

Constructing and Norming Diagnostic Battery Tests of Verbal and Non-Verbal Learning Disabilities for Students in Arabic Schools

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The purpose of this study is to construct and evaluate diagnostic battery tests of verbal and non-verbal learning disabilities for students in the Arabic schools. 612 students were in the 3rd, 4th and 5th grades of primary school were involved, mostly from Egypt and Saudi Arabia. Their ages ranged from 7.94-10.98 with mean age = 9.62 and SD = ±0.93. The Diagnostic Battery Tests (DBT) of VLD and NVLD for the primary school students was developed in accordance with the Arabic environment. The Battery includes seven subtests divided into two fields; the verbal learning disabilities and the non-verbal learning disabilities. The tests are developed in accordance with the ages of students and their academic grades. With the help of results, it has been found that DBT of VLD and NVLD have shown good reliability and validity indicators. Additionally, DBT showed the ability to distinguish between neurotypical students and those with learning difficulties. With increasing grades from three to five, the increase in performance level, decrease in performance time and standard deviations were noticeable, which can be attributed to the improvement in learning, experience, maturity and cognitive growth level with the progress of grades.

Keywords: Learning Disabilities, VLD, NVLD, Battery Tests

INTRODUCTION

Learning disabilities are common, affecting about 10-15 percent of school-aged children and approximately 1.0-2.5 percent of the general population (APA, 2000; Gillberg & Soderstrom, 2003). Learning disabilities encompass several conditions leading to functional impairment. Children with a learning disability exhibit diverse learning styles and illustrate diverse areas of strengths and weaknesses. Initially, the term “learning disability” defines those children who have normal intelligence, but they were unable to perform adequately in the general educational setting, and it also occurs together with behavioral, emotional, and social problems (Gillberg et al., 2004). Several at-

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tempts have been made to classify learning disabilities subtypes for the purpose of developing effective strategies or interventions. The subtypes were initially categorized as academic and developmental learning disabilities (Kirk & Clafant, 1984). Gurian & Koplweicz (2000) categorized it as a lack of academic achievement or deficiency in verbal acquisition. However, previous literature reported two subtypes of learning disabilities extensively, namely: Verbal Learning Disabilities (VLD) and Non-Verbal Learning Disabilities (NVLD) (Drummond et al., 2005; Rourke, 1988; Rourke & Tsatsanis, 1996).

The subtype VLD is characterized by auditory processing problems, spelling and poor reading skills, and other disorders which influence the processing of written and verbal language, expression and reception (Johnson, 1995; Kamhi & Catts, 2002; Palombo, 1996). These problems, particularly issues in phonological word processing, produce a gridlock limiting information flow to upper processing levels (Hulme & Snowling, 1992; Ransby & Swanson, 2003; Shankweiler et al., 1995). On the other hand, NVLD is characterized by deficiency in several areas such as tactile-perceptual abilities, psychomotor coordination, and visual-perceptual organization (Harnadek & Rourke, 1994). Children with NVLD have noticeable visual-spatial deficits (Rourke, 1995), corresponding to right hemisphere brain processes (Kolb & Whishaw, 1996). Therefore, researchers have proposed that the right hemisphere of children with NVLD functions inadequately (Guo et al., 2001; Nichelli & Venneri, 1995). The key characteristics related to NVLD include problems with social skills, abstract problem solving or nonverbal skills deficits, and combination of comparatively low visual-spatial skills and high verbal skills. Lack of skills that are widely subsumed or mentioned under major deficits include: problems with nonverbal humor aspects, semantic or pragmatic language comprehension and usage, struggle with novel stimuli, difficulty in reading strong words, confusion with directionality or time, concept formation, spatial agnosia, poor tactile perception, and difficulty with mathematics (Badian, 1992; Gross-Tsur et al., 1995; Harnadek & Rourke, 1994; Rourke et. al., 2002; Teeter & Semrud-Clikeman, 1997). With children, poor performance in mathematics has been associated with weak functioning of the visual-spatial working memory (Buchanan, Pavlovic, & Rovet, 1998; Heathcote, 1994; Gathercole & Pickering, 2000; McLean & Hitch, 1999) and with visual-spatial abilities (Geary, 1993). Children with NVLD exhibit a pattern high verbal IQ - low performance IQ (VIQ-PIQ), as their performance is poor in visual-spatial working memory tasks (Cornoldi, Vecchia, & Tressoldi, 1995).

