Original Article

Psychometric Properties of Physical Well-Being, Health and Motor Development Inventory for assessing School Readiness

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Objectives: The objective of this study was to examine the psychometric properties of the 'physical well-being, health and motor development inventory' used to assess school readiness in ordinary and mentally retarded pre-school children.

Method: A descriptive study examining validity was conducted using random sampling. Two hundred students (160 ordinary and 40 mentally retarded children) were randomly selected from the city of Tehran. In investigating the validity of the inventory, evidence related to content validity and construct validity were used.

Results: The evidence related to content validity showed that the questions related to the domain elements of gross motor skills, fine motor skills, nutrition and safety exercises all had high correlation coefficients with the overall elements. Some of the questions related to the domain elements of sensorimotor skills, physical fitness and activities of daily living did not have acceptable correlation coefficients. However, after removing the outliers the overall validity coefficient and subsequently that of the overall test increased. The t computed for construct-related evidence was significant too. Eventually, the validity coefficients were estimated at 0.859, 0.832, 0.671, 0.585, 0.725, 0.719 and 0.719 for gross motor skills, fine motor skills, sensorimotor skills, physical fitness, activities of daily living, nutrition and safety exercises, respectively.

Discussion: The results indicate that the overall inventory and its elements have good validity for assessing preschool children's readiness in the domains of physical well-being, health and motor development.

Keywords: educational readiness, physical well-being, health and motor development, test validity

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Introduction

One of the most important aspects of human health is paying attention to physical well-being and health & motor development during childhood particularly in the pre-school age. The child's development is dependent on a wide ecological background, beginning with the family and extending to the community and culture in which s/he is being brought up in.

Pre-school readiness in children can be classified into the following five domains (1).:

1- Physical well-being, health & motor development
2- Social and emotional development
3- General knowledge and Cognition
4- Approaches toward learning
5- Language, communication and literacy

A child's developmental potential is not exactly predictable at birth, and is dependent on interdisciplinary fields like: psychology, sociology, social welfare, education received during childhood, speech therapy, occupational therapy, healthcare, public health, physical well-being and normal motor

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development. Bearing in mind the significance of children' early years of life and the influential role numerous individuals play in their growth, it seems necessary to express our expectations in terms of 'what children should know and be able to do'. These expectations called 'early learning standards' provide information on developmental domains to those who take care of and teach pre-school children (2). No doubt, if the pre-school assessment of children in the fields of health, physical well-being and motor development are correctly organized and executed, in practice, they can lead to better child care and development and desirable early learning, followed by primary education.

Growth or development has many aspects, one of which is motor development, which has been the focus of experts like Gezel (3). The formation of the central nervous system can be explained on the basis of two models, a 'hierarchical model' of performance and a 'systematic model'. The 'hierarchical model' of performance emphasizes that the performance of upper levels ensues after the reaction and performance of lower levels. According to the systematic model too, during development, the link between performance and brain cortex, basal ganglia and cerebellum becomes stronger. Therefore, we should expect delay in motor development, model formation and unnatural growth stages following brain injuries (4). Early therapeutic interventions at any stage can prevent the progression of unnatural growth and reduce the side-effects of brain injury. Naturally, early interventions are much better than those that are carried out after the complete presentation of the disorders symptoms and aging of the child (5). Moreover, screening on the basis of a specific framework can accurately assess the determinant factors of natural development, and is a hypothesis approved by the American Academy of Pediatrics.

There are different tests for assessing children's motor skills, one of which is the Battery test that is designed for children aged 3-16 years. However, these tests are not specific to school entry. Nonetheless, there are tests such as the 'Miller Assessment for Preschoolers' that assess the overall condition of the child (4). This test does not take into account safety issues however.

Maxwell and Clifford believe that school readiness goes beyond the child alone, and involves the child, the family, the school environment and the community (6). Bearing this outlook in mind, assessing the child's school readiness is only part of the comprehensive assessment that should take place (7). According to Meisels et al (8) two issues must be kept in mind in preparing the child for education and a successful experience at primary school: a) the child must have motivation, maturity and cognitive and motor abilities to acquire knowledge and skills, b) the child must be able to successfully adapt to the school environment. Weakness of any type in health, physical well-being and motor development weaken the child's self-confidence, motivation and learning and disrupts the child's school adaptation. Hayase et al concluded that individuals acquire most of their abilities for activities of daily living (ADL) between the ages of 3 and 6. So children should be able to do most of their personal tasks on their own and without the help of others.

