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Validity and Reliability of Locomotor Development Inventory in Malaysian Education Context

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Abstract

The purpose of this article is to report the, validity and reliability of locomotor development inventory that has been used to evaluate locomotor development of children aged 7, 8 and 9 years old. The first phase of the study has been carried out through Exploratory Factor Analysis and test re-test procedure by using data from 90 boys from a primary school in Penang, Malaysia. The Exploratory Factor Analysis through orthogonal rotation varimax method has shown six sub test have been developed. Meanwhile, the test re-test coefficient is .98. The reliability and objectivity of the assistant examiner also have been obtained, the r coefficient ranged from .88 to .95 and ranged from .84 to .92, accordingly. The Cronbach Alpha of the overall items is .82. For the second phase of the study, the Confirmatory Factor Analysis as well as Pearson correlation analysis has been carried out toward data of 192 boys from the primary schools in Malaysia. The purpose of this analysis is to support the factor structure developed from the first phase of the study. The Cronbach Alpha of the items is .82, meanwhile for each subtest developed ranged from .74 to .89. As the conclusion, the result of Confirmatory Factor Analysis supported the six subtest developed from the first phase of the study and the subtest are distinctive.

Keywords: Validity, Reliability, Locomotor Development

Introduction

Gross motor development is very important in basic movements to enable children to engage in physical and learning activities with confidence. Gross motor development of the early-school children can be the result of a combination of many factors such as motor efficiency experiences, fun, the environment and the individual themselves (Gallahue & Ozmun, 2006; Haywood & Getchell, 2009). Gross motor development of children can be improved by giving them the opportunity to perform variety of physical activities in the movement (such as walk, run, jump) and in the games. However, according to Ulrich (2000), the development of motor skills is divided into two; locomotor skills and manipulative skills. This study will focus on the locomotor skills only.

Locomotor skills are the skill that requires an individual to move through spaces, from one place to another place (Bruce & Meggit, 2005; Cools, Martelaer, Samaey & Andries, 2011). In this study, locomotor skills tested are run, gallop, hop, leap, horizontal jump, and slide. This study used Test-2-2000 Gross Motor Development (GMD-2) (Ulrich, 2000), as an instrument. This test measures the psychomotor domain. Therefore, the level of gross motor development of children involved locomotor Standard Score (SPL), which consists of (i) run, (ii) gallop, (iii) hop, (iv) leap, (v) horizontal jump and (vi) slide tests.

The locomotor skills are a basics skills development and closely associated with the development of the child's age. Children who do not have competence in the development of locomotor are not capable of doing the task well and is likely to drop out of sports-specific movements (Gallahue, 2006; Harter, 1978; Rudisill, 1989; Ulrich, 2000; Santrok, 2011). There are number of studies have been done on the role of locomotor development of children related to their participation in physical activity (Barnett, Van Beurden, Morgan, Brook & Bread, 2009; Rudisill, Mahar & Meaney, 1993; Sollerhed, Apitzsch, Rastam and Ejlertsson, 2008; Southall, Okely & Steele, 2004; Ulrich, 1989; Weiss & Amoros, 2005; Wrotniak, Epstein, Dorn, Jones & Kondilis, 2006). Furthermore, the measurement of locomotor development component is often been used as a basis to assess the level of gross motor development based on chronological age of the individual. The TGMD-2 test has been used as a measure of gross motor development of children in these studies such as Goodway and Rudisill (1996), Wong and Cheung (2007), Goodway and Branta (2003), Chrysagis, Douka, Baka, Apostolopoulou and Koutsouki (2009), Hall and McCullick (2002) and Apache (2005). In conclusion, based on previous studies, intervention programs have been designed to measure gross motor development of the children and used this instrument to measure the level of gross motor development of children.

