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Diagnostic predictors of learning readiness for pre-school children: A meta-analytic review

Mahnaz Akhavan Tafti, (*Corresponding author), PhD, Associate Professor, Department of Educational psychology, Alzahra University, Tehran, Iran. makhavant88@gmail.com
Salehe Piryaei, PhD Candidate of Educational Psychology, Alzahra University, Tehran, Iran.

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Abstract

Background and Objectives: Students with learning difficulties encounter poorer school outcomes and major problems in learning. Researchers investigated the factors in preschool stage that will help to diagnosis learning problems.

Methods: A meta-analytic review provides means for assessing which factors show the strongest effects on long-term outcomes.

Results: This article presents a meta-analysis of main screening tests of learning disabilities examining 3 sources and 27 samples published from 2000 to 2017 in Iran. Fourteen screening tests were identified among 25 studies. The combined effect size for detection were 24.262 (CI: 19.111-29.412), respectively. Among them, the Kaufman's Neurological-Clinical Diagnostics Battery is the best alternative for preschoolers screening.

Conclusion: Implications for future research and practice are considered.

Keywords: Learning readiness, Preschool children, Learning disabilities

Background

Diagnosing difficulties early in childhood and using practical approaches to deal with those difficulties are the potential to provide significant social and economic improvement. This is especially true where problems will likely advance with time; potentially effect on their quality of development, and end up in significant costs to society (1). Learning disabilities (LD) as an important deficit of general intellectual and adaptive functioning originates in childhood (2). Having understanding disability impairments, children with an increase of severe LD may have difficulties in verbal communication and may require support with daily tasks and most of them will experience complex physical health, sensory, and mobility difficulties (3). Studies indicated that most of children (around 70%) that have difficulties in learning in the primary grades continue to learn poorly (4) and low achievement is present in most definitions of learning disabilities (1). Disabled child does not achieve adequately for the child's age when provided with learning experiences and instruction appropriate for the child's age standards (e.g, Oral expression. Listening comprehension, Written expression, Basic reading skill, Reading fluency skills, Reading comprehension, Mathematics calculation., & Mathematics problem solving) (1). Also, employing immature strategies such as denial by children who've difficulty with learning can be harsh self-critics (5). Juel and Leavell (6) followed children's reading development during the primary grades and found that children have been poor readers in first grade remained poor readers in grade 4 too. These children hence have an increased risk for several psychological problems specially depressive disorders and Posttraumatic Stress Disorder (PTSD) (7).

With the significance of early intervention for the children vulnerable to learning disabilities, a complicating issue in interventions generally, with implications for prevention, could be the ongoing

Table1. Statistics of studies in random and fixed factor model

Model	Study name	Subgroup within study	Statistics for each study							Weight (Fixed)	Weight (Random)
			Mean	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	Relative weight	Relative weight
	ASQ	Combined	50.352	9.282	86.159	32.159	68.545	5.425	0.000	0.00	3.87
	behavior	behavior	20.000	1.221	1.492	17.606	22.394	16.376	0.000	0.20	7.36
	Bender	cognitive	9.670	0.310	0.096	9.061	10.279	31.144	0.000	3.04	7.47
	BENDER-G	cognitive	19.070	0.299	0.090	18.483	19.657	63.709	0.000	3.27	7.47
	BRIEF	Combined	18.606	0.127	0.016	18.358	18.854	147.014	0.000	18.32	7.48
	global	global	22.410	0.154	0.024	22.108	22.712	145.328	0.000	12.34	7.48
	KABC	Combined	5.880	0.117	0.014	5.651	6.109	50.267	0.000	21.44	7.48
	KIST	Combined	24.600	0.238	0.057	24.133	25.067	103.303	0.000	5.17	7.48
	Pre-behavio	global	21.290	0.161	0.026	20.975	21.605	132.430	0.000	11.35	7.48
	SSRS	Combined	27.770	0.607	0.368	26.581	28.959	45.760	0.000	0.80	7.45
	WISCONSI	Sustained	27.560	3.018	9.108	21.645	33.475	9.132	0.000	0.03	6.81
	WISC-R	IQ	103.480	1.826	3.333	99.902	107.058	56.678	0.000	0.09	7.22
	WM	Combined	3.032	0.124	0.015	2.789	3.275	24.468	0.000	19.11	7.48
	working	backward	1.500	0.246	0.061	1.017	1.983	6.086	0.000	4.83	7.48
Fixed			13.056	0.054	0.003	12.950	13.163	241.046	0.000		
Random			24.262	2.628	6.905	19.111	29.412	9.233	0.000		

Table 2. Between-study heterogeneity and effect sizes of screening tests

Model		Effect size and 95% confidence interval					Test of null (2-Tail)		Heterogeneity				Tau-squared			
Model	Number Studies	Point estimate	Standard error	Variance	Lower limit	Upper limit	Z-value	P-value	Q-value	df (Q)	P-value	I-squared	Tau Squared	Standard Error	Variance	Tau
Fixed	14	13.056	0.054	0.003	12.950	13.163	241.046	0.000	26718.144	13	0.000	99.951	92.313	53.479	2860.021	9.608
Random	14	24.262	2.628	6.905	19.111	29.412	9.233	0.000								

debate surrounding explanation of learning disabilities and the way they may be appropriately diagnosed (8,9). The definition of vulnerability in early childhood describes risk for learning disabilities. In this vein, learning disabilities is often looked as a bad developmental outcome (10), contributing to unexpected and significant (11) difficulty with basic academics and be a consequence of multiple vulnerabilities that arise from biological, psychological, and social systems and complex interactions (12). Early developmental factors that help diagnose and predict learning disabilities consistently, merit consideration as targets for preventive services, and are generally presumed to consult vulnerabilities (13). On its own, assessments that identify biological risk factors for learning disabilities are neither sensitive nor specific enough for learning disability diagnosis (14-16).