Assessment of the aforementioned domains can yield useful information to relevant authorities and policy-makers to lay greater focus on developmental domains, as they are important influential factors that affect other educational activities. In the same context, the current study was dedicated to the design and validity check of an inventory for screening and assessment of children's physical readiness prior to school entry.

Methods

A descriptive study including inventory design and its validity check was conducted.

Sampling - The statistical population of the study included all ordinary and mentally retarded children across the country that had completed the pre-school course and were ready to enter primary school in the 2006-2007 educational year. However, the participants comprised 160 ordinary and 40 mentally retarded pre-school children from Tehran. This sample size was chosen in light of the existent limitations and the fact that a similar sample size had been used in other similar studies as well.

Data collection tool - The inventory that was designed by the 'Research Institute for Exceptional Children' to assess children in the domains of physical well-being, health and motor development consisted of the following: The research tool consisted of four sub-domains. These sub-domains were, respectively: motor development, physical development, personal care & hygiene, and safety. Each sub-domain included the following parenthesized elements: motor development (gross motor, fine motor and sensorimotor skills); physical development (physical fitness); personal care & hygiene (activities of daily living & nutrition); safety

(safety exercises). Each domain element in turn included a number of 'indicators' as follows: gross motor skills- 21 indicators; fine motor skills- 20 indicators; sensorimotor skills- 8 indicators; physical fitness- 8 indicators; activities of daily living- 15 indicators; nutrition- 6 indicators; and safety exercises- 9 indicators.

There were three options in front of each indicator that indicated whether the child did or did not possess that particular indicator. The options were: yes, sometimes, and no. the aforementioned objectives and indicators had been extracted from a couple of American States' pre-school program objectives and indicators of physical well-being, health and motor development, and at the same time based on Washington's Education program. The evidence relevant to construct and content validity was used in reviewing the validity of the abovementioned questionnaire.

Results

Content-related evidence: Table (1) shows that all the questions of the 'gross motor skills' domain element in the 'physical well-being, health and motor development inventory' have high correlation with the overall element; among its 21 questions the correlation coefficients (CC) of 18 questions ranged between 0.316 – 0.609. The CCs for questions 4, 5 and 20 ranged from 0.26 to 0.293. All these values were considered acceptable.

Table (1) also illustrates that all the questions of the 'fine motor skills' domain element in the 'physical well-being, health and motor development questionnaire' have high correlation with the overall element; among its 20 questions the CCs of 18 questions ranged between 0.327 – 0.606. The CCs for questions 8 and 9 ranged from 0.213 to 0.283. All these values were considered acceptable.

Most of the questions of the sensorimotor domain element had high correlation with the overall element, and the CCs of 5 of 10 questions ranged from 0.367 to 0.535. The CCs of questions 4, 7 and 10 ranged from 0.207 to 0.233 for the entire sample. All the CCs were considered acceptable (table 1). However, although most of the questions had good correlation, questions 1 and 9 had low correlations with the overall domain element (-0.07 and 0.08 respectively), and question no. 1 even had negative correlation. The CCs calculated were an indication of the questions' homogeneity with the overall test, and, removing the non-homogenous questions would raise the entire test's validity coefficient. Hence, questions 1 and 9 were removed from the sensorimotor element, reducing the questions from 10 to 8, to raise the overall validity coefficient. The 8 questions went under analysis again, the results of which have been illustrated in table 2. The findings show that after removing questions 1 and 9, most of the questions had high correlation with the overall element. The CCs of 5 questions ranged from 0.372 to 0.498; they were 0.2 – 0.262 for questions 4, 7 and 10. All the aforementioned values were considered acceptable; the CCs of many questions increased after removing the outliers.

Most of the questions of the physical fitness domain element had high correlation with the overall element, and the CCs of 4 of 10 questions ranged from 0.318 to 0.33. The CCs of questions 1, 8 and 9 ranged from 0.242 to 0.289 for the entire sample. All the CCs were considered acceptable. However, questions 2, 4 and 7 had low correlation with the overall domain element (0.178, 0.138 and 0.083 respectively). Questions 4 and 7 were removed from the physical fitness element, but question 2 was preserved (because its CC was close to 0.2) to allow the removal of questions 4 and 7 to raise its CC. After removal the 8 questions underwent analysis again. According to the findings in table 2 most of the questions of the 'physical fitness' domain element had high correlation with the overall domain element after removal of the outliers. The CC of half the questions ranged from 0.321 to 0.377. The CC of questions 2, 5, 8 and 9 were estimated at 0.2 – 0.294 for the entire sample. All these values were acceptable.

