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Development and Validity of the School Interim Competency of Performance Skill Battery Scale (SICPSBS)

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Abstract

Background: The current study aimed to develop a tool to assess the performance skills of Iranian children aged 5 to 7 years in order to evaluate their school competency based on the occupational therapy practice framework and to determine its validity.

Materials and Methods: Performance skills are the cornerstone of the tool. The eight-step design process of Devellis was used to develop the tool. To analyze the content validity, the content validity index, and the content validity ratio were used. Following administration of the tool in 100 children (5 to 7 years) in the pilot study, the items were analyzed. After applying the tool to 400 children aged 5 to 7 years, the construct validity of the tool was determined with confirmatory and exploratory factor analysis and differential, convergent, and divergent validity.

Results: The primary item pool included 212 items which was reduced to 112 items after administrating content validity and item analysis. Based on exploratory factor analyses, Kaiser-Meyer-Olkin (KMO) index was (0.890), and five factors indicating 55.02% of the total variance were obtained. The confirmatory factor analysis confirmed the results. The discriminant validity between the age groups was statistically significant ($P < 0.001$); r ranged from 0.447 to 0.867 for convergent validity and 0.073 to 0.597 for divergent validity.

Conclusion: The results indicated the excellent validity of the SICPSBS to assess the performance skills of 5 to7 year-old Iranian children in terms of school competency. The test evaluates all sensory-perceptual, motor-praxis, visual-perception, cognitive, social interaction, and process domains for each child.

Key Words: Child, Competency, School, Tool Development, Validity.

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1- INTRODUCTION

Getting ready for school is considered to be a level of competency in school-age children that is necessary for their further achievements (1, 2). Snow (2006) indicated that family, teachers, and children need a system to efficiently evaluate the competence of children for school entry (2). The school competency assessment tools can be classified as 1) the tests evaluating children in terms of set expectations for development at a particular age such as the Gesell Readiness Scale (3), and 2) the tests assessing academic knowledge such as the Metropolitan Readiness Test (4). Other available tests are a combination of the two mentioned types of tests, such as the Miller Assessment for Preschoolers (5).

These tests have some disadvantages: they are poor predictors of academic achievements in future; no strong psychometric properties have been reported for them to support making decisions based on their results, and in the best situation, they can only identify half of unprepared cases accurately (6,7). In addition, most of these assessment tools rely on academic evaluations or cognitive abilities. Socioemotional development and behavioral evaluation of these tools are mostly observational, interview-oriented, and cannot be included in scoring systems of the tests (8). Based on the Vygotsky theory, learning leads to development; in other words, the experiences that the child gains through interactions with others and the environment, leads to development (7). Each child has a complicated pattern of physical, emotional, cognitive, verbal, behavioral, and motivational strengths and weaknesses, and it is not possible to categorize the child into one of the two classes of competent or incompetent for school based on this complicated profile. Different factors such as early childhood environment (including cultural, economic, and social situation), peers, school, family, and neighbors affect children (9-12). Therefore, to assess children's school competency, a proper tool based on the cultural and social conditions of the community should be developed. On the other hand, a comprehensive viewpoint is required to develop such tools. There are several factors involved in the occupation of education according to Occupational Therapy Practice Framework (OTPF), which only one factor, performance skills, is child-based. Evaluation of performance skill components (such as motor-praxis, sensory-perceptual, emotional-social, cognition-metacognition, and communication skills) can reveal strengths and weaknesses of the child at school entry (13). In Iran, every year around 1 million students start their first grade. Before entering the school, children are assessed in different domains such as visual and auditory screening tests, motor development-physical wellbeing, mental-emotional health, social competence, verbal skills, general information, and cognitive skills; however, none of these is performed using standard assessment tools (14). The current study aimed to develop a tool to assess performance skills in children aged 5 to 7 years in order to evaluate their school competence and determine their weaknesses to make parents aware of their children’s status and take timely measures to empower the child before entering the school. The study also aimed to evaluate the validity of the developed instrument.

2- MATERIALS AND METHODS

The eight-step design process of Devellis (15) was used in the current study to develop the tool in 3 phases: first phase included steps 1 to 4, and the initial questionnaire was formed in this phase. The second phase comprised of step 5 and the content validity of the initial questionnaire was assessed in this phase. The third phase included steps 6 to 8 when

the initial questionnaire items were analyzed and the final questionnaire was developed; and then its construct validity was assessed.

2-1. First phase

The initial questionnaire developed in this phase based on steps 1 to 4.

First step: The main concept of the tool—performance skills—and its domain were introduced and determined based on the occupational therapy practice framework 2nd edition (13). This domain contains sensory-perceptual, motor-praxis, cognitive, emotional regulation, and communication skills.

Second step*:* To form an items pool, the deductive method using books, lectures, previous tests, and tools in each domain was used. Tools employed for sensory-perceptual skills included a Sensory Profile, a Newsha Developmental Scale, Test of Visual Perceptual Skills, and Beery-Buktenica Developmental Tests of Visual-Motor Integration. The tools used for the motor-praxis domain were Bruininks-Oseretsky Test of Motor Proficiency, Test of Gross Motor Development, the Denver Developmental Screening Test, the Lincoln-Oseretsky Motor Development Scale, the McCarthy Scales of Children's Abilities, and the Motor Assessment Battery for Children. Two tests of Sensory Profile and the Behavior Rating Inventory of Executive Function were used for the cognitive and emotional regulation domains and the sensory profile was used to evaluate communication skills.

Third step*:* This step, carried out alongside the second step, determined the format for measurement of the extracted items. Different domains were scored in different forms. Three different scoring models were applied to the developed questionnaire: 1) The 5-option Likert scale including always (scored 4), often (scored 3), sometimes (scored 2), rarely (scored 1), and never (scored 0). Items 2 -7, associated with communication skills, were scored in reverse order. 2) The 3-option Likert scale including completely can do (scored 2), to some extent can do (scored 1), and cannot do at all (scored 0). 3) In Yes-No (can do-cannot do) questions, yes (can) was scored 1 and no (cannot do) was scored 0.

Fourth step*:* The items pool was reviewed by the research team in order to decrease the number of items through integration or exclusion of similar or repeated items, and accordingly the initial questionnaire was developed.

2-2. Second phase

This phase included step 5 to determine the content and face validity of the initial questionnaire.