Currently, much progress has been made in early identification of children who are at an increased risk for learning difficulties (17-21). It has led to the development of measures that are useful in identifying children who exhibit risk factors for learning disabilities. These types of tests have already been used diagnostically to classify children and specifically to find out the children's current status (severity of the problems) (22). Some of them have been useful in determining the strengths and weaknesses of someone, a determination that is useful in designing someone program (18,23). However, through the comprehensive screening of preschool children, all cognitive, emotional and psycho-social aspects would be assessed.

Cognitive functions include all processes of transforming, reducing, organizing, elaborating, storing, recovering, and using data and these processes as perception, memory, and reasoning have a crucial role in future preschoolers performance(24). On the other hand, developmental and emotional health conditions that are common in young children may lead to social and academic difficulties in later childhood and beyond (18). According to Dorman (19), an item analysis of the Stanford- Binet Intelligence Test revealed superior performance by socially skilled children on such areas as comprehension, verbal reasoning, and discrimination tests. Therefore, social skills are related to many aspects of adaptive functioning and researchers have found significant relationships between social competency, creativity, academic achievement, and cognitive performance (25-27). Kim, Anderson, and Bashaw (28) found significant correlations between standardized measures of achievement/future academic performance and social behavior of children. Also, assertive behaviors in preschool children were connected with school readiness and intellectual achievement in later years (22). Results indicate that the little one who is curious, alert, and assertive will discover more from his environment and

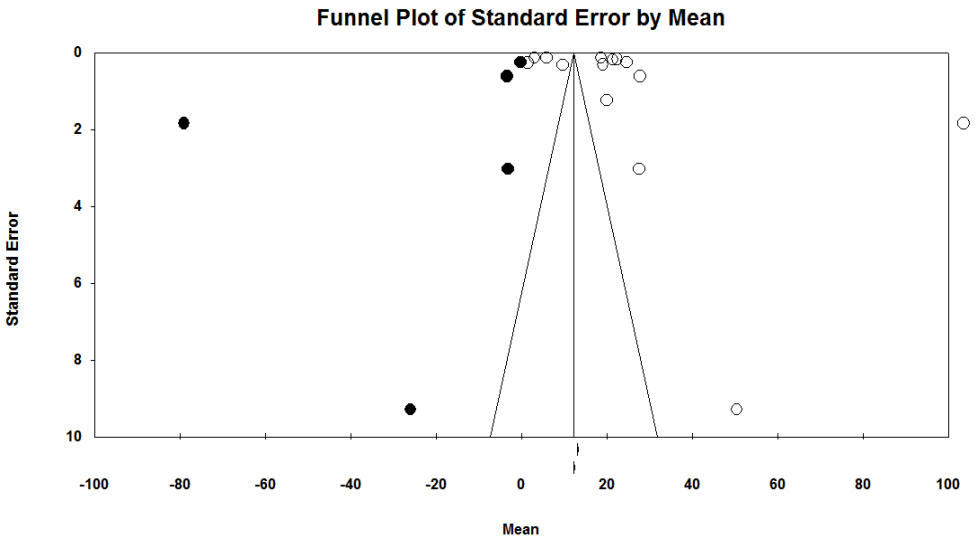

Fig. 1. The funnel plot for this meta-analytic review

the little one who is passive, apathetic and withdrawn will learn less about his environment due to his diminished contact (14).

However, assessment of developmentally disabled preschoolers is a vital yet challenging task. Assessment is defined since the systematic use of direct along with indirect procedures to document the characteristics of a target of interest (28). This target is frequently a single child, however it is often a small group of children (26). Screening tools that focus on early vulnerabilities for learning disabilities should quickly and unambiguously screen for differences that confer vulnerability for learning disabilities before child attain school age (29). While screening tools are by definition never as comprehensive as diagnostic assessment (29), they could provide information regarding strengths and weaknesses and can be utilized for selecting children for further assessment or for preventive interventions (29).

The literature review of pre-school screening studies in Iran indicate that some assessments are most useful as screening devices (e.g., Preschool children's behavioral problems test (30), school readiness test (31), Ages and stages questionnaire (ASQ)(32), Kaufman's Neurological-Clinical Diagnostics Battery (33)); other assessments are most useful as diagnostic or placement instruments and in describing a person's present status in terms of the severity of the problem (e.g., the Bayley Scales of Infant Development (34), the Stanford-Binet (35), and the Wechsler intelligence scale for children- revised (36), and Primary Scale of Intelligence (37). Finally, other assessments are most useful in program development and planning for individual mentally retarded infants and preschoolers (e.g., behaviorally based criterion-referenced measures (38)). Thus, it is worth identifying the best alternative among the long list of screening tests. Therefore, this systematic review aimed to quantitatively analyze the diagnostic accuracy of various pre-school screening tests and compare their efficiency.