However, the test is to detect the level of gross motor development of children aged 7 to 9 years are very difficult to obtain, unless the test GMD-2 (Ulrich, 2000). Previous studies mostly done in the West, such as William (2009) and the measurement are not really suitable with Malaysia education context. These instruments are not being reviewed extensively by scholars in the sports science testing and measurements field such as Hashim (2004) and Baharom (2013). The second issue is about the use of appropriate statistical methods to build and verify the items in the instrument. Dickey (1996) pointed out that the exploratory factor analysis (EFA) itself cannot be used as a basis for a final determination regarding an underlying construct, because the analysis is designed to maximize the amount of variance within the current variable set, and subsequent analyses with other data sets may not reproduce the same factor structure. Furthermore, EFA is focused on statistics and not based on a theory to determine the structure of the scale of measurement, and is not sufficient to assess the error (Henson, Capraro & Capraro, 2004). Therefore, the use of EFA, confirmatory factor analysis (CFA), content validity and internal consistency of the methods in the construction and validation of items in the instrument is well suited (Baharom, 2013; Mansor, Mat Norwani & Marzuki, 2011). In addition, the revised instrument is very limited, therefore it is desirable to build up an inventory of locomotor skills which is empirically validated to measure the level of children gross motor development in primary schools in Malaysia.

Therefore, the aim of the study was to (a) produce a set of items to measure the level of gross motor development of children in locomotor components; (b) conducting the EFA to assess the factor structure of the items that measure; (c) access the objectivity of the assistance examiner (d) conducting CFA to examine the factor structure built the first phase

of the study, using a separate sample (e) estimate the internal consistency of each item in the sub-scale is formed.

This study is important to the Ministry of Education (MOE) in assessing the effectiveness of the physical education curriculum implemented for children aged 7 to 9 years in school. The revise, valid and reliable test can be used by the relevant parties in evaluating the program and improving any ongoing program. In addition, locomotor test with high validity can be used by teachers in assessing the level of teaching and learning of their students. Furthermore, findings from the high validity and reliability test will ensure the data obtained more accurate in Malaysian education context. The right data will provide authentic information to parents, school administrators and MOE departments and other bodies such as PERMATA in designing programs more effectively.

However, from the theoretical point of view, this study will contribute to the new knowledge of children locomotor development in Malaysia, whether it occurs according to chronology age or vice versa even though they have undergo the Malaysian standard curricula. This is because the accurate findings must be derived from the valid and reliable instrument. Therefore, this locomotor test will be suitable to use in testing the locomotor development stage of the children and also can find out the extent of delay in the development as well as provide an initial action to overcome this problem.

Test of Gross Motor Development (GMD-2)

Test of Gross Motor Development (GMD-2) was developed by Ulrich in 1985 to evaluate the performance of gross motor skills of children between the ages of three to ten years (Cool, Martelaer, Samaey & Andries, 2011; Gabbard, 2008) and being renewed by him in 2000. Test GMD-2 consists of two tests that measure the elements of gross motor skills of children aged three to ten years, and have being tested the empirical validity at the West. According to Ulrich (2000), gross motor skills involve locomotor and manipulative skills. Locomotor skills involved the movement from one place to another place (Haywood & Getchell, 2005). These skills involved run, gallop, hop, leap, horizontal jump and slide (Ulrich, 2000). This test also can be used to identify children that are behind their peers in gross motor development of locomotor significantly. All locomotor items are from the existing inventory. These items were adapted from the GMD-2 (Ulrich, 2000) after obtaining his consent through electronic mail. Scale of this test is 0 to 1 (dichotomous) as the original test. Scores are processed to ordinal data, which enabled the researcher to conduct further analysis.

Sampling

The first phase of the study (pilot study) is conducted on 30 boys in each age group 7, 8 and 9 years (N = 90) at SK Seri Permai, Penang. This pilot study has been done on children aged 7, 8 and 9 years, on early July 2011 and it took about two weeks. For the second phase of the study, a total of 192 students (boys) have been selected from a national school in the Southwest Penang, Malaysia. The respondents were among boys aged 7, 8 and 9 years (Baharom, 2013).

Validity and Reliability

This section will discussed the analysis of validity and reliability conducted in the study for the first phase and the second phase of the study.