A) To determine content validity: This was conducted both qualitatively and quantitatively. The qualitative method was carried out in parallel with the quantitative method and 12 occupational therapists with at least 4 years related experience were asked to comment on the appropriateness, clarity, and simplicity of the items. To quantitatively determine the content validity of the questionnaire, the content validity ratio (CVR) was used to determine whether each item was essential, and the content validity index (CVI) was used to determine the relevance of each item to the subscale being used.

To determine the essential items, the Lawshe formula was used to determine CVR. For this purpose, the expert panel was asked to evaluate each item (Essential = 3; useful, but not essential = 2, and not essential = 1). Then, the CVR was calculated using the Lawshe formula **(Formula.1).** Based on the Lawshe table (**Table.1**), items with a CVR < 0.56 were excluded from the questionnaire (16).

$$CVR = \frac{n_e - (N/2)}{N/2}$$

Formula.1: Where, N = the total number of specialists, n_e= the number of specialists judging an item 'essential' (16).

Relevance of each item: After exclusion of items based on their CVR score, the monitored questionnaire was given to the panel in order to determine the CVI. For this purpose, 2 types of CVI were determined for the questionnaire: 1) the individual-content validity index (I-CVI), and 2) the scale content validity index (S-CVI).

1) I-CVI calculation: For this purpose, the panel of experts was asked to determine the relevance of each item based on a 4-option Likert scale as not relevant = 1; needs revision = 2; quite relevant, but needs some revision = 3; and completely relevant = 4. The number of experts who scored 3 or 4 on each item was divided by the total number of experts to obtain the I-CVI (11-13, 15). Also, to decide on these items, based on CVI measures, the modified Kappa coefficient **(Formula.2)** was used. This coefficient is an indicator of appraiser agreement on the relevance of each item. Based on the guidelines provided by Cicchetti and Sparrow (1981) and Fleis (1981), Kappa measures 0.40 to 0.59 are considered weak, 0.60 to 0.74 good, and ≥ 0.74 excellent (16). In the current study, a Kappa coefficient >0.74 was considered as the cut off criterion for endorsement.

$$P_c = \left[\frac{N!}{A!\ (N-A)!}\right] 0.5^N$$

Where, N= number of experts, A= number agreeing on good relevance, P_c= the Probability of chance agreement

$$k^* = \frac{I\_CVI - P_c}{1 - P_c}$$

Formula.2: The method of calculating modified Kappa.

2) S-CVI calculation: The S-CVI/average (S-CVI/Ave) was calculated in the current study. For this purpose, the total I-CVI measure was divided by the total number of items. Measures ≥ 0.90 the questionnaire has excellent content validity (17).

B) To determine face validity: Since it was anticipated that access to parents at the time of sampling would be limited, following content validity 2 forms of the questionnaire were developed for parents and the examiner; accordingly, 18 items in sensory-perceptual, 18 items in cognitive, and all 10 items in emotional regulation and all 7 items in communication skills were included on the parents' form in order to allow them to quickly score their child based on their observations. Some items in the sensory-perceptual, motor-praxis, and cognitive skills were included in the examiner form, since scoring was based on the child's answer or action. Then, the 2 forms of the questionnaire were evaluated for their face validity. The face validity of the parents' form was assessed qualitatively based on a face-to-face interview. For this purpose, the questionnaire was given to 10 parents who were able to read and write. They were asked to comment on the clarity, simplicity, and lack of ambiguity of the items and modify the ones with ambiguity and complications.

To determine the face validity of the examiner form, 10 occupational therapists were asked to score the items based on their simplicity and clarity; accordingly, to score simplicity, the following scoring model was used: that is not simple or it is complex = 1; needs revision = 2; it is simple, but needs revision = 3; and it is totally simple = 4. To score clarity, the following was used: that is unclear and ambiguous = 1; needs revision = 2; it is clear, but needs some revision = 3; and it is totally clear = 4. Then, their consensus on the simplicity and clarity of the items was measured and their suggestions were applied.

Table-1: Lawshe's table (Minimum Values of the Content Validity Ratio, the One Tailed Test, P=0.05)

Number of Specialist	5	6	7	8	9	10	11	12	13	14	15	20	25	30	35	40
Min CVR	0.99	0.99	0.99	0.75	0.78	0.62	0.59	0.56	0.54	0.51	0.49	0.42	0.37	0.33	0.31	0.29

Min: Minimum.

2-3. Third phase

This phase included steps 6 to 8. Administration of the questionnaire to children 5 to7 years old, item analysis, and determining the construct validity of the questionnaire were carried out in this phase.

Sixth step: The questionnaire was administered in a pilot study to 100 children aged 5 to 7 years. For this purpose, an approval code was obtained from the Ethics Committee of Iran University of Medical Sciences, Tehran, Iran, and permission to visit preschool centers was provided by the Department of Education in Tehran. The inclusion criteria were lack of neurological disorders or orthopedics diseases (based on preschool medical records), lack of psychosocial complications based on the Child Symptom Inventory-IV (CSI-IV) (18), and the Ages and Stages Questionnaire (ASQ) (19), and good command of the Farsi language. After obtaining the signed written informed consent from the parents, the children were enrolled in the study. The subjects were free to withdraw from the study at any stage. Sampling was conducted in preschool centers in Tehran, Iran. Preschool centers were randomly selected from the Center, North, South, East, and West regions of the city. Both the parents and examiner questionnaires were administered in each center. The collected data was used for item analysis (Seventh step).

Seventh step: Item analysis was conducted in this step. For this purpose, the items were evaluated based on difficulty, discrimination coefficient, and scale correlation. Data obtained from the pilot study were analyzed in this step.

Item difficulty: This is used to determine the level of difficulty for each item. To measure the difficulty coefficient, for the 25 subjects who obtained the highest score on a certain item as well as the 25 who obtained the lowest score on the same item were determined. Then, the number of subjects in each group that answered the item correctly was determined and accordingly, the total number of correctly answered subjects in both groups was divided into the total number of subjects in the 2 groups. The item was included if the measure ranged from 0.3 to 0.7 (20).

Item discrimination: This was used to determine the ability of each question to discriminate the weak subjects (the questionnaire responders) from the strong ones. To determine the discrimination coefficient, the total number of correct answers in both weak and strong groups were measured and divided by the total number of subjects in the group. The item was included if the measure was > 0.5 (indicating that the item could discriminate the weak subjects from the strong ones) (20).