Table (1) shows the results of the ADL skills, where most of the questions had high correlation with the overall domain element and the CCs of 10 of 18 questions ranged from 0.306 to 0.497.

Table 1. The correlation coefficient of every question compared to the score of all the domain elements

Question	Cronbach's alpha upon removal of each question							Correlation coefficient of each question compared to the score of the overall domain element						
	Safety	Nutrition	Activities of daily living	Physical fitness	Sensorimotor skills	Fine motor skills	Gross motor skills	Safety	Nutrition	Activities of daily living	Physical fitness	Sensorimotor skills	Fine motor skills	Gross motor skills
1	0.72	0.7	0.707	0.523	0.661	0.826	0.859	0.237	0.38	0.362	0.261	-0.07	0.46	0.316
2	0.7	0.686	0.708	0.55	0.578	0.824	0.852	0.364	0.455	0.353	0.178	0.476	0.472	0.472
3	0.722	0.657	0.721	0.505	0.604	0.823	0.851	0.257	0.537	0.212	0.33	0.38	0.581	0.483
4	0.704	0.719	0.71	0.55	0.64	0.826	0.858	0.357	0.3	0.344	0.138	0.233	0.396	0.293
5	0.662	0.652	0.724	0.5	0.563	0.822	0.858	0.548	0.542	0.219	0.328	0.535	0.572	0.26
6	0.669	0.659	0.000	0.502	0.616	0.819	0.857	0.513	0.519	0.000	0.331	0.367	0.606	0.322
7	0.671		0.725	0.584	0.634	0.827	0.845	0.509		0.11	0.083	0.248	0.409	0.609
8	0.704		0.7	0.528	0.579	0.832	0.857	0.356		0.445	0.422	0.47	0.213	0.351
9	0.686		0.715	0.514	0.654	0.83	0.851	0.44		0.27	0.289	0.08	0.283	0.49
10			0.73	0.507	0.642	0.827	0.848			0.005	0.318	0.207	0.364	0.558
11			0.718			0.822	0.849			0.235			0.533	0.594
12			0.698			0.824	0.849			0.469			0.441	0.542
13			0.69			0.835	0.855			0.493			0.327	0.414
14			0.722			0.825	0.849			0.253			0.42	0.561
15			0.689			0.821	0.851			0.497			0.485	0.492
16			0.712			0.823	0.851			0.339			0.464	0.517
17			0.715			0.824	0.854			0.306			0.424	0.481
18			0.707			0.822	0.852			0.351			0.487	0.494
19						0.831	0.851						0.401	0.521
20						0.818	0.858						0.576	0.265
21							0.855							0.394

The CCs estimated for questions 3, 5, 9, 11 and 14 ranged from 0.212 to 0.27. All the aforementioned values were considered acceptable. However, since questions 3, 6, 7 and 10 exhibited low correlation with the overall domain element they were removed, the results of which are evident in table (2); many of the questions' CCs increased after removing the outliers. The results of the 'nutrition' and 'safety exercises' elements are presented in table (1), where all the questions had high correlation with the overall element, so there was no need to remove any question.

Table 2. The correlation coefficient of each question compared to score of overall domain elements

Question	Cronbach's alpha upon removal of each question			Correlation coefficient of each question compared to the score of the overall domain element		
	Activities of daily living	Physical fitness	Sensorimotor skill	Activities of daily living	Physical fitness	Sensorimotor skill
1	0.708	0.543	-	0.362	0.321	-
2	0.707	0.584	0.485	0.365	0.2	0.608
3	0.722	0.533	0.393	0.212	0.3556	0.633
4	0.71	-	0.238	0.351	-	0.673
5	0.727	0.557	0.495	0.207	0.294	0.606
6	-	0.523	0.372	-	0.377	0.647
7	-	-	0.262	-	-	0.664
8	-	-	0.498	-	-	0.602
9	0.701	0.571		0.445	0.224	-
10	0.717	0.569	-	0.27	0.237	-
11	-	0.531	0.2	-	0.357	0.677
12	-			-		
13	0.719			0.25		
14	0.699			0.469		
15	0.693			0.471		
16	0.722			0.269		
17	0.692			0.477		
18	0.717			0.312		
19	0.719			0.263		
20	0.709			0.345		

Construct-related evidence: Table (3) shows the 't' computed for the following domain elements: gross motor skills (3.165), fine motor skills (3.52), sensorimotor skills (3.417), physical fitness (3.43), activities of daily living (4.085), nutrition (5.131) and safety exercises (4.212). The aforementioned values were significant at a level of 0.01.