In any recent diagnostic system or classification system, for instance ICD or DSM, NVLD is not categorized. Findings from dozens of published books, and numerous hundreds of peer-reviewed journal articles have illustrated

clinical features, which characterize this problem and provide convincing evidence to support its validity (Casey, 2012).

When children with NVLD enter primary school, they are usually placed in accelerated or gifted programs on account of their robust verbal skills (Thompson, 1997). Conversely, it is essential to incorporate graphomotor activity in written spelling. Graphomotor activity includes deficiency in NVLD neuropsychological areas of psychomotor, visual perceptual, and tactile-perceptual skills. Therefore, such children write with difficulty and slowly, and face problems in copying text from a book or a whiteboard. Due to these problems, they find it difficult to complete their task on time. Their nonverbal insufficiencies are apparent in reading comprehension tests in which, for these children, matching of words to synonym is easier than matching words and pictures. Moreover, they often miss the point on television programs or filmstrips (Johnson, 1987).

Lee (2009) accentuated that NVLD children at initial stages can be recognized through academic and neuropsychological manifestations in accordance with VIQ-PIQ inconsistencies on Wechsler Intelligence Scales for Children (WISC). It has been suggested that WISC-R intelligence profile of children with NVLD among 76 percent of the cases (Rourke 1999), these findings can be highlighted (Molenaar-Klumper, 2002) as follows:

1. Lowest scores within the performance section; two of the three performance subsets including patterns, figure laying and substitution.
2. Within the verbal section, highest score was observed in two of the three subtests that are information, conjunctions and vocabulary.

Consequently, NVLD children were recognized through their academic performance by arithmetic subtests, spelling, reading, Wide Range Achievement Test (WRAT), and a battery of two main categories of neuropsychological measures, including a) socio-emotional, visual-spatial, and visual-perceptual and b) auditory-perceptual and verbal and measures. Considering these tests as a source of information as well as norm-referenced tests, it must be clear that inclusion of evaluation of all the basic deficit and assets associated with NVLD in psychological testing is necessary. In a comprehensive neuropsychological assessment, body functions, which are usually evaluated, include (Casey, 2012) the following:

1. Memory and learning for both nonverbal and verbal material;
2. Concentration, responsiveness, and working memory;
3. Language related or verbal abilities (for example, auditory-verbal perception, conceptualization and abstract verbal reasoning, verbal fluency, oral expression, and oral comprehension).
4. Tactile perception (for example, recognizing and perceiving without seeing the shapes of blocks present in the hand);

5. Visual perception (for example, spatial reason and reasoning using several types of visual materials including both abstract and concrete);
6. Cognitive efficiency or processing speed;
7. Motor performance with hands and arms (for example, motor strength, eye–hand coordination, and motor speed), and
8. Higher-order cognitive processes (for example, planning, problem solving with innovative information, reasoning, and the ability to use feedback for developing and refining problem-solving strategies).

Apparently, the test involved in the assessment of NVLD should be selected on the basis of psychological domains of body functions and interests. Most neuropsychologists will include age-appropriate version of Wechsler Intelligence Scale and academic performance test as part of their test battery. The academic achievement test includes arithmetic tests, spelling, and word reading at least, for instance WRAT-IV or WIAT-III (Sullivan & Bowden, 1997). Other significant components have been derived from Halstead-Reitan batteries include Category Test, Grooved Pegboard Test, Tactual Performance Test, Trail Making Test, Dynamometer Test, Finger Tapping Test, Sensory-perceptual Examination, Kløve-Matthews, and Hand Dominance Exam (Casey, 2012).

Based on the given literature and previous studies, and due to the lack of Arabic screening tool for NVLD, the researchers developed verbal and non-verbal learning disabilities diagnosing battery for Arabic school children (aged 9-11).

PURPOSE OF THE STUDY

The purpose of the study is to construct and evaluate diagnostic battery tests of verbal and non-verbal learning disabilities for students in the Arabic schools. The questions asked in this study were as follows:

- What are the subtests of the diagnostic battery tests of VLDs and NVLDs?
- What are the psychometric properties of the diagnostic battery tests of VLDs and NVLDs?
- What are the performance and time norms for the subtests of the diagnostic battery tests of VLDs and NVLDs for students in grades three, four, and five of primary school?