Item scale correlation: This coefficient was obtained by calculating the correlation coefficient between each item and the total score. The item was included if the

coefficient was > 0.3 (21). If an item met 2 out of 3 of the aforementioned criteria, it was included in the questionnaire; otherwise, it was excluded. The final instrument developed was accordingly named the ″School Interim Competency of Performance Skill Battery Scale (SICPSBS)" (**Index.1**) (*please see the index.1 at the end of paper*).

Eighth step*:* The construct validity of the SICPSBS was determined in this step. For this purpose, exploratory and confirmatory factor analysis and convergent, divergent, and discriminated validity were used. In this regard, SICPSBS was administered to 400 children within the age range of 5 to 7 years. After obtaining permission from the Department of Education in Tehran via an introduction letter from the Research Vice Chancellor of Iran University of Medical Sciences, cluster sampling was conducted in five geographical regions of the city (Center, North, South, West, and East). The inclusion criteria of the children were the same as mentioned earlier in the sixth step. Informed consent was also obtained from the parents and ethical considerations were also observed, as performed previously in the sixth step. Then, the data were analyzed with SPSS software version 18.0 using exploratory factor analysis via principal component analysis by the varimax rotation method.

The confirmatory factor analysis was also carried out with LISREL version 8.8. Convergent and divergent validity were determined using a Pearson's correlation test; the correlation of each domain with the total score was considered as convergent validity, and the correlation of each domain with other domains was considered as divergent validity. If the Pearson coefficient was > 0.4 or < 0.7 in convergent and divergent validity, the convergent and divergent validity of the instrument is considered to be good (10). The discriminant validity was determined using the known group method to evaluate the total score of the test in children aged 5 to 7 years in 6-month intervals. For this purpose, one-way analysis of variance (ANOVA) was used. Then, a Tuckey post hoc test was used to compare the difference between age group.

3- RESULTS

3-1. First phase

Domains and items on the questionnaire were developed. For sensory-perceptual skills, motor-praxis skills, cognitive skills, emotional regulation skills, and communication skills, 237 items, 100 items, 66 items, 31 items, and 15 items were extracted, respectively. Then, the items in each domain were evaluated by the researchers; any repeated or similar items were integrated or excluded. Some items were replaced based on consensus, some others were combined, and finally a 253-item questionnaire was developed and entered the next phase (**Table.2**).

3-2. Second phase

A) Results of the content validity analysis*:* After identifying essential items using CVR and removing those scoring < 0.56, there were sensory-perceptional skills with 39 items, motor-praxis skills with 21 items, cognitive skills with 15 items, emotional regulatory with 11 items, and communication skills with 6 items. After determining CVI in terms of relevance, none of the items scored < 0.74 and accordingly, no item was removed; but one of the items in emotional regulation skills was transferred to communication skills. S-CVI/Ave was also determined for the questionnaire (0.965). Finally, 166 items were maintained in the questionnaire (**Table.2**). The questionnaire was developed into 2 forms, one for the parents and one for the examiner.

B) Results of face validity analysis*:* In the quantitative face validity analysis, all items scored > 0.79; hence, no item was

removed. In the qualitative face validity analysis, after a face-to-face interview with the examiners (occupational therapists) and the test parents, some of the questions were reviewed and revised due to ambiguity or lack of simplicity.

Table-2: Number of Items in the process of Scale development

Dimensions	Subscales	First phase		Second phase	
		Second step	Forth step	Number of deleted items in CVR	Number of items in CVI
Sensory-Perceptual Skills	Oral processing	11	4	1	3
	Auditory processing	5	8	5	3
	Visual processing	4	2	0	2
	Vestibular processing	10	5	3	2
	Tactile processing	18	10	4	6
	Behavioral outcomes of sensory processing	10	4	1	3
	Perception of motion direction	10	3	1	2
	Perception of motion position	10	3	0	3
	Auditory perception	4	3	1	2
	Visual perception	112	70	25	45
	Visual-motor integration	18	18	2	16
	Total	212	130	43	87
Motor- Praxis Skills	Gross motor	55	33	13	20
	Fine motor	35	15	2	13
	Total	90	48	15	33
Cognitive Skills	Inhibition	17	9	3	6
	Shifting	13	6	4	2
	Working memory	11	5	0	5
	Planning/organization	25	6	3	3
	Initiation	10	4	1	3
	Memory of numbers	10	4	2	2
	General knowledge	10	8	0	8
	Total	96	42	13	29
Emotional-Regulation Skills	Emotion-behavioral responses	26	16	8	8
	Monitoring	11	5	2	3
	Total	37	21	10	11
Communication Skills		14	12	6	6
Total		412	253	87	166

CVR: Coefficient of Variation Ratio; CVI: Content validity index.

Table-3: Demographic properties of participants in a pilot phase

Age groups (month)	Male Mean ± Standard deviation	Female Mean ± Standard deviation	Total number of participants
60-65	62.75±1.71(12)	63±1.75 (12)	24
66-71	68.53±1.66 (13)	68±1.58 (13)	26
72-77	75.46±1.05 (13)	75.53±1.89 (13)	26
78-83	81.00±1.80 (12)	80.75±1.54 (12)	24
Total	71.94±7.03(50)	71.82±6.98 (50)	100

3-3. Third phase

First the initial questionnaire containing 166 items was assessed in a pilot study on 100 children aged 5 to 7 years. Demographic characteristics of the subjects are shown in **Table.3**. Then, the item analysis was carried out. Results of the analyses (discrimination coefficient, difficulty coefficient, and item scale correlation) are shown in **Table.4**.

Items that met at least 2 out of 3 of the mentioned criteria were maintained. Accordingly, 28 items from the sensory-perceptual skills, 15 items from motor-praxis skills, 8 items from cognitive skills, and 1 item from communication skills were excluded. However, no item was removed from emotional regulation skills. To determine the validity of SICPSBS, the questionnaire was administered to 400 children aged 5–7 years. Demographic characteristics of the participants are shown in **Table.5**.