First Phase of the Study

Content Validity

This method is used in determining the validity of the content in the instrument by seeking expert opinions. The panel of experts has been asked to evaluate and examine the items in terms of content and objectives to be measured (Ary, Jacobs & Sorenson, 2010). The locomotor original instruments have been translated twice by the experts by using the `back technique`. Translation is done from the English version to Malay version by researchers. Then the questionnaire was translated back into English. This instrument is delivered to the six panels of expert. Then, the instruments is being administered to six experienced teachers to identify if there is a mistake and recorded in the space provided for the improvement or dropped (Johnson & Christensen, 2008; Flowers, 2006; Mertens, 2005; Gall, Gall and Borg, 2007). They consist of 4 trained teachers from the pilot schools and two sport officer unit officer form Penang State Department Education. The aim is to improve the questionnaire and ensure that it is suitable for use in Malaysian educational environment.

Researchers also asked the sample to weight the clarity and validity of each item (Flowers, 2006). Scale of 1 to 10 has been used in determining the validity coefficient for each item. Items that have a coefficient of less than 70% have been removed from the instrument. Tuckman and Waheed (1981) in Sidek Mohd Noah and Jamaludin Ahmad (2005) stated that only the coefficient of more than 70% has content validity. Therefore, items that have the coefficient less than 70% will be removed from the instrument.

Exploratory Factor Analysis (EFA)

Exploratory Factor Analysis (EFA) through principal component analysis (PCA) has been performed by using SPSS version 18.00. This analysis was conducted to identify and prioritize a large number of items into the constructs under a certain variable according to the sample (Tabachnick & Fidell, 2007). In addition, this method can reduce the number of variable dimensions into limited in numbers but still refer to the same characteristics (Henson & Roberts, 2006) to be used in further analysis. The methods have been taken by researchers are as recommended by Hair, Black, Babin, Anderson & Tatham (2010), Tabachnick and Fidell (2007), Kollias, Hatzitaki, Papaiakovou, & Giatsis (2001) and Henson and Roberts (2006) are:

i. Items have the `anti-image of correlation` ≥ .5
ii. Test Bartlett's Test of Sphericity should be significant (p <.05) to measure the correlation between the items or variables.
iii. Adequacy test sample Kaiser-Meyer-Olkin high of ≥ .5
iv. Value of the correlation coefficient matrix of ≥ .3 and above
v. Eigen values greater than 1.
vi. Items that have the capacity factor (factor loading) ≥ .5 only maintained.
vii. Total percent of variance must greater than 50%.
viii. Factors are based on the basic theories and previous studies.

Test Re-Test

According to Baumgartner,Jackson, Mahar and Rowe (2007), the measurement of a pilot study in Physical Education can be obtained through several times experiment and the reliability is calculated by intra class reliability coefficients. According to Thomas and Nelson (2001), the test re-test is used to find the reliability of the test or instrument. A pilot study on children aged 7, 8 and 9 years has been done by using locomotor test to obtain the reliability of the test items. Researchers have used a sample of 30 children of all ages, (7, 8 and 9 years

boys) who were randomly selected on a group of subjects by considering the absence or mortality (Campbell & Stanley, 1993) of the sample. Test re-test method is used to get the consistency of the reliability of the locomotor tests, reliability coefficient of efficiency, as well as reliability of assistant examiners (Baumgartner et al., 2007). Each treatments of the sample was assessed, videoed and used to analyse the score later. The Pearson correlation has been used to obtain the correlation coefficient of the reliability of each components of the locomotor development test.

To ensure the validity and reliability of the score based on video recordings, the researchers were trained to master the general testing procedures, understand the aims, control the interpretation of data related to locomotor development and testing process. For the purpose of ensuring that researchers have the consistency in the evaluation of the scores, the researchers have conducted a training session by using video tape of treatment on three children before carried out in actual situations as suggested by Ulrich (2000).

Meanwhile, the researchers also used four assistant examiners in the pilot study to administer the test. All assistant examiners selected are Physical Education and Sports Science teachers and has experiences in teaching the subject. Assistant examiners are selected based on their qualifications and on a voluntary basis. Each assistant examiner are given intensive training on the test instructions, procedures, standards and technical locomotor developments that are necessary to administer the test, which took place at the school hall for two days. All assistants understand the number of attempts, the aims and the environment that affect the reliability of the test (Baumgartner, et al., 2007).