METHOD

Participants

In this study, 612 students were involved that are neurotypical or have learning disabilities. Students in their 3rd, 4th and 5th grades of primary school were involved, mostly from Egypt and Saudi Arabia. Their ages ranged from

7.94-10.98 with mean age = 9.62 and SD = ± 0.93 , the following table (Table 1) refers to the description of the participating students.

Table 1. Participating Pupil's Description

Statement	Sample distribution	Number of students	Percentage %
Country	Egypt	392	64.05%
	Saudi Arabia	220	35.95%
Gender	Male	344	56.21%
	Female	268	43.79%
Grade	3 th	236	38.56%
	4 th	204	33.33%
	5 th	172	28.11%
Diagnosis	Ordinary	540	88.24%
	With LD	72	11.76%
Total participants		612	100%

Measures and Procedures

Diagnostic Battery Tests of VLD and NVLD. The Diagnostic Battery Tests (DBT) of VLD and NVLD for the primary school students was developed in accordance with the Arabic environment. The Battery includes seven subtests divided into two fields; the verbal learning disabilities section includes three sub-tests that involve spelling test, recognition in reading test, reading comprehension and listening test, whereas the non-verbal learning disabilities section includes four sub-tests including sensory-motor skills test, mathematical calculations test, visual- spatial processes test, and test of emotional and social aspects. All tests depend on the performance of the students, except for the seventh test (emotional and social aspects test), which depends on the evaluation of the teacher or school worker (Psychologist or social worker). Each test of the seven sub-tests has performance instructions and answer time.

When preparing the battery sub-tests, it has been taken into account that three different grades are involved in the study. The tests are developed in accordance with the ages of students and their academic grades so that tests can provide sufficient stimuli to the children. In light of the previous studies and literature, (Bloom & Heath, 2010; Burger, 2004; Hahn, 2004; Keller et al., 2006; Lee, 2009; Mamen, 2002; Mammarella et al., 2009; Martin, 2007; Semrud-Clikeman & Glass, 2008; Stewart, 2002; Tanguay, 2002; Whitney, 2002) the norms of the verbal and non-verbal learning disabilities diagnosis has been detected.

Verbal learning disabilities (VLD) tests

1. Spelling test: It consists of (68) items distributed in spelling skills set such as letters, words and sentences pronunciation, writing letters from memory, words analysis, and words. The students try to answer the test within the time allotted for each grade, the right answer scores one and the wrong one scores zero.
2. Recognition in reading test: It consists of (24) items distributed in skills set such as letter shape recognition, extension, words and sentences recognition. The students put their efforts to answer the test within definite time for each grade, the right answer scores one and zero for a wrong one.
3. Reading Comprehension and Listening test: It consists of (34) items involving skill sets such as to understand the word through antonyms and synonyms, meaning, and understand sentence and paragraph meaning. These questions are also time-limited for each grade and similar to other tests, the right answer scores one and the wrong one takes zero, except four items in the third exercise (i.e., understand the word meaning). For these items, the right answer takes two and a half points, the semi right takes one and the wrong takes zero.

Non-verbal learning disabilities (NVLD) tests

1. Sensory-motor skills test: It consists of (20) items distributed in sensory motor skills set such as visual-spatial visualization, visual recognition, copying, designing, tactile, coloring and walk in the mazes. The students try to answer the test within defined time for each grade. The score for right answer is two and half, for semi right answer one and for wrong answer is zero.
2. Mathematical calculations test: It consists of 16 items involving basic arithmetic operations; addition, subtraction, multiplication and division. The score for right answer is one, whereas zero for wrong answer.
3. Visual-spatial processes test: It consists of 20 items involving the skills set; visual attention, visual-spatial working memory, and visual-spatial perception. This is also time-limited and the scoring is one and zero for right and wrong answers respectively.
4. Emotional and social aspects test: It consists of 18 items which involved social and emotional skills of children. It depends on the evaluation of the teacher or school worker (psychologist or social worker). The participants have to answer the questions by selecting one of the three responses provided. The three responses (always-sometimes-rare) are adopted form Likert scale and grade 3-2-1 are

given to each response respectively. This test is also time-limited for each grade.