A) Results of exploratory factor analysis using principal component analysis with rotated varimax*:*

Based on the results of the Kaiser-Meyer-Olkin Measure of sampling adequacy (KMO) (0.890), and the Bartlett test for sphericity (d_f: 351, P < 0.001), the sample size was adequate. We used eigenvalues greater than 1 to determine the number of factors (22). The results indicated that the variables of the developed instrument were categorized into 5 factors in which the first, second, third, fourth, and fifth factors constituted 20.82%, 15.48%, 6.38%, 6.37%, and 5.93% of the total variance, respectively. In addition, all factors of the instrument could only express 55.02% of the construct attributed to performance skills. Results of the rotated component matrix are shown in **Table.6**. According to the results, the Emotion-behavioral response as a 25th subscale (**Table.6**) was related to more than one factor. Therefore, the cross loading for this subscale was calculated by the differences in magnitude of its loadings. It was under 0.2.

A) Results of confirmatory factor analysis*:* The subscales of the instrument and the factors achieved in the exploratory factor analysis were entered into the analytical model as observed variables and latent variables, respectively. The results confirmed the exploratory factor analysis (**Figure.1**). Fitness tests were also performed (**Table.7**).

B) Results of discriminant validity*:* The results of one-way ANOVA showed significant differences among the age groups (F=7.494, P < 001). The Tuckey post hoc test showed that the total score of the age group 78 to 83 months was significantly higher than that of other age groups, but no significant difference was observed among the other 3 groups (**Table.8**).

C) Results of convergent and divergent validity: The correlation of each domain score with the total score of the test was also assessed. For the convergent validity, r ranged from 0.447 to 0.867. On the other hand, r for divergent validity ranged from 0.073 to 0.597.

Table-4: The result of item analysis

Dimensions	Subscales	Number of items in the primary battery	Item difficulty (Min-Max)	Item discrimination (Min-Max)	Item scale correlation (Min-Max)	Number of remained items
Sensory-Perceptual Skills	Oral processing	3	0.60-0.94	0.12-0.80	0.38-0.79	2
	Auditory processing	3	0.54-0.80	0.40-0.92	0.74-0.81	2
	Visual processing	2	0.74-0.90	0.20-0.52	0.70-0.82	1
	Vestibular processing	2	0.68-0.92	0.16-0.64	0.71-0.89	1
	Tactile processing	6	0.82-0.94	0.12- 0.36	0.45-0.72	0
	Behavioral outcomes of sensory processing	3	0.60-0.88	0.24-0.80	0.36-0.84	1
	perception of motion direction	2	0.80-0.84	0.32-0.40	0.54- 0.56	0
	Perception of motion position	3	0.54-0.66	0.68-0.92	0.60-0.75	3
	Auditory perception	2	0.54-0.90	0.20-0.92	0.47-0.88	1
	Visual perception	45	0.28-0.90	0.08-1.00	0.26-0.75	38
	Visual-motor integration	16	0.04-1.00	0.00-0.92	0.04-0.77	8
	Total	87	---	-----	-----	57
Motor-Praxis Skills	Gross motor	21	0.04-0.94	0.00-0.76	-0.04-0.63	14
	Fine motor	12	0.34-0.98	0.04-0.68	0.09-0.65	4
	Total	33	------	----	-----	18
Cognitive Skills	Inhibition	6	0.58-0.80	0.40-0.80	0.68-0.80	5
	Shifting	2	0.70-0.74	0.52-0.60	0.86-0.90	2
	Working memory	5	0.60-0.88	0.24-0.88	0.64-0.83	3
	Planning/organization	2	0.54-0.76	0.48-0.92	0.76-0.86	3
	Initiation	2	0.64-0.84	0.58-0.68	0.85-0.86	2
	Memory of numbers	2	0.30-0.46	0.40-0.92	0.82-0.91	2
	General knowledge	10	0.30-1.00	0.00-0.92	0.00-0.74	4
	Total	29	----	----	----	21
Emotional-Regulation Skills	Emotion-behavioral responses	7	0.54-0.78	0.44-0.92	0.64-0.82	7
	monitoring	3	0.58-0.72	0.56-0.84	0.83-0.87	3
	Total	10	----	----	----	10
Communication Skills		7	0.56-0.84	0.32- 0.80	0.35-0.75	6
Total		166		----------		112

Table-5: Demographic properties of participants in administration phase

Age groups (month)	Male Mean ± SD	Female Mean± SD	Total number of participants
60-65	63.86 ±1.47	63.70±1.18	100
66-71	68.16±1.67	68.90±1.35	100
72-77	74.62±1.93	72.46±1.19	100
78- 83	81.16 ±1.86	80.92±1.78	100
Total			400

SD: Standard deviation.

Table-6: Factor loading of the measurements of School Interim Competency of Performance Skill Battery Scale (SICPSBS) in the principal component analysis and rotated using Varimax

Row	Subscales	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1	Oral processing	0.308				
2	Auditory processing				0.670	
3	Visual processing	0.481				
4	Vestibular processing				0.599	
5	Behavioral outcomes of sensory processing				0.587	
6	Perception of motion position	0.743				
7	Auditory perception	0.739				
8	Visual discrimination		0.747			
9	Visual memory		0.725			
10	Spatial relationship		0.645			
11	Form constancy		0.713			
12	Visual sequential Memory		0.705			
13	Figure ground discrimination		0.687			
14	Visual closure		0.772			
15	Visual-Motor integration		0.486			
16	Gross motor			0.620		
17	Fine motor			0.696		
18	Inhibition				0.825	
19	Shifting				0.695	
20	Working memory				0.659	
21	Planning/organization				0.692	
22	Initiation				0.776	
23	Memory of numbers					
24	General knowledge					0.555
25	Emotion-behavioral responses				0.780	0.678
26	Monitoring				0.798	
27	Communication				0.391	

Table-7: Confirmatory Factor Analysis Error and Goodness of Fit Indices for the School Interim Competency of Performance Skill Battery Scale (SICPSBS)

Fitness criteria	Acceptable fitness	Performance skills
χ^2/ DF/P-value	P<0.05	515.82/ 314/ P=0.00
SRMR	SRMR<0.10	0.062
GFI	GFI>0.90	0.87
NFI	NFI>0.90	0.91
NNFI	NNFI>0.90	0.96
RFI	RFI>0.90	0.89
IFI	IFI>0.90	0.96
CFI	CFI>0.90	0.96
AGFI	AGFI>0.80	0.84
PNFI	PNFI>0.50	0.81