Reliability Assistant Examiners

To get the reliability of assistant examiners, researchers used Pearson correlation coefficient to determine the correlation between the scores of assistant examiner with scores of researchers. The reliability of the assistant examiners must more than or equal to .80. According to Burton & Miller (1998) and Safrit & Wood (1995), the correlation coefficients between ±.80 to 1.00 is high, ± .60 to .79 is moderately high, ± .40 to .59 is moderate, ± .20 to .39 ± .00 is low and to .19 indicates no correlation, has been used as guideline in this research.

Objectivity Assistant Examiners

The objectivity of assistant examiners depends on how clear the scores system have been given, the number of trials, the tests difficulty, test instructions and test environments. Objectivity is the close agreement between the two examiners or more, based on the test scores obtained, by comparing the testers` scores for a similar test administered (Baharom, 2013, 2012; Hashim, 2004). Every assistant examiner has been given an intensive training on the classified test instructions, standards procedures and methods of calculation (Baharom, 2013; Hastad & Lacy, 2002). All assistant examiners must understand the accuracy of calculating the score, the number of trials, difficulties of running the test, instruction and test environments will affect the reliability of the test (Baumgartner et al, 2007). Objectivity of locomotor development test by using GMD-2 (Ulrich, 2000) has been obtained through `interclass reliability' (Burton & Miller, 1998; Morrow, Jackson, Disch & Mood, 1995; Safrit, 1981), where the coefficients obtained by Pearson correlation coefficient. According to Baumgartner et al, (2007), the correlation coefficient of objectivity tests range from 0.85 to 1.00, is considered acceptable.

Reliability of locomotor test

The reliability of locomotor test in this study has been obtained through test re-test analysis. According to Anastasi and Urbina (1997), the instrument has high reliability test, r = .96. Meanwhile, Ulrich has reported the high reliability of r = .98 for the locomotor test items. In order to obtain the reliability of the locomotor test based on the Malaysian environment, the researchers and assistant examiners have tested a group of the same subject and re-tested by using the same tests and obtained the scores that is almost the similar (Burton & Miller, 1998; Safrit, 1973). Items in this test shows high test re-test correlation. The previous researchers also found the items have high test re-test correlation, r = .91 for gross motor composite (Wouter, Kristine, Christiane & Caroline, 2009). Agnes and Daniel (2009), also reported high reliability of r = .88 for locomotor skill subtest. Meanwhile, Kerri, Staples and Reid (2009), reported that the value of r = .88 for the item locomotor components. While, Kwan (2009), also has reported the high reliability of locomotor skill subtests items of r = .95. To ensure the reliability of locomotor test items in this study, the researchers have used the Cornbrach's Alpha coefficient. The internal reliability of the reviewed locomotor test items by using Cronbach's coefficient alpha is ranged from .85 to .91 (Wouter, et al., 2009).

Second Phase of Study

Confirmation factor analysis

Confirmation factor analysis was conducted by using Amos software version 21.00. The aim is to test the stability of the score of 6 sub test found in locomotor tests. This analysis was conducted using data from the second phase of the study. All parameters were estimated using the method of 'maximum likelihood'. The Chi-square multivariate test of has been carried out. Various coefficients have been used to evaluate the model that fits to the data (Hu & Bentler, 1999). In this study, the coefficients used are the chi-square test, the ratio of x^2/df, Comparative Fit Index (CFI), Bollen`s Increamental Fit Index (IFI), Tucker-Lewis Index (TLI) and the Root Mean Square Error of Approximation (RMSEA). The main objective of coefficients is used to assess the goodness-of-fit of the model. Because of the chi-square coefficient depends on the sample size (Byrne, 2010; Schumacker & Lomax, 2004), it is less suitable to use in determining the suitability of the model (Icobucchi, 2010). Therefore, the coefficients such as CFI, IFI and TLI also assessed. Value of the x^2/df ration less than 3, and .80 for the CFI, IFI and TLI has been used as the lower cut off value of the acceptable fit (Nunnally & Bernstein, 1994; Schumacker & Lomax, 2004; Hair et al., 2010; Byrne, 2010; Kline, 2010). In addition, the RMSEA less than .06 indicate good fit, while the value of .08 indicates a reasonable fit (Hu & Bentler, 1999).