RESULTS

Psychometric properties of the DBT

The psychometric properties of DBT include validity, reliability and internal consistency that have been checked on elementary level with larger sample including learning typical and normal and students with learning disabilities at several schools in the Arab Republic of Egypt and Saudi Arabia. The primary sample included 612 students. The results of validity, reliability and internal consistency of the DBT are as follows:

I-Validity. Validity can be calculated with the help of following procedures;

1. **Face Validity:** The contents of the test battery have been displayed to a group of experts in the field of learning disabilities, working in Arab and foreign universities. These experts expressed their opinions on sub-tests and suggested diagnostic criteria of verbal and non-verbal learning disabilities. The experts have recommended a set of observations and suggestions, and the research team has made all the suggested modifications and corrections related to the seven sub-tests. After the modifications, all the test batteries received higher agreement ranged from 55% to 100%, indicating that most of the experts were satisfied with the tests.
2. **Criterion-related Validity:** The research team has used external criteria to check the validity of the DBT on a group of students ($n = 186$). The external criteria were Kaufman Assessment Battery for Children (KABC) and Wechsler Intelligence Scale for Children (WISC). The results illustrated acceptable and good validity indicators, where the correlation coefficients values were high, positive and ranged from 0.447 to 0.756.
3. **Items Validity:** The research team calculated the validity on the battery sub-tests by finding out the validity of items on a group of students ($n= 274$) while detecting relationship between the score of each item and the total score of the sub-test to which it belongs. The calculated correlation coefficients ranged from 0.536 to 0.841 indicating acceptable and good validity indicators.
4. **Discrimination Validity:** This method has been used to check the ability of the DBT to discriminate between the normal students and the students with LD in general, through conducting the battery tests on a group of normal students ($n = 114$), and a group of students with learning disabilities ($n = 72$), and by calculating

means, standard deviations of the two groups and the value of “T”, the results are presented in table 2.

Table 2 . Test Results for Normal and Students With LD DBT Performance

DBT sub- tests	Group	N	Mean	SD	“T” value
Spelling test	Normal	114	57.07	2.63	14.327**
	With LD	72	46.15	2.66	
Recognition in reading test	Normal	114	18.63	3.39	4.421**
	With LD	72	15.15	1.09	
Reading comprehension and Listening test	Normal	114	27.67	1.35	25.809**
	With LD	72	18.85	0.88	
VLD field total score	Normal	114	103.37	3.56	23.726**
	With LD	72	80.15	3.12	
Sensory-motor skills test	Normal	114	26.7	1.34	18.6**
	With LD	72	20.35	0.88	
Calculations test	Normal	114	27.5	1.17	22.838**
	With LD	72	19.65	1.23	
Visual- spatial processes test	Normal	114	29.87	1.48	10.119**
	With LD	72	25.7	1.34	
Test of emotional and social aspects	Normal	114	42.33	1.71	14.786**
	With LD	72	34.55	1.99	
NVLD field total score	Normal	114	126.4	3.06	31.412**
	With LD	72	100.25	2.59	
Total score	Normal	114	229.77	5.38	33.7 **
	With LD	72	180.4	4.54	

Notes. (Degree of freedom = 184, “***” = p < 0.01)

As shown in table 2, there are significant differences between the mean scores of normal students group and group of students with LD in the sub-tests of the battery. This means that the DBT sub-tests have a good discriminatory ability between the strong levels and weak levels of the variables and measured dimensions.

II-Reliability. The research team has calculated the reliability of the DBT by using several methods, presented as follows;

1. Test- retest method: By using the method of tests' re-application for calculating reliability with an interval of 25 days between the first and the second application on a group of normal as well as learning disabled students, the reported correlation coefficients values are presented below in table 3.

Table 3. Correlation Coefficients for DBT Scores as Indicators of Reliability

DBT sub-tests	Normal students (n = 218)	Students with LD (n = 68)
	Correlation coefficients (Reliability)	Correlation coefficients (Reliability)
Spelling test	0.701**	0.738**
Recognition in reading test	0.664**	0.715**
Reading comprehension and Listening test	0.740**	0.708**
VLD field total score	0.722**	0.731**
Sensory-motor skills test	0.537**	0.626**
Calculations test	0.826**	0.814**
Visual- spatial processes test	0.615**	0.682**
Test of emotional and social aspects	0.864**	0.881**
NVLD field total score	0.752**	0.784**
Total score of whole DBT	0.742**	0.768**

Notes. “**” = $p < 0.01$

As presented in table 3, the correlation coefficients between the first and the second applications of the DBT express high, positive and acceptable reliability values and demonstrate the persistence of scores related to DBT sub-tests.