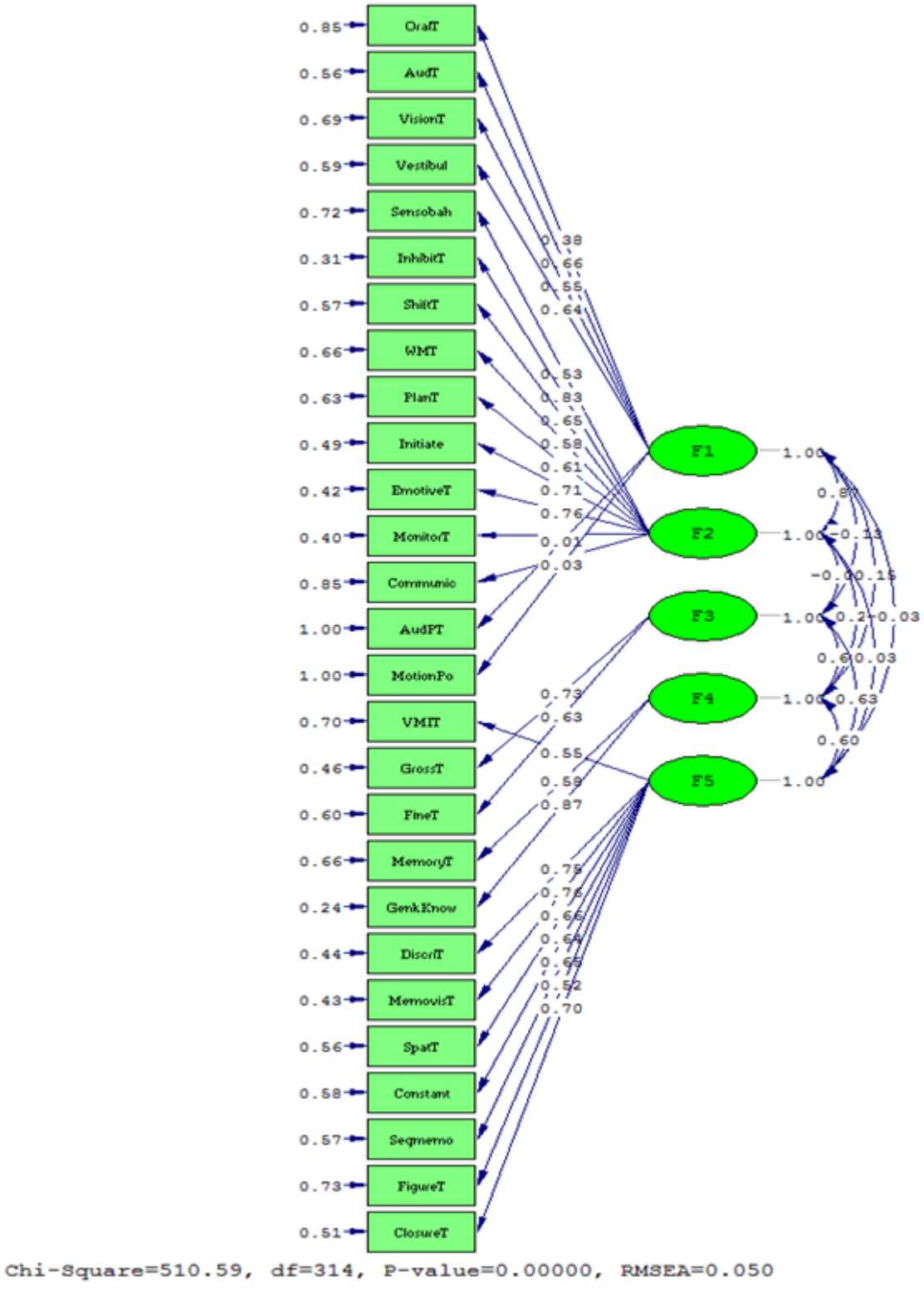

Fig.1: Significance Levels of the Rates, Latent Variables, and Explained Observed Variables for the Three-Dimensional Model of the SICPSBS.

Table-8: Age difference in the total score of School Interim Competency of Performance Skill Battery Scale (SICPSBS)

Age groups (month)	Number of participants	Mean ± SD	One-way ANOVA
60-65	100	185.71±23.69	F=7.494 P<0.001
65-71	100	183.56±28.04	
72-77	100	189.51±28.86	
78-83	100	199.90±24.98	

SD: Standard deviation.

4- DISCUSSION

The current study was conducted to develop an instrument to assess performance skills of Iranian school-age children, 5 to 7 years old, in terms of school competency. Also, the study determined the content and the construct validity of the developed instrument. In the current study, the instrument design and the item selection were precisely performed inferentially based on the previous literature and tools. Domains were selected based on the OTPF 2nd edition which is related to performance skills (sensory-perceptual, motor-praxis, cognitive, emotional regulation, and communication skills). The domains were selected due to their effects on the successful participation of the child in the occupation of education (14). This provides a competitive, strong advantage for SICPSB compared with other instruments developed to evaluate school readiness in children; for example, in the Bracken School Readiness Assessment (BSRA), only the concepts of colors, shapes, sizes, number/counting, and differences are assessed, or the Miller Assessment for Preschoolers (MAP) has only 5 performance indices, including foundation, coordination, verbal, nonverbal, and complex task indices, while in the Phelps Kindergarten Readiness Scale (PKRS), the domains are verbal processing, perceptual processing, and auditory processing (5, 21, 24). The First Step screening test also evaluates cognition, communication, motor, socioemotional, and adaptive functioning. Of course, socioemotional and adaptive functioning domains of the First Step were not included in the main score of the child and their assessment is optional and they only are observational evaluation of the child's behavior (25). SICPSB is more comprehensive and evaluates all of the domains necessary for successful performance in school and the occupation of education. In addition, emotional regulation and communication skills that are descriptively evaluated in other tests are assessed quantitatively in the current study and were calculated in the score of the related domain and total scores. Moreover, all of the domains of the current study are consistent with those of National Education Goal Panel, which is used to determine the strengths and weaknesses of the child in terms of school competency (26). Content validity is a subjective, 2-stage process, and is an important stage in the development of a tool. The content validity of SICPSB was excellent; to determine CVR in the current study, the Lawshe formula, one of the strongest methods, was used. Another method to determine CVR was developed by Wilson et al. (2012) and its results are consistent with those of Lawshe (27). In the Lawshe formula, the essential items are selected and the inessential ones are excluded from the items pool. Accordingly, in total 87 items were excluded from the current study in the CVR stage based on the experts' comments. In the present study, the modified Kappa statistics as well as the

Waltz and Bausell method was used to determine CVI (28). Polite et al. noted that CVI is an indication of the appraisers' agreement on the relevance of an item, and cannot determine agreements about the irrelevance of items (28). S-CVI-Ave was also used in the current study. This scale includes information about the performance of each item among the average features, and, unlike that of S-CVI/UA, its calculation is not difficult. In total, the results of the current study showed excellent content validity for the developed tool, since I-CVI > 0.78 and S-CVI/Ave > 0.90 (30). The results of different tool developing studies have indicated that using experts' opinion is the most common method used to exclude inappropriate items. The results of a systematic review by Morgado et al. (2017) showed that only a few studies used the comments of the target group for item analysis (31).