Correlation

To confirm the existence of these six factors are distinctive, Pearson correlation has been conducted (Baharom, 2013; Hashim, 2004). The correlation coefficient (r) for all sub tests must be less than .70, this shows that these sub tests are independent (Pallant, 2011). All items in the six sub tests has been averaged to produce mean score before further analysis.

Reliability

Researchers have used internal consistency approach in the study to test the reliability of the locomotor test items. According to Gay, Mills and Airasian (2009), the Cornbrach Alpha is one of the internal consistency approaches to test the reliability. Cornbach Alpha value of at least

.60 or .70 can be considered as a good measurement, and better if approached .90 (Aron, et al., 2005; Merten, 2005; Miller, 2002; Cohen, Manion & Morrison, 2007) .

Findings

Findings of First Phase

Content Validity

Locomotor test was translated from English to Bahasa Malaysia and to English by the researchers using back technique procedures used by Hulin, Drasgow and Parsons (1983). Prior to that procedure, the authorization from Dale A. Ulrich, Professor, School of Kinesiology, Director, Center on Physical Activity and Health in Pediatric Disabilities, University of Michigan has been done via email to use the instrument in Malaysia. From the standpoint of content and language, the validity of this test has been obtained from six experts in this field, where the skills available and suitable to be implemented in the preschool and early childhood education. To obtain the validity of the locomotor test, the researcher has conducted the process of getting the validity of subject matter experts as well as linguists. Two of those experts are two experts in Bahasa Malaysia, and two experts in English language, as the procedure has been suggested by Baumgartner et al. (2007).

Then, the locomotor test has been reviewed by two lecturers Sports Science lecturers to ensure the contents and the language used Some items have been reviewed and corrected as suggested by the feedback given from the experts. Then the items test again retranslated into English and been submitted to two English language experts as to ensure the instrument does not deviate from the original. For the content validity, the instrument has been distributed to a panel of experts and the validity coefficient has been used as suggested by Mohd Noah and Ahmad (2005) the expert validity coefficient of the locomotor items was .90 ($r = .90$, $n = 6$). According Mohd Noah & Ahmad (2005) and Tuckman and Waheed (1981), validity coefficient of more than .70 is considered acceptable.

Construct validity

EFA results demonstrate the anti-image correlation coefficient greater than 0.5. The KMO sample adequacy test shown the coefficient of.93 and Bartlett's test of Sphericity Test was significant with Chi-square value of 607.1 on 66 degrees of freedom, proven the number of samples is sufficient. Analysis showed that all locomotor subtest in this study has the correlation coefficient $r = .3$ and above. Meanwhile there are two components that have eigenvalues greater than 1. Both of these components explain 73.23 percent of total variance as shown in Table 1.

Table 1
Results of EFA on Total Variance Explained

Component	***Initial Eigenvalues***			***Extraction Sums of Squared Loadings***		
	Total	***% of Variance***	***Cumulative %***	***Total***	***% of Variance***	***Cumulative %***
1	7.739	64.489	64.489	7.739	64.489	64.489
2	1.048	8.736	73.225	1.048	8.736	73.225
3	.680	5.666	78.891			
4	.512	4.269	83.159			
5	.692	3.264	86.423			
6	.488	3.234	89.657			

Extraction Method: Principal Component Analysis.

The principal component analysis 'varimax rotation' has been used to minimize the number of locomotor components that have a high correlation to each of the factors. Table 2 shows the results of rotated factors, the component explains 65.84 percent of variance. Meanwhile, the total variance can be explained by this component is 84.85 percent.

Table 2
Total Variance Explained

Component	***Rotation Sums of Squared Loadings***		
	Total	***% of Variance***	***Cumulative %***
1	6.781	65.844	84.854

Extraction Method: Principal Component Analysis.

Table 3 shows the loading of the locomotor subtest, all six sub test locomotor used in this study shown a high communality scores or loadings and support the test conducted by previous researchers (Ulrich, 2000).