2. Cronbach's alpha method: This method has been used for calculating the reliability of the DBT involving two groups; normal students (n=238) and learning disabled students (n=72), the reliability values are illustrated in the following table;

Table 4. Reliability Coefficients (Alpha) of DBT as Indicators of Stability

DBT sub-tests	Normal students (n = 238)	Students with LD (n = 72)
	Reliability coefficients (alpha)	Reliability coefficients (alpha)
Spelling test	0.638**	0.662**
Recognition in reading test	0.585**	0.592**
reading comprehension and Listening test	0.672**	0.704**
VLD field total score	0.686**	0.765**
sensory-motor skills test	0.546**	0.558**
calculations test	0.701**	0.736**
visual- spatial processes test	0.553**	0.618**
test of emotional and social aspects	0.72**	0.742**
NVLD field total score	0.701**	0.714**
The whole total score	0.714**	0.736**

Notes. “**” = p <0.01

From the results of table 4, it can be concluded that Cronbach’s alpha coefficient values for the DBT are positive, and high. These values are acceptable and demonstrated the persistence of scores in DBT sub-tests.

III-Internal Consistency. To check the internal consistency (homogeneity) of the battery sub-tests, the internal correlation coefficients of the DBT sub-tests (V LD and NVLD) and the total score of tests has been calculated on a group of normal and learning disabled students (n = 612), table 5 shows the calculated results.

Table 5. Internal Correlation Coefficients of VLD Sub-Tests

V LD sub-tests	Spelling test	Recognition in reading test	Reading comprehension and Listening test	VLD field total score
Spelling test	-	-	-	-
Recognition in reading test	0.732**	-	-	-
reading comprehension and Listening test	0.646**	0.682**	-	-
Verbal LD field total score	0.751**	0.764**	0.806**	-

Notes. “***” =P<0.01

As shown in above table, values of all the internal correlation coefficients are positive and high enough to indicate the internal consistency of the battery tests.

Table 6. Internal Correlation Coefficients Values of NVLD Sub-Tests

NVLD sub-tests	Sensory-motor skills test	Calculations test	Visual-spatial processes test	Test of emotional and social aspects	NVLD total score
Sensory-motor skills test	-	-	-	-	-
Calculations test	0.622**	-	-	-	-
Visual- spatial processes test	0.684**	0.752**	-	-	-
Test of emotional and social aspects	0.738**	0.706**	0.637**	-	-
NVLD total score	0.716**	0.745**	0.688**	0.724**	-

Notes. “***” =P<0.01

The values presented in table 6 illustrated that the co-efficient values of NVLD sub-tests are positive and sufficient to specify the internal consistency of DBT.

Performance, Diagnostic and Time Norms

Investigators calculated the performance, diagnostic and time norms of the DBT of VLD and NVLD sub-tests, for primary grades (third, fourth and fifth), on a group of normal and learning disabled students (n = 612), the tables 7, 8, and 9 illustrate the obtained results.

Table 7. Results of the Performance and DBT Times for Third Grade

DBT sub-tests	Items no.	Max. score	Performance norms				Time norms	
			High-est score	Low-est score	M	SD	M	SD
Spelling test	68	68	63	29	50.22	9.8	22.18	4.88
Recognition in reading test	24	24	21	10	16.88	3.76	20.04	3.16
Reading comprehension and Listening test	34	38	34	13	22.06	4.92	22.86	5.12
VLD field total score	126	130	116	57	89.16	16.85	65.08	12.84
Sensory-motor skills test	20	40	28	14	21.98	4.15	24.16	5.78
Calculations test	16	32	26	14	20.88	4.3	17.88	2.66
Visual- spatial processes test	20	40	34	16	27.91	5.04	10.22	2.08
Test of emotional and social aspects	18	54	46	23	37.05	7.18	8.16	1.68
NVLD field total score	74	166	128	71	107.82	20.06	60.42	11.64
Total score of whole DBT	200	296	242	138	196.98	36.84	125.5	22.96

Notes. (N = 236, Age range = 7.94-8.90 years)

From table 7, it can be observed that the performance score average of the DBT for third grade students in the field of VLD is $M=89.16$ and $SD=\pm 16.85$, and in the field of NVLD, $M= 107.82$, $SD= \pm 20.06$. Considering the whole test battery, $M= 196.98$, $SD= \pm 36.84$. Therefore, for diagnosing students with NLVD and VLD in 3rd grade, we rely on the following norms.