In the current study, although a part of the questionnaire was specified to parents' responses about their children, since the parents are not competent to select items, only the comments of experts were used to exclude inappropriate items. The parents' comments on the face validity of the questionnaire were used; based on their comments, clear items without any ambiguity were developed. The pilot study was conducted to make any necessary adjustments before the finalization of the questionnaire. Many studies ignore this stage, but since the ultimate goal of the current study was to develop a tool that can provide adequate evidence, the pilot study was essential. After determining the difficulty coefficient of the items, the very simple and very difficult ones were excluded (32). The difficulty coefficient plays an important role in item analysis, since practically all statistical scores of the test are to some extent affected by it (33). Domains and subscales of the questionnaire were designed and developed based on the OTPF (2nd edition); but the results of the exploratory factor analysis, performed using principal component analysis, did not confirm all of the domains of the model completely and another classification for some subscales was extracted. However, in total, 5 domains were selected and based on the authors' opinion; all of the 5 domains were renamed. Confirmatory factor analysis confirmed the structure of the 5 factors developed through the exploratory factor analysis. The first domain was called sensory-perceptual skills and included subscales of oral, visual, auditory, and vestibular processing, kinesthesia/ motion position, and auditory perception that were allocated to this domain. Although the factor load of auditory and vestibular processing was higher in the other factor, they were allocated to sensory-perceptual skills based on the OTPF (2nd edition).

The visual motor integration and visual perception were among the subscales placed in the domain of sensory-perceptual skills in the initial questionnaire. Exploratory factor analysis placed them in a separate domain and accordingly, they were called visual perceptual skills. This domain is separately evaluated in SICPSB and is of great importance, because multiple studies have indicated that information processing in the visual perception area is one of the major predictive factors of first grade competency (34). In addition, visual perception disorders result in dysfunction in educational performance of children such as reading and writing. Also, the results of a study by Brown and Link (2015) showed a significant relationship between visual perception, visual-motor integration, and hand writing skills in school-age children (35), which supports the necessity of this domain as a separate factor in SICPSB. The two subscales of fine and gross motor skills in the same factor confirm the domain of motor-praxis

skills based on the OTPF (2nd edition). The MAP included these two subscales in a domain called coordination (24). In the PKRS test, the perceptional motor domain relied on visual-motor integration skills, which is different from that of SICPSB (36). The behavioral outcomes of sensory processing, inhibition, shifting, working memory, planning/organization, initiation, emotion-behavioral responses, monitoring, and communication skills are the components of a subscale obtained from exploratory factor analysis. The authors called it as process and social interactional skills based on the OTPF (3rd edition) (32), although in the 3rd edition, process skills and social interactional skills are placed in two separate domains, but since both of them are the subscales of performance skills, they are named and integrated as one factor. The method used for performance skills classification is different in the two available versions of OTPF, but since the basis of classification is the theories and occupational therapy models, the combination of these two domains does not interfere with the concept of performance skills (14, 37).

In the 2nd edition of the occupational therapy practice framework, cognitive and emotional regulation skills are introduced in separate domains, but focusing on their definition and comparing them with the concept of executive function reveals that the domains can be integrated into a single factor, because executive functions include two hot and cold components; the hot executive function deals with high level of cognitive functions, and the cold executive function relies on the control of emotion and social cognition (38). The fifth factor is comprised by two subscales of memory of numbers and general information, which is based on the decision of research team; it was called the cognitive skills domain. Items in the general information subscale are similar to items in BSRA (20). In addition, the subscale of general information is similar to that of the nonverbal index in MAP (24). Evaluation of discriminant validity showed that for the SICPSB, the total score of the age group 78 to 83 months was significantly higher than the other three age groups, although the differences among the other three age groups was insignificant; the reason can be justified by maturation approaches. The skills and function of the children improve as their age increases (7, 8). Although the results of the current study confirmed this hypothesis, this does not mean that children simply achieve adequate competency for school entry at a certain age, and the authors believe that the items and domains of the tool should be revised and modified, if necessary. Results from the convergent and divergent validity of the test also indicated that all domains of the test imply a general concept, namely performance skills. Divergent validity also indicated that each feature has its own trait and each domain has its own attribute.

5- CONCLUSION

Based on the results of the current study, the SICPSB developed to assess the performance skills of children aged 5 to 7 years in order to determine their competency to school entrance has excellent validity. The test includes all sensory-perceptual, motor-praxis, visual perception, cognitive, process and social interactional domains. In addition, each domain evaluates its own attributes. All domains imply the general concept of performance skills that are necessary for school competency. In the process of content validity determination, an items pool with numerous different items seems useful, but in the current study the items pool resulted in the unwillingness of additional experts to determine the content validity of the initial questionnaire. Another limitation of the current study was difficult access to participants during the sampling process; this was even more difficult in the pilot study. Even after

excluding some items during the content validity analysis, the number of items in the examiner form was relatively high which resulted in spending a longer time to complete the questionnaire. However, this problem was adjusted in the final version of the questionnaire due to the exclusion of many items by item analysis. It is necessary to evaluate the reliability of the questionnaire in an additional study. The reliability among examiners, test-retest, examiner reliability, and feasibility of the test need to also be determined.

6- CONFLICT OF INTEREST:

None.

7- ACKNOWLEDGEMENT

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Appendix.1: The School Interim Competency of Performance Skill Battery Scale.