Table 3
Locomotor Test Loadings

Locomotor Sub test	Component
	1
Run	.769
Gallop	.745
Hop	.675
Leap	.765
Horizontal Jump	.615
Slide	.776

N90

Based on the validity coefficient reported by previous researchers (Anastasia & Urbina, 1997; Wouter et al,, 2009; Ulrich, 2000 and Wong and Cheung, 2007), the content validity of this instrument was ranged from r = .88 to .97. According to the phase 1 study validity coefficient, r = .98 it concluded that locomotor test can be used to measure the part of the composite

gross motor development of school children. Meanwhile, the reviewed inventories are better in terms of the validity compared to previous studies as shown in Table 4 below.

Table 4
The overall validity value of locomotor inventory

Construct	**Correlation Coefficient**			
	Phase 1	Evaggelinou, et.al **(**2002)	Wong and Cheung (2007)	Simons,et.al (2008)
Lokomotor test	.98	.74	.79	.79

Test re-tests has been done by using the same test administration on the same subject in two different times. This method is often used in measuring physical fitness and motor skills. The test is administered on the subject to obtain the first set of data, then repeated the test has been done to obtain the second set of data. Similar test procedures has been undergo by all assessors. By using the correlation method, both data are correlated to obtain the reliability coefficient value. The interval between the first test with the second test needs to be considered because factors such as maturity, learning and physical changes influenced the variables being measured. The interval of two to four days is appropriate for tests that involved muscle fatigue.

The internal consistency of locomotor test items have been obtained through test re-test procedure. Based on the reliability coefficient reported by previous researchers the Cronbach's Alpha are ranged from .85 to .91 (Wouter, Kristine, Christiane & Caroline, 2009). To ensure the reliability of the locomotor sub test items, researchers have used Cronbach's Alpha. The Alpha coefficients of locomotor sub tests obtained in this study have been shown in table 5.

Table 5
The overall reliability value of locomotor inventory

TGMD-2 Items	**Alpha**
Locomotor	
Run	.79
Gallop	.80
Hop	.79
Leap	.79
Horizontal Jump	.80
Slide	.81
Alpha (*n*=30)	**.82**

Reliability of Assistant Examiners

To obtain the reliability of assistant examiners, Pearson correlation analysis has been used to determine the correlation coefficient between the reliability scores of assistant examiner with scores of researchers. The reliability coefficient must more than or equal to .80 to be accepted as an assistant examiner. Table 5 shows the results of assistant examiners and researchers scores regarding the locomotor tests. The correlation coefficient obtain is ranged from .82 to

.95. These results demonstrate assistant examiner has the high reliability in administer GMD-2 locomotor subtest.

Table 5
The Correlation Coefficient Between Researchers And Assistant Examiners

Test of locomotor skills	**Tester reliability**			
	Tester 1	**Tester 2**	**Tester 3**	**Tester 4**
Run	.88	.94	.94	.94
Gallop	.92	.89	.92	.92
Hop	.91	.92	.96	.94
Leap	.88	.84	.82	.89
Horizontal Jump	.95	.95	.95	.95
slide	.93	.91	.91	.93

N90

Objectivity of Assistant Examiners

The objectivity of assistant examiners test re-test of locomotor based on TGMD-2 (Ulrich, 2000) in this study were obtained through `interclass reliability '(Burton & Miller, 1998; Marrow, et al, 1995; Safrit, 1981), where the correlation objectivity of the tests were measured through Pearson-r. According to Baumgartner et al, (2007), in most physical measurements, the correlation coefficient is ranged from .85 and 1. Based on Table 6, the correlation coefficient of the objectivity among the locomotor assistant examiners in conducting the test to the children aged 7 to 9 years is range from .89 to .93.

Table 6
The correlation coefficient of Assistant Examiners Objectivity

Test of locomotor skills	**Assistant Examiners**
Run	.89
Gallop	.89
Hop	.92
Leap	.84
Horizontal Jump	.93
Slide	.91

N=90

Correlation coefficients obtained, showed the locomotor tests in this study has high objectivity of assistant examiners. Based on the correlation coefficients of objectivity proposed by Baumgartner et al, (2007), the assistant examiners are able to meet the requirements of objectivity to evaluate the performance of locomotor development of children in this study.