Table 3. Results of the T-Test comparing the scores of the two 'Ordinary' and 'Mentally retarded' groups in each of the inventory's domain elements, to estimate divergent validity

Group	Domain element	n	$\bar{X}$	S	t	P value
Ordinary Mentally retarded	Gross motor skills	40 40	78.56 9.49	29.7 64.11	165.3	002.0
Ordinary Mentally retarded	Fine motor skills	40 40	35.53 46	67.7 73.10	52.3	001.0
Ordinary Mentally retarded	Sensorimotor skills	40 40	08.21 85.17	33.3 95.4	417.3	001.0
Ordinary Mentally retarded	Physical fitness	40 40	85.21 78.18	82.2 92.4	43.3	001.0
Ordinary Mentally retarded	Activities of daily living	40 40	35.42 55.36	74.3 16.8	085.4	000.0
Ordinary Mentally retarded	Nutrition	40 40	78.14 2.11	68.2 5.3	131.5	000.0
Ordinary Mentally retarded	Safety exercises	40 40	38.23 48.18	85.3 27.6	212.4	000.0

$P<0.01$

<u>The inventory's validity coefficient:</u> Table (4) shows the validity coefficients estimated for each domain element: gross motor skills (0.859), fine motor skills (0.832), sensorimotor skills (0.645), physical fitness (0.553), ADL (0.724), nutrition (0.719) and safety exercises (0.719). The highest and lowest values were estimated for the 'gross motor skills' and 'physical fitness' elements respectively. These coefficients have been calculated before removing the outliers.

Table 4. The validity coefficients of the inventory's domain elements for the entire sample *before* removing the outliers

Domain element	No. of Samples	No. of questions	r_α
Gross motor skills	129	21	859.0
Fine motor skills	134	20	832.0
Sensorimotor skills	139	10	645.0
Physical fitness	148	10	553.0
Activities of daily living	152	18	724.0
Nutrition	155	6	719.0
Safety	155	9	719.0

Since some of the questions were removed because of their low correlations, the calculations were repeated once more after the removal, the results of which are illustrated in table (5). These values increased in comparison to the previous values computed.

Table 5. Validity coefficients of inventory's domain elements for entire sample *after* removing outliers

Domain element	No. of Samples	No. of questions	r_α
Gross motor skill	129	21	859.0
Fine motor skill	134	20	832.0
Sensory motor skill	139	8	671.0
Physical fitness	148	8	585.0
Activity of daily living	152	15	725.0
Nutrition	155	6	719.0
Safety	155	9	719.0

Discussion

By 'test validity' we are referring to the appropriateness, meaningfulness and extent to which certain inferences can be justified on the basis of the scores gained in that test. We need to gather certain evidence to approve such inferences. Traditionally, validity has been classified into three types on the basis of the evidence considered: content-related validity, criterion-related validity, and construct-related validity (9-11). In assessing the validity of the current inventory content-related evidence and construct-related evidence were taken into consideration. Assessment of school readiness in children has many aspects, namely political, educational and social (2). The focus laid by National Goal-Setting Committees, preliminary programs, and European countries on developmental domains in pre-school programs emphasizes the need to assess children developmentally. Based on the study conducted by Scott-Little et al such standards have been developed on the basis of the 'Child Based Outcome (CBO)' and are developmentally oriented. Hence the developmental assessment of children is based on the CBO or child-based behavioral outcomes. The behavioral outcomes or CBO addressed by Scott-Little et al that have been the basis of standard development for preschoolers in the five child developmental domains. We have based our assessment on the same outcomes in the form of the indicators mentioned earlier.

The US National Information Center has introduced a number of tools and organizations in its report titled 'Assessment tools for measuring children's behavioral outcomes during childhood education'. One of the tools introduced is the 'Individual Growth and Development Indicators' (IGDI) tool that has been prepared on the basis of developmental domains and is being used as a reference that measures individual developmental performance. The State of Connecticut has published a comprehensive curriculum titled the 'Preschool Assessment Framework' which measures various developmental domains on the basis of the State's standards. These standards have been oriented toward the 'National Goal-Setting Committee's outlook. 'High Scope' is another organization that has prepared a preschool development assessment tool- in 2005- on the basis of the domains and indicators under consideration in this study. The 'California Department of Education' too developed and used an observation tool that was precisely based on the developmental domains of the 'National Goal-Setting Committee', under the title of 'Desired Results Developmental Profile'. The research team used these references to design the overall framework of the assessment tool.