School Interim Competency of Performance Skill Battery Scale (SICPSBS)

Developed by:

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خرده‌آزمون مهارت‌های حسی– ادراکی

مهارت‌های حسی– ادراکی			همیشه (نمره ۰)	غالبا (نمره ۱)	کاهی (نمره ۲)	به ندرت (نمره ۳)	هرگز (نمره ۴)
پردازش دهانی	۱	وقتی غذاهای بافت‌دار (مثل پرتقال یا گوشت) یا وسایل غذاخوردن (مثل قاشق) وارد دهانش می‌شود، عق می‌زند					
	۲	از خوردن بعضی مزه‌ها یا غذاهایی با بوهای خاص دوری می‌کند (برای مثال: مرغ، ماهی، گوشت گوسفند، شیر، پنیر، لیموترش)					
پردازش شنیداری	۳	اگر در اطرافش سرو صدا زیاد باشد حواسش پرت می‌شود و یا آن‌که عملکردش به هم می‌ریزد (برای مثال: ناتوانی در تکمیل تکلیف به دلیل سر و صدای زیاد اطرافش)					
	۴	وقتی نام او را صدا می‌زنند، پاسخی نمی‌دهد در حالی که شنوایی کودک سالم است					
پردازش دیداری	۵	در نگاه کردن به تمام افراد یا اشیاء به آن‌ها خیره می‌شود و یا زل می‌زند					
پردازش وستیبولار	۶	به علت جنب و جوش و تحرک زیاد، کودک کاری را به اتمام نمی‌رساند (برای مثال: ناتوانی در نشستن مداوم و تماشای یک کارتون، ورجه وورجه کردن هنگام پوشیدن لباس)					

مهارت‌های حسی– ادراکی			اجرای موقعیت حرکت/یا عضو مربوطه (نمره ۱)	پاسخ نادرست/ عدم پاسخ (نمره ۰)
حس حرکت/ موقعیت (درک موقعیت)	۷	صاف کردن انگشت میانی		
	۸	صاف کردن مچ دست		
	۹	صاف کردن آرنج		

مهارت‌های حسی– ادراکی			می‌تواند (نمره ۱)	نمی‌تواند (نمره ۰)
ادراک شنیداری	۱۰	می تواند جملات ۱۶ هجایی را تکرار کند جمله" دفتر نقاشی و مداد و از کیف بیرون بیار"		

خرده‌آزمون مهارت‌های ادراک دیداری

مهارت‌های ادراک دیداری			می‌تواند (نمره ۱)	نمی‌تواند (نمره ۰)
یکپارچگی بینایی حرکتی	۱	می‌تواند اعداد ۱ تا ۵، را کپی کند به طوری که قابل تشخیص باشند		
	۲	می تواند محیط اشکال مربع یا مثلث را با خطهای صاف (نه مواج) پُررنگ کند		
	۳-۸	کپی کردن تصویر (شامل ۶ تصویر دفترچه تصاویر ادراک دیداری)		
ادراک دیداری (شامل تصاویر دفترچه تصاویر)	۱-۵	تمیز دیداری		
	۶-۱۲	حافظه دیداری		
	۱۳-۱۸	ارتباطات فضایی		
	۱۹-۲۳	ثبات شکل		
	۲۴-۳۰	حافظه توالی دیداری		
	۳۱-۳۳	تشخیص شکل از زمینه		
	۳۴-۴۰	اکمال دیداری		

خرده آزمون مهارت های حرکتی– طرح‌ریزی

مهارت های حرکتی– طرح‌ریزی			به‌طور کامل می‌تواند (نمره ۲)	به‌طور نسبی می‌تواند (نمره ۱)	اصلا نمی‌تواند (نمره ۰)
مهارت های حرکتی درشت	۱	ایستادن پاشنه به پنجه (حالت گردو شکستن)			
	۲	راه رفتن روی یک خط به سمت جلو (پاشنه به پنجه، حالت گردو شکستن)			
	۳	راه رفتن روی یک خط به سمت عقب (پنجه به پاشنه، حالت گردوشکستن)			
	٤	پریدن پروانه ای به جلو			
	٥	لی لی کردن			
	٦	ضربه زدن به توپ ساکن با پا			
	۷	ضربه زدن به توپ با یک دست			
	۸	پرتاپ توپ از بالای سر به سمت هدف مشخص شده با دو دست			
	۹	پرتاپ توپ از بالای سر به سمت هدف مشخص شده با یک دست			
	۱۰	بالا انداختن توپ و گرفتن آن با دو دست			
	۱۱	پرتاب توپ به زمین و گرفتن ان با دو دست			
	۱۲	گرفتن توپ پرتاب شده با دو دست			
	۱۳	لمس بینی با انگشت اشاره			
	۱٤	مشت کردن و باز کردن دو دست به طور متناوب			
مهارت های حرکتی ظریف	۱٥	لمس پد انگشت شست با پد تک تک انگشتان			
	۱٦	حرکت چرخشی انگشت شست و اشاره			
	۱۷	می‌تواند خطوط صاف/ منحنی/ زاویه دار را روی کاغذ قیچی کند			
	۱۸	کلید را در قفل قرار داده و قفل را باز می‌کند			

