) skital, ix) 4 inches rubber ball, x) batting tee, xi) plastic bat, xii) basket ball, xiii) soccer ball, xv) tennis ball, xvi) softball, and xvii) score form (Test of Gross Motor Development – Ulrich, 2000).

All 192 case subjects were required to provide their personal details: i) name, ii) birth date, iii) gender, iv) race, v) father's occupation, vi) name of the school and vii) parent's consents with signatures. The subjects were divided into two groups based on gender (male and female). The subjects were required to go through all tests, which included the locomotor and manipulative skills items. The test items for locomotor skills consisted of running, galloping, hopping, leaping, horizontal jumping and sliding. The test items for manipulative skills involved striking a stationary ball, stationary dribbling, catching, kicking, overhand throwing and underhand ball rolling. Each subjects were given two trials to answer all items. A facilitator demonstrated the way to physically perform all items before the actual test. Scores were valued based on the subjects performances during the test, in which motor responses were recorded during the last session of the test. The researchers then analyzed the recorded videos to get the raw score. All raw scores were recorded on the score form. The data on the behaviour responses were also gathered from the video. Using the Pinnacle Studio 9 and Adobe Premiere 6.5 application software, the videos were edited and all the 12 skills tested were stored in folders for each subject.

Traditional Games Modules

There were five modules used as treatments in this study in which they were conducted for a period of 10 weeks. In each module, two types of traditional games were combined which involved both locomotor and manipulative skills. These combined modules were designed to give opportunities to the children to play one traditional games for at least four times during the whole 20 training session.

Among the names of the games involved were 'Pukul Berapa Dato Harimau', Rounders, 'Kuda Kepang', 'Main Monyet', 'Ketinting', 'Pepsi Cola', 'Bola Sepak Getah', 'Galah Panjang', 'Susun Tin' and 'Mini Basketball' (adaptation).

Physical Education Modules

The modules consisted of 20 sessions of physical education training. These modules were developed based on the Primary Physical Education syllabus. The locomotor skills involved in these modules were crawling, walking, rolling, running, jumping and galloping. Meanwhile, manipulative skills tested were skills in hula hooping, ball slapping, ball rolling, ball hitting, ball throwing and fending off ball. The aim of the modules is to balance the skills for playing traditional games with the increased level of age equivalent locomotor scores (AEL) and age equivalent manipulative scores (AEM).

Data Gathering Techniques

The subjects were given two trials before the final performance responses were recorded. Then, the performance scores were valued based on the criteria of behaviours exhibited in the test. The gross motor movements made by the subjects were also recorded and analyzed. A score of 0 or 1 is given to each skill that matches the criteria developed. Raw sub scores of locomotor and manipulative skills range from 1 to 48. Raw sub scores of locomotor and manipulative test were converted to standard deviation scores based on chronological age. For example, if the raw score for a locomotor test for nine year old male subjects was 34 and the standard deviation is 5. If the raw score for manipulative test was 38, the standard deviation is 6. The total standard deviation scores for both tests were 11. As a result, GMDQ score recorded was 73. The standard deviation scores were valued into the form of GMDQ score based on the GMDQ norm. AEL and AEM scores accumulated from the raw scores skills changed based on the related skills norm. The data collection procedures are the same with the procedures used by the TGMD-2 (Ulrich, 2000) with a coefficient of 0.88-0.96 (Hardy, 2009).

Data Analysis

The data were analyzed based on the research hypotheses. The impact of learning using the traditional games modules on the level of gross motor development of research subjects were identified scientifically. This is where multivariate statistical inferences were used to statistically analyse each of the research question of the study.

1st Research Question :

Which groups were having a deficit in the age equivalent locomotor and manipulative scores among the FELDA children at the early stage of schooling?

This research aims to investigate a group that was delayed in age equivalent locomotor and manipulative skills based on the mean of their chronological age. The delay was calculated by deducing the total scores of locomotor and manipulative skills by chronological age. The data were analyzed descriptively to produce mean values and standard deviation scores based on the scores of age equivalent locomotor and manipulative skills. The group that has experienced the most delay in

age equivalent locomotor and manipulative skills was selected to follow the next intervention program in the study.

2nd Research Question:

Are there any significant differences in the gross motor development of subjects in the controlled group and treatment group after undergoing interventions?

Multivariate Analysis of Variance (MANOVA) was carried out to identify the impact of interventions on the subjects in the treatment groups in the study. The study aims at finding significant differences between the control and treatment groups in term of gross motor development in the pre and post tests. The analysis was also done to identify if there are significant differences between scores in the post test for the treatment and control groups. Because MANOVA reported a significant difference (pairwise comparisons), the test for comparing the pair means was done using an estimated marginal means to determine the specific difference between intervention and levels of gross motor development.