I-Students with VLD. The students who receive a total score in the field of VLD tests earned less than the average minus one standard deviation ($M-1SD$). At the same time, their total score in the field of NVLD tests was greater than the average minus one standard deviation ($M-1SD$) of points (less than ($M-1SD$) $VLD = 89.16-16.85 = 72.31$ degree; greater than ($M-1SD$) $NVLD = 107.82-20.06 = 87.76$ degree).

II-Students with NVLD. The students who receive total scores in the field of NVLD tests earned less than the average minus one standard deviation ($M-1SD$). At the same time, their total scores in the field of VLD tests were greater than the average minus one standard deviation ($M-1SD$) of points (less than ($M-1SD$) $NVLD = 107.82-20.06 = 87.76$ degree; greater than ($M-1SD$) $VLD = 89.16-16.85 = 72.31$ degree).

As it can be seen from the above table, the time average of the battery application in the third grade in the field of VLD tests ($M=65.08$ min), in the field of NVLD tests ($M=60.42$ min), and in the whole battery tests ($M=125.50$ min).

Table 8. Results of the Performance and DBT Times for Fourth Grade

DBT sub- tests	Items no.	Max. score	Performance norms				Time norms	
			High-est score	Low-est score	M	SD	M	SD
Spelling test	68	68	64	31	52.88	8.96	20.04	4.26
Recognition in reading test	24	24	22	10	17.74	3.08	18.18	2.9
Reading comprehension and Listening test	34	38	35	14	23.12	4.85	21.14	4.28
VLD field total score	126	130	119	61	93.74	14.88	59.36	11.07
Sensory-motor skills test	18	39	31	16	23.86	3.9	22.04	4.36
calculations test	16	32	30	16	22.04	4.66	15.8	2.54
Visual-spatial processes test	20	40	36	16	29.74	4.92	9.42	1.98
Test of emotional and social aspects	18	54	51	25	40.72	8.02	8.16	1.44
NVLD field total score	74	166	136	75	116.36	19.74	55.42	9.64
Total score of whole DBT	200	296	250	143	210.1	32.86	114.78	20.8

Notes. (N = 204, Age range = 8.91-9.93 years)

The performance score average of the DBT for fourth grade students in the field of VLD is $M=93.74$ with $SD= \pm 14.88$, in the field of NVLD is $M= 116.36$, $SD= \pm 19.74$, and in the whole DBT is $M=210.10$, $SD= \pm 32.86$, as presented in the table. Thus, for diagnosing and deriving students with VLD and NVLD in the third grade, we rely on the following norms:

III-Students with VLD. The students who received total score in the field of VLD tests earned less than the average minus one standard deviation ($M-1SD$). Simultaneously, their total score in the field of NVLD tests was greater than the average minus one standard deviation ($M-1SD$) of points (less than ($M-1SD$) $VLD = 93.74-14.88 = 78.86$ degree; greater than ($M-1SD$) $NVLD = 116.36-19.74 = 96.62$ degree).

IV-Students with NVLD. The students who receive a total degree of NVLD tests earned less than the average minus one standard deviation (M-1SD). At the same time, their total scores in the field of VLD tests were greater than the average minus one standard deviation (M-1SD) of points (less than (M-1SD) NVLD= $116.36-19.74 = 96.62$ degree; greater than (M-1SD) VLD= $93.74-14.88 = 78.86$ degree).

It can be observed from the above table that the time average of the battery application among the fourth grade students in the field of VLD tests is $M=59.36$ min, in the field of NVLD tests $M=55.42$ min, and in the whole battery tests $M=114.78$ min.