Reliability of Locomotor Test

Internal consistency of locomotor test has been obtained through Cronbach's alpha coefficient. The Cronbach's alpha of the items from the previous study is ranged from .85 to .91 (Wouter, et al, 2009). The Alpha values for each subtest are shown in Table 7. The results

of the pilot study shown the overall Cronbach Alpha locomotor subtest ranged from .82 to .83, which explains the GMD-2 has a high reliability instrument and aligned with the result previous study. The results shown the Cronbach Alpha coefficient of locomotor item is .82 (Baharom, 2013). Hence, the items are suitable for the purpose of testing (Nunnally & Bernstein, 1994).

Table 7
The Internal Consistency of Locomotor Subtest

TGMD-2 Subtest Item	Alpha Coefficient
Run	.79
Gallop	.80
Hop	.79
Leap	.79
Horizontal Jump	.80
Slide	.81
Locomotor Alpha value (*n*=90)	.82

The researchers also used test re-test procedure to determine the consistency of the correlation coefficient (Baumgartner et al, 2007). Pilot test data has been analyzed using Pearson's r statistics for the reliability. According to Baumgartner et al, (2007), generally the most physical measurements, the reliability coefficient of the test is ranged from .60 to 1. Table 8 reports the findings of the pilot study, the reliability of the instrument subtest is between .77 to locomotor .93 by the children age of 7 to 9 years.

Table 8
Test Re-Test coefficient

Subtest locomotor	**Age**		
	7 year	**8 year**	**9 year**
Run	.91	.82	.83
Gallop	.88	.78	.86
Hop	.88	.77	.89
Leap	.86	.79	.89
Horizontal Jump	.93	.83	.90
Slide	.79	.82	.88