As previously mentioned, content validity is one of the aspects considered in assessing the validity of a tool. Generally speaking, content validity shows the extent to which the questions or tasks in a test represent the entire set or domain previously defined. Methods of evaluating the connection between the components of a test and the entire set are mostly based on expert opinion and professional experience (12). However, as pointed out by Magnusson validity-related data depend on the questions' characteristics, and content validity-related evidence can be inferred from the question's correlation with the entire test (13). Upon examining the inventory we found that there was no need to remove the questions of the domain elements of gross and fine motor skills, nutrition or safety exercises. On the contrary, the domain elements of physical fitness, sensorimotor and ADL skills required removal of non-homogenous questions to increase their correlation coefficients to ensure the construct validity of the domain elements.

Divergent validity has been used to support the construct validity of the 'physical well-being, health and motor development inventory'**.** Divergent validity means that the test does not measure constructs other than the one the test has been designed for. The findings of the study reject the null hypothesis, and we may conclude that there were significant differences between the mean scores obtained by the ordinary and mentally retarded group in all the domains of the inventory. Ordinary children scored higher in all the domains as compared to the mentally retarded group. This difference approves the divergent validity of the 'physical well-being, health and motor development inventory'**.** Eventually, internal consistency was used to estimate the validity coefficient of the 'physical well-being, health and motor development inventory' used to assess preschoolers' readiness. In the internal consistency method a single test is executed only once. It is a method commonly applied to estimate the validity coefficient. The coefficient calculated in this manner is dependent on the test's consistency of application, from one question to another. So it is in fact the homogeneity indicator of the test material and an indicator of the overlap of different questions in assessing a common characteristic. Therefore, to estimate the internal consistency of the inventory, the most generalized form of analysis of variance i.e. Cronbach's alpha was used. According to our results, all the domain elements of the 'physical well-being, health and motor development inventory' have acceptable validity and can be used to assess school readiness in ordinary and mentally retarded preschoolers.

Conclusion

The results of the current study indicate that the developed inventory has good validity and may be used for the screening and assessment of preschoolers' school readiness.

References

1. Kagan SH, Moore E, Bredkamp S. Reconsidering Children's Early Development and Learning: Toward Common Views and Vocabulary. Washington' DC: National Education Goals panel. 1995.
2. Scott-Little C, Kagan SL, Ferlow VS. Standards for Preschool Children's Learning and Development. Who Has Standards, How Were They Developed, and How Are They Used? Carolina: SERVE Greensboro NC; 2003.
3. Mansour Mahmoud. [Genetic Psychology, Psychological development from infancy to old age (Persian)].Tehran: Termeh publication; 1999.
4. Case-Smith S. Occupational Therapy for Children. London: Mosby. 2005.
5. Shonkoff JP, Meisels SJ. Handbook of early childhood intervention. New York: Cambridge University Press; 2000.
6. Maxwell KL, Clifford RM. School readiness assessment. Young Children. 2004;59(1):42-6.
7. Meisels SJ. Testing Four and Five Year Olds: Response to Salzer and to Shepard and Smith. Educational Leadership. 1986;44(3):90-92.
8. Hayase D, Mosenteen D, Thimmaiah D, Zemke D, etal. Age-related Changes in Activities of Daily Living Ability. Australian Occupational Therapy Journal. 2004;51:192-198.
9. Anastasia O.Psychometry.Baraheni M. (Persian translator) Tehran: Tehran University Press. 1992.
10. Sharifi H. [Fundamentals of Psychometry and Psychological Assessment (Persian)]. Tehran: Roshd Press. 1998.
11. Saif AA. [Methods of Educational Measurement and Evaluation (Persian)]. Tehran: Doran Publisher; 2009,pp: 1-552.
12. Hooman HA.[Multivariate Data Analysis on Scientific Research (Persian)]. Tehran, Parsa Publication, 2001.
13. Reynolds WM, Resoruces PA. RCDS (Reynolds Child Depression Scale) Professional Manual. Florida: Psychological Assessment Resoruces; 1989.
14. Adèr HJ, Mellenbergh GJ. Advising on research methods: A consultant's companion. Huizen, The Netherlands: Johannes van Kessel Publishing; 2008.