خرده‌آزمون مهارت‌های پردازشی و اجتماعی– تعاملی

مهارت‌های پردازشی و اجتماعی– تعاملی			همیشه (نمره ۰)	غالبا (نمره ۱)	گاهی (نمره ۲)	به ندرت (نمره ۳)	هرگز (نمره ۴)
مهار کردن	۱	نسبت به تقاضای مسائل پرخاشگرانه یا خارج از کنترل عمل می‌کند (برای مثال: در برابر درخواست های خود یا دیگران)					
	۲	بی قرار است (برای مثال: بی‌موقع بلند شدن از صندلی سر کلاس، مکرر بلند شدن از جلوی تلویزیون هنگام تماشای یک کارتون)					
	۳	بدون فکر قبلی عمل می‌کند (برای مثال: پریدن وسط صحبت دیگران، خارج از نوبت پریدن وسط یک بازی)					
	٤	در متوقف کردن کارهای خود دچار مشکل می‌شود (برای مثال: وقتی کاری را انجام می‌دهد، آن‌قدر ادامه می‌دهد که لازم است به او گفته شود: "نه" یا "بس کن")					
	٥	در انتظار کشیدن برای رسیدن به نوبت، مشکل دارد					
انتقال	٦	یک حرف را بارها و بارها تکرار می‌کند (در هنگام تعریف کردن یک داستان یا شرح وقایع روزانه بخشی از آن را تکرار کرده و مطلب را ادامه نمی‌دهد)					
	۷	برای انتقال از یک کار به کار دیگر با مشکل مواجه است و گیر می‌کند (برای مثال: هنگام شستن دست و صورت شیر آب را باز و بسته می‌کند و مرحله بعدی را انجام نمی دهد)					
حافظه فعال	۸	برای انجام و یا تکمیل یک وظیفه، نیاز به کمک فرد بزرگسال دارد تا مراحل را به او یادآوری کند (برای مثال: انجام یک تکلیف درسی، درست کردن یک پازل یا نقاشی)					
	۹	در تمرکز بر کارهای روزمره تکالیف مدرسه و تغیره مشکل دارد و یا در اثر سر و صدا به راحتی حواسش پرت می‌شود					
	۱۰	وقتی سه جمله به او گفته می‌شود و یا سه کار از او خواسته می‌شود، فقط مورد اول یا آخر را به خاطر می آورد					
برنامه ریزی/ سازماندهی	۱۱	در انجام کارهای معمول صبح برای آماده شدن جهت رفتن به مدرسه (مانند مسواک زدن، لباس پوشیدن، صبحانه خوردن) مشکل دارد					
	۱۲	اتاق، میز/کمد/کشو/ کیف مدرسه اش را همیشه نامرتب و به هم ریخته رها می کند یا زمانی که دیگران آن را مرتب کنند					
	۱۳	وسایل شخصی و یا آموزشی خود را گم می‌کند و یا جا می‌گذارد					
شروع کردن	۱٤	هیچ کاری را خودش شروع نمی‌کند و برای شروع هر کاری باید به او گفته شود که آن را شروع کن، حتی کاری را که تمایل به انجام آن دارد					
	۱٥	در اوقات فراغت نمی‌داند چه بازی انجام دهد، ایده‌ای برای انتخاب بازی ندارد یا در وقت آزاد حوصله‌اش سر می‌رود و شاکی است که هیچ کاری نیست که انجام دهد و باید به او گفته شود که مثلا "نقاشی بکش یا ماشین بازی کن"					

مهارت‌های پردازشی و اجتماعی– تعاملی		همیشه (نمره ۰۵)	غالبا (نمره ۱)	گاهی (نمره ۲)	به ندرت (نمره ۳)	هرگز (نمره ۴)
پاسخ های هیجانی- رفتاری	۱۶	ترس‌هایی دارد که فعالیت‌های روزمره او را مختل می‌کند				
	۱۷	مضطرب به نظر می‌رسد				
	۱۸	وقتی در یک تکلیف ناموفق است، واکنش هیجانی شدیدی (مانند جیغ زدن، گریه کردن، پاره کردن دفتر) از خود نشان می‌دهد				
	۱۹	به سادگی ناراحت می‌شود و یا گریه می‌کند				
	۲۰	در تمامی فعالیت‌ها دارای خلق و خوی فشارقی است				
	۲۱	به‌طور ناگهانی و غیرمنتظره رفتارهای پرهیاهو و خشمگین دارد اما به یکباره آرام می‌شود				
	۲۲	بازی را مختل می‌کند و از یک بازی به بازی دیگر می‌رود (برای مثال: خراب کردن یک بازی در اواسط آن و رفتن به سراغ یک بازی دیگر)				
بازنگری	۲۳	از رفتار خودش هنگامی که در گروه است، آگاه نیست (برای مثال: نمی داند چه رفتار اشتباهی را درگروه انجام داده است و باید اشتباهش را به او بگویند)				
	۲۴	نمی‌داند که چگونه رفتارهایش دیگران را اذیت می‌کند				
	۲۵	اشتباهات کارش را بررسی نمی‌کند و خطاهای ناشی از بی دقتی دارد				
مهارت های ارتباطی	۲۶	مقررات و قوانین محیط اجتماعی را رعایت می‌کند				
	۲۷	معمولا درخواست‌ها و دستورالعمل‌های والدین/ مراقبینش را دنبال کرده و اکثرا مسئولیت‌هایی که به او سپرده می‌شود را انجام می‌دهد				
	۲۸	در جستجوی دریافت اطلاعات از دیگران است و می‌تواند اطلاعات دریافتی را به دیگران انتقال دهد				
	۲۹	در بازی‌ها و فعالیت‌های گروهی با کودکان دیگر شرکت می‌کند و بازی‌های مختلف (بازی‌های تخیلی یا پیچیده) را پیشنهاد می‌دهد				
	۳۰	قادر به توضیح دستورالعمل بازی‌ها به همبازی‌های خود است				
	۳۱	به خوشحالی/ ناراحتی دیگران به صورت کلامی، واکنش مثبت/ منفی نشان می‌دهد (برای مثال: تبریک گفتن، یا همدلی کردن و پرسش در مورد علت ناراحتی دیگران)				
پیامد رفتاری پردازش حسی	۳۲	در پیدا کردن اشیا در زمینه های شلوغ ناکام می‌ماند و نیاز به تلاش زیاد دارد (برای مثال: پیدا کردن کفش هایش در یک جای به‌هم ریخته، یا پیداکردن اسباب بازی مورد علاقه در کشوی پر از وسیله)				

خرده‌آزمون مهارت‌های شناختی

مهارت های شناختی			اگر کودک دو مرحله مستقیم و معکوس را صحیح پاسخ دهد (نمره ۲)	اگر کودک فقط یک مرحله (مستقیم یا معکوس) را صحیح پاسخ دهد (نمره ۱)	اگر کودک هیچ یک از مراحل را انجام دهد (نمره ۰)
حافظه ارقام (مستقیم/ معکوس)	۱	می‌تواند ۳ عدد گفته شده را به ترتیب مستقیم و سپس معکوس تکرار نماید (برای مثال: ۶-۸-۳)			
	۲	می‌تواند ۴ عدد گفته شده را به ترتیب مستقیم و سپس معکوس تکرار نماید (برای مثال: ۷-۱-۴-۳)			

مهارت های شناختی			به‌طور کامل می‌تواند (نمره ۲)	به‌طور نسبی می‌تواند (نمره ۱)	اصلا نمی‌تواند (نمره ۰)
دانش عمومی	۳	اشیا مختلف را بر اساس ویژگی‌های کلی طبقه‌بندی می‌کند (برای مثال: میوه‌ها، سبزیجات، حیوانات)			
	٤	می تواند به صورت طوطی‌وار تا ۲۰ بشمارد			
	٥	مفهوم اعداد ۱ تا ۱۰ را تشخیص می‌دهد			
	٦	مفهوم زمان های مختلف را می‌داند (برای مثال: امروز، دیروز، فردا)			