Methods

This systematic review followed standard guidelines for conducting and reporting systematic reviews of diagnostic studies, including Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA)(39). Review was conducted of research on preschool screening children published in 2000-2017 in Iran. To identify relevant studies, computerized databases (Iran Doc, Magiran, SID, & Noor mags) were searched using combinations of these key words in Persion: preschool children, preschool screening, preschool assessment, cognitive screening, emotional screening, psycho-social screening, learning disabilities, and learning problems. So in the current review, publications were required to report original data on preschoolers screening. All participants in any study must be at least 6 years old at the time of screening/assessment. Other inclusion criteria were the mean age of participants within the study of validating and customizing a screening tool and screening modality (individual versus group). Theoretical articles and review articles that did not include original data were excluded. Meta-analytic procedures were used to analyze retest-adjusted effect sizes from the systematic review. Study-specific effect size estimates were

weighted by the analysis means, standard deviation and sample size combining to form a standard effect size. Between-study heterogeneity was quantified using χ^2 and I^2 statistics. All analyses were performed utilizing the CMA version 2 software package.

Results

Following the literature search and study selection, a total of 122 abstracts were identified from the databases. All titles or abstracts were screened, and 48 articles were relevant to screening tools for preschoolers. 23 papers were excluded for the following reasons: Studies were systematic reviews (n= 5), studies did not fulfill inclusion criteria (n = 16), and studies lacked data details for meta-analysis (n= 2). The definitive analysis in this systematic review included 25 studies published from 2000 until 2017 for preschool children in Iran.

A total of 14 screening tests were identified in the 25 eligible studies, including Bender Visual Motor Gestalt Test (40) (2 studies), preschool children's behavioral problems(40), school readiness (41), Ages and stages questionnaire (ASQ) (42), Kaufman's Neurological-Clinical Diagnostics Battery (43), Behavior Rating Inventory for Executive Function-Preschool (BRIEF-P) (44), Wisconsin test (45), Wechsler intelligence scale for children- revised (46) (2 studies), Kindergarten Inventory of social/emotional tendencies (KIST) (47), working memory test (48), Social Skills Rating Systems (SSRS) (49). Results for meta-analysis of screening tools are presented in Table 1 and Table 2 shows the effect sizes and statistics of the combined data in the bivariate random-effects model.

Effect size with point estimate for fixed model is 13.056 (CI: 12.950-13.163) and for random model concludes 24.262 (CI: 19.111-29.412). KABC with the largest weight (21.44) defined as the most efficient screening tool in this review. Figure 1 presents the funnel plot for this meta-analytic review. A funnel plot is a scatterplot of treatment effect against a measure of study precision (50). It is used primarily as a visual aid for detecting bias or systematic heterogeneity. A symmetric inverted funnel shape arises from a 'well-behaved' data set, in which publication bias is unlikely (50).

Results of I^2 statistics (99.951, $p<0.0001$) and funnel plot indicated that there is meaningful heterogeneity on scores of screening tools. This means there is likely publication bias in our dataset but that publication bias alone cannot explain the asymmetry. Publication bias refers to the fact that studies with no significant findings have a smaller chance of publication than studies with significant findings.

Discussion

Results of the current meta-analysis on main preschool screening tests in Iran showed that preschooler screening tools had heterogeneity in effect sizes and statistical results. However, some other screening tests (51-52) have comparable diagnostic performance that had better efficiency than the other preschoolers screening tests.

The goal of the assessment of young children like since it is for just about any individual, namely, the derivation of information to facilitate decision making (53). Typically, a problem, such as delayed development, occurs in one form or another and short screening process supports the determination of whether a more in depth assessment is named for. The detailed assessment, usually consisting of a combination of interviews, observations, and direct testing, supplies the core of information necessary for precise decision-making (23).

It could be argued that young children with special needs have already been, and will continue to be, identified for intervention services regardless of definitional problems (14)(18). There is, however, a need to address these problems on the basis of pragmatic along with scientific issues. Pressures for ensuring the accountability of early intervention will demand precision in the practical problem of identifying eligible children (20). Inferring casual relationships between intervention and outcome will demand greater focus on the particular classification of child characteristics and presentation of a comprehensive model for screening.

Limitation and Directions for Future Researches

This study has several limitations. For instance, the screening tests were not directly compared in the same populations. Each study used different populations, and the inclusion criteria and prevalence of disabilities in each regions/area are varied. It will be better than directly compare screening tests utilizing the same group of participants with similar socio-economic status (SES). Second, just a few studies were included all dimension of screening – cognitive/physical/ socio-emotional- in test screening of preschoolers. Therefore, the test performance could not be directly compared. Future researchers can currently investigate the performance of children applying the comprehensive screening test.

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