Research Findings

1st Research Question:

Descriptive analysis produced mean and standard deviation values based on the scores of age equivalent locomotor and manipulative skills. The results of the analysis determined the group that were having difficulties in the gross motor development that were selected to go for the intervention program in the 2nd phase of the research. Referring to Table 1, the analysis in general shows the levels of gross motor development of subjects which are below average (50%) based on their GMDQ scores percentile.

Table 1: Age Equivalent Analysis

Class	Age Equivalent Locomotor	Deficit	Age Equivalent Manipulative	Deficit	GMDQ	GMDQ Percentile
Year 1	5.37	-0.89	4.96	-1.30	85.47	20.56
Year 2	5.51	-1.74	5.23	-2.02	77.78	11.77
Year 3	6.07	-2.13	5.58	-2.62	75.81	7.42

AEL= Age Equivalent Locomotor, AEM= Age Equivalent Manipulative, Deficit= deficit compared to min of chronological age, GMDQ= gross motor development scores, GMDQ PERSENTIL= percentile scores of fundamental motor development

Based on the mean scores of chronological order, year three subjects were found to have difficulty in motor development with a deficit of 2.13 years in the age equivalent locomotor skill compared to year two subjects with a delay of 1.74 years and year one subjects with a deficit of 0.89 years. A similar situation happened to the age equivalent manipulative skill for year three subjects where they were having a deficit (2.62 years) in motor development compared to year two subjects who were

having 2.02 years deficit and 1.30 years deficit for year one subjects. GMDQ scores were referred in determining the gross motor development levels among the subjects. The findings showed that year one student's level of gross motor development was better compared to year two and year three subjects. It was concluded that year three subjects had the most difficulty in gross motor development, so the group was chosen to be the treated group in the 2nd phase of the study. The 2nd phase study would determine there are positive impacts of the traditional games on the age equivalent locomotor scores (AEL) and age equivalent manipulative scores (AEM) of the FELDA children at their early years of schooling.

2nd Research Questions :

Pre-test MANOVA Analysis

Referring to Table 2 in general, the Wilks' Lambda multivariate test showed there were significant differences in the impact of the intervention activities on the gross motor development of the control and treatment groups during the pre-test session. Based on the result, there was a significant difference for the mean for the gross motor development [$F(3, 60) = 3.39; p < 0.05$]. Analysis on univariate F test showed there were significant differences for the pre-test scores of variables with GMDQ [$F(1, 62) = 4.46; p < 0.05$, eta squared = 0.07]. Furthermore, it also showed significant difference in the scores for pre-test of variables AEL [$F(1, 62) = 0.001; p < 0.05$] and AEM [$F(1, 62) = 0.93; p < 0.05$]. These differences exist because of the two groups' physical requirements in the program.

Analysis of Pairwise Comparison was carried out to identify the couple mean that showed significant difference of both mean (control and treatment group). Referring to the means values of both groups, it was identified that the treatment group significantly outperform the control group with variable GMDQ (mean score: treatment group = 62.13, control group = 58.75). Table 3, show the mean value of the treatment group was significantly higher than the control group with GMDQ scores (min differences = 3.38; $p < 0.05$).

Table 2: MANOVA Analysis of Pre-test and Post-test for Groups Gross Motor Development

Variables	Pre-test		Post-test	
	Groups (N=64)			
	<i>F</i>	<i>Eta squared</i>	<i>F</i>	<i>Eta squared</i>
GMDQ	4.46*	.07	116.16***	.65
AEL	.001	.00	36.53***	.37
AEM	.93	.02	48.76***	.44
Multivariate F	3.39		40.28***	
Eta Squared	.145		.668	
*** p<0.001	*p<0.05			

Post-test MANOVA Analysis

Referring to Table 2, the result of Wilks' Lambda test in general showed that traditional games activities did have significant impact on the gross motor development of the subjects. Based on the test results, there were significant difference between the means for gross motor development of both groups [$F(3,60) = 40.28$; $p < 0.001$, eta square = 0.668]. There is 66.8 % variance in the couple means described the impact of traditional games intervention. Analysis of univariate F also showed significant difference in the post-test scores with variable scores of GMDQ [$F(1,62) = 116.16$; $p < 0.001$, eta square = 0.65], AEL [$F(1,62) = 36.53$; $p < 0.001$, eta square = 0.37] and AEM [$F(1,62) = 48.76$; $p < 0.001$, eta square = 0.44] for both groups.

Analysis of Pairwise Comparison was done to identify the couple mean that has significant difference for mean values of GMDQ, AEL and AEM scores for both treatment and control groups. Findings showed that the treatment group performed significantly better than the control group in all dependant variables, i.e., GMDQ (mean value: treatment = 89.22, control = 65.97), AEL (mean value: treatment = 7.41, control = 5.16 and AEM (mean value: treatment = 7.18, control = 5.17).