N=90

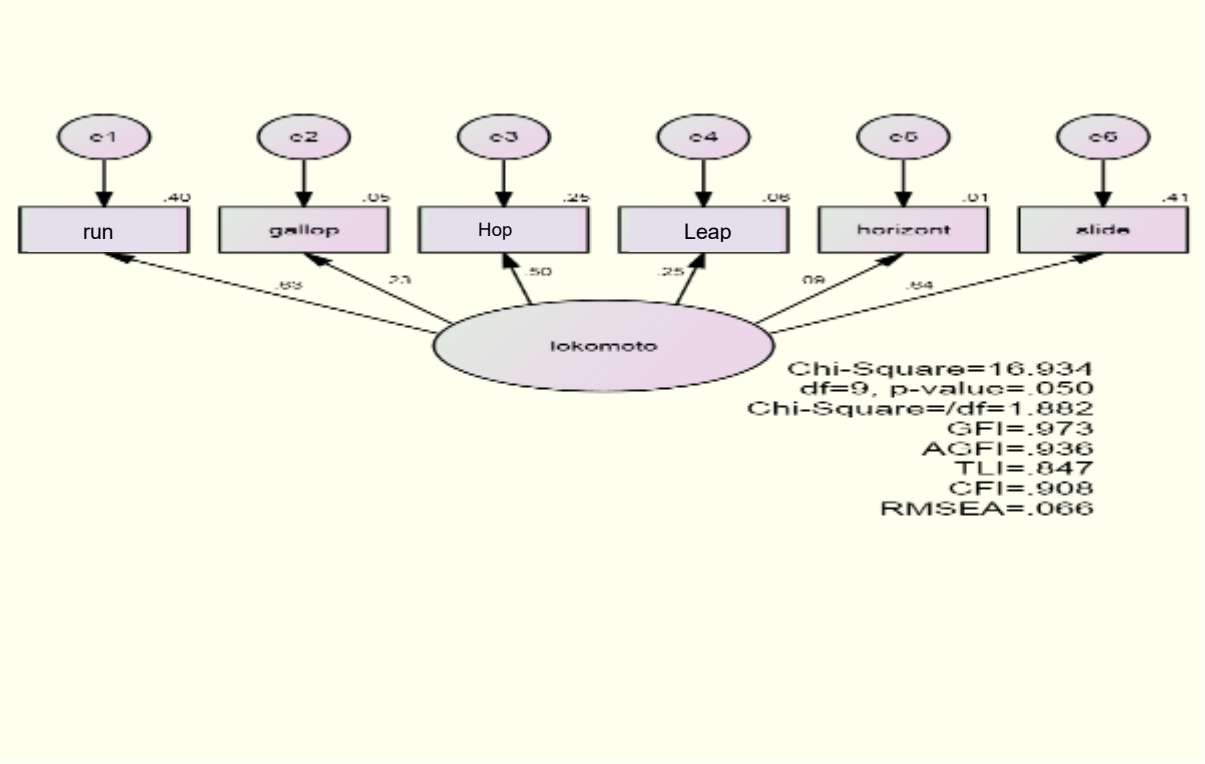
Findings of Second Phase

Confirmatory Factor Analysis

The unmodified CFA model is shown in Table 9 below. The findings show that the six locomotor subtests fits with the data. All fit indices are at the good level (Choi, Fuqua & Newman, 2009). According to Nunnally and Bernstein (1994) and Schumacker and Lomax (2004), if the fits indices are close to 1.0, then the model is considered fits to the data.

Table 9
Summary Index of CFA

Model	*x2*/df	AGFI	GFI	CFI	IFI	TLI	RMSEA
Six-factor model was not modified	1.882	.936	.973	.908	.902	.847	.066



The results of Pearson correlation analysis

The value of the correlation coefficient (r) for all subtest are ranged between .51 to .69, which is less than .70. Table 10 below to confirm the existence of six factors are distinctive.

Table 10
Pearson correlation coefficient matrix between sub test

Construct	Run	Gallop	Hop	Leap	Horizontal jump	Slide
Run	1	.69**	.60**	.69**	.63**	.51**
Gallop		1	.51**	.72**	.63**	.45**
Hop			1	.69**	.60**	.51**
Leap				1	.71**	.67**
Horizontal Jump					1	.51**
Sliding						1

**. *p*< .01, *N* = 192

Reliability

The comparison of the Cronbach alpha coefficient for this subtest from the previous studies, Anastasi and Urbina (1997) and Wouter et al, (2009) study, are shown in Table 11. However, after two phases of study the researcher found that the coefficients are better compared to

previous studies, except Ulrich (2000). Hence all the coefficients are suitable for the purpose of testing (Nunnally & Bernstein, 1994; Cohen et al., 2007).

Table 11
The Findings of The Internal Consistency Reliability of The Inventory Locomotor

Subtest	**The Cronbach Alpha Coefficients**				
	Phase 1	Phase 2	Ulrich (2000)	Anastasi and Urbina (1997)	*Wouter,et.al (2009)*
Run	.79	.633	.98	.947	.954
Gallop	.80	.744	.98	.602	.658
Hop	.79	.740	.97	.632	.886
Leap	.79	.790	.98	.846	.868
Horizontal Jump	.80	.895	.97	.867	.854
Slide	.81	.845	.96	.856	.834

Summary and Discussion

The main objective of this study was to develop and validate the items in the inventory used to measure locomotor sub test, part of the development of gross motor for children age 7 to 9 years. This study uses the basic theory and statistics to identify the items that developed the six locomotor inventory items. Results from this study suggests the locomotor inventory items and its subtest produce the good reliability to measure a part of the gross motor development of children aged 7 to 9 years in Malaysian primary school. The reliability of the whole test and subtest indicates the good internal consistency that is consistent across the research phase, where the Cronbach's alpha coefficients for all subtest ranged from .63 to .92. Therefore, these items are suitable for use of testing the gross motor development. This study has several weaknesses; the comparison between the results of the study with the results of the study in terms of the Cronbach alpha coefficient could not be made due to lack of inventory being reviewed extensively by scholars. Second, respondents consisted only of at age 7 to 9 years old (level one of Malaysian primary school). Therefore future research should be extended to children age 10 to 12 years old (level two of Malaysian primary school students). Further studies should also be conducted to find the existence of children locomotor development inventory from the viewpoint of the teachers. However, it is hoped that this reviewed locomotor inventory is helpful especially to researchers who are interested to understand futher about the development of children`s gross motor in primary school.

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