Table 3 describes that the mean values of the treatment group is significantly higher than the mean of the control group in GMDQ scores (mean difference = 23.25; $p < 0.001$), AEL (mean difference = 2.25; $p < 0.001$), and AEM (mean difference = 2.25; $p < 0.001$), and AEM (mean difference = 2.01; $p < 0.001$).

Table 3: Pairwise Comparison Analysis For Pre-Test And Post Test

Dependent Variables	Pre-test			Post test		
	Group (mean)	Group (mean)	Difference in mean	Group (mean)	Group (mean)	Difference in mean
GMDQ	Treatment (62.13)	Control (58.75)	3.38*	Treatment (89.22)	Control (65.97)	23.25***
AEL	(4.35)	(4.34)	.01	(7.41)	(5.16)	2.25***
AEM	(4.63)	(4.40)	.23	(7.18)	(5.17)	2.01***

*** P < 0.001

*P < 0.05

MANCOVA Analysis for GMDQ Score in Pre-Test

MANCOVA analysis was carried out by controlling the pre-test scores to handle memory effects among the participants because of similar tests carried out during the pre and post-tests. Referring to Table 4, by taking into consideration pre-test scores in general Wilks' Lambda test results show significant impact of Traditional Games on the gross motor development. Also, based on the result, there is a significant difference for mean of gross motor development [$F(4,58) = 39.77$; $p < 0.001$, eta squared = 0.669] for both groups, even though the pre-test scores were controlled. Traditional games described the 66.9% variance in the mean couple for gross motor development.

Table 4: MANCOVA Analysis For GMDQ Score Based On Groups With A Controlled Pre-Test (GMDQ-PRA)

variables	Groups (N=64)		GMDQ (Pre) (N=64)	
	<i>F</i>	<i>Eta squared</i>	<i>F</i>	<i>Eta squared</i>
GMDQ (post)	104.90***	.63	7.79**	.11
AEL (post)	35.83***	.37	.45	.01
AEM (post)	40.69***	.40	5.14*	.08
Multivariate <i>F</i>	39.77***		11.75***	
Eta Squared	.669		.374	

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

Pre-test analysis showed significant effects with [$F(3, 59) = 11.75$; $p < 0.001$, eta squared = 0.374] on the gross motor development of the subjects. Pre-test described 37.4 % variance with couple mean of gross motor development. Meanwhile, univariate *F* test analysis showed a significant difference of GMDQ score (post) [$F(1, 61) = 104.90$; $p < 0.001$, eta squared = 0.63], AEL (post) [$F(1, 61) = 35.83$; $p < 0.001$, eta squared = 0.37], and AEM (post) [$F(1, 61) = 40.69$, $p < 0.001$, eta squared = 0.40].

Pairwise Comparison analysis was also done to identify the pair that exhibited significant difference for means for GMDQ (Post), AEL (Post) and AEM (Post). According to mean values of both groups, the treatment group significantly performed better than the control group in all independent variables as follows : GMDQ (post) (mean score: treatment = 88.45, control = 66.74), AEL(post) (mean score: treatment = 7.44, control = 5.12), and AEM(post) (mean score: treatment = 7.09, control = 5.25).

Table 5, show the mean value of treatment group is significantly higher than the mean of control group in GMDQ (post) mean with a difference of 21.72; $p < 0.001$, AEL (post) mean with a difference of 2.32; $p < 0.001$, and AEM (post) mean with a difference of 1.84; $p < 0.001$. The results showed the significant positive impact of traditional games on the gross motor development between both group after going through the intervention program and taking into account the pre-test score. The difference existed for post-test scores with the influences of pre-test scores.

Table 5: *Pairwise Comparison Analysis*

Dependent Variables		Groups (mean)	Groups (mean)	Mean Differences
Post Test	GMDQ2	Treatment (88.45)	Control (66.74)	21.72***
	AEL2	Treatment (7.44)	Control (5.12)	2.32***
	AEM2	Treatment (7.09)	Control (5.25)	1.84***

*** P < 0.001

Conclusion

The findings showed year one subjects achieved a better score in gross motor development based on GMDQ score compared to year two and year three subjects. One of the factors that influenced the achievement was the children's natural growth. The analysis also showed that year three subjects' gross motor development was the weakest compared to that of year one and year two.

In terms of the deficit on age equivalent compared to chronological age, year three subjects had experienced substantial deficit on the locomotor and manipulative skills than year two and year one subjects. In general, year three subjects were the group that had most difficulty in terms of gross motor development of children at their early stage of schooling. After a series of intervention using traditional games, the result showed significant impact on the gross motor development on all dependent variables: AEL, AEM and GMDQ. Similar results were gathered when the pre-test scores were controlled.

The study proved that traditional games could give significant impact on the gross motor development of the subjects even after controlling the pre-test scores. The analysis result supported and proved that intervention program that applied traditional games activities could assist to improve the gross motor development level of the treatment group in the research.

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