Table 9. Results of the Performance and DBT Times for Fifth Grade

Battery tests	Items no.	Max. degree	Performance norms				Time norms	
			High-est degree	Low-est degree	M	SD	M	SD
Spelling test	68	68	67	33	54.62	8.14	17.9	3.86
Recognition in reading test	24	24	24	13	18.26	2.86	16.94	2.04
Reading comprehension and Listening test	34	38	36	15	24.58	4.96	20.02	4.16
VLD field total score	126	130	122	67	97.46	13.94	54.86	9.74
Sensory-motor skills test	20	40	36	18	22.76	3.68	20.8	4.18
calculations test	16	32	32	18	25.84	3.76	13.94	2.26
Visual- spatial processes test	20	40	38	18	31.15	4.06	8.98	1.68
Test of emotional and social aspects	18	54	52	31	42.74	7.12	7.02	0.988
NVLD field total score	74	166	147	80	122.49	18.64	50.74	8.94
Total score of whole DBT	200	296	263	154	219.95	30.22	105.6	17.92

Notes. (N = 172, Age range = 9.94-10.98 years)

With the help of table 9, it can be stated that the performance score average of the DBT for fifth graders in the field of VLD is $M= 97.46$ with $SD= \pm 13.94$, in the field of NVLD $M=122.49$ with $SD= \pm 18.64$, and in the whole DBT $M= 219.95$, $SD= \pm 30.22$. Thus, for diagnosing students with VLD and NVLD in the fifth grade, we depend on the following norms:

V-Students with VLD. The students who receive a total score in the field of VLD tests earned less than the average minus one standard deviation ($M-1SD$). At the same time, their total scores in the field of NVLD tests were greater than the average minus one standard deviation ($M-1SD$) of points (less than ($M-1SD$) $VLD= 97.46-13.94 = 83.52$ degree; greater than ($M-1SD$) $NVLD= 122.49-18.64 = 103.85$ degree).

VI-Students with NVLD. The students who receive a total degree of NVLD tests earned less than the average minus one standard deviation ($M-1SD$). At the same time, the total scores in the field of VLD tests were greater than the average minus one standard deviation ($M-1SD$) of points (less than ($M-1SD$) $NVLD = 122.49-18.64 = 103.85$ degree; greater than ($M-1SD$) $VLD = 97.46-13.94 = 83.52$ degree).

As it can be seen in table 9, the time average of battery application in fifth grade in the field of VLD tests is $M=54.86$ min, in the field of NVLD tests $M=50.74$ min, and in the whole battery tests $M=105.60$ min.

DISCUSSION

Based on the results, DBT of VLD and NVLD provide good reliability and validity indicators. Validity was established by using international and highly validated external criteria: Kaufman Assessment Battery for Children (KABC) and Wechsler Intelligence Scale for Children (WISC), which respectably showed acceptable and good validity indicators. Additionally, DBT showed the ability to distinguish between normal students and those with learning difficulties. Reliability has been verified through the re-application of the sub-tests and showed high stability of scores for normal students and with learning disabilities. Moreover, Cronbach's alpha method showed high reliability indicators, as well as the internal consistency has been verified for the VLD and NVLD subtests. The correlation coefficients were positive and significant indicating internal consistency of the DBT.

The performance, diagnostic and time norms of DBT of VLD and NVLD sub-tests have been calculated for primary grades (third, fourth, and fifth) by using means, standard deviations, and performance time. The performance mean for grade three in the field of VLD was 89.16 with $SD= 16.85$, and performance time mean $M= 65.08$ min. The performance mean in the field of NVLD was 107.82 with $SD= 20.06$, and performance time mean $M=60.42$ min. The time mean for solving entire DBT was $M= 125.50$ min, for third

grade students. For the grade four, performance mean in the field of VLD was 93.74 with SD= 14.88, and time mean $M=59.36$ min, while the performance mean in the field of NVLD was 116.36 with SD= 19.74, and time mean $M=55.42$ min. The mean time taken by the fourth graders to solve the whole DBT was $M=114.78$ min. Performance mean for fifth graders in the field of VLD was 97.46 with SD=13.94, and time mean $M=54.86$ min, whereas the performance mean in the field of NVLD was 122.49 with SD=18.64, and time mean $M=50.74$ min. The average time taken by the fifth graders to complete the DBT was $M=105.60$ min.

While comparing the grades from three to five, the increase in performance level, decrease in performance time and standard deviations were noticeable, which can be attributed to the improvement in learning, experience, maturity and cognitive growth level with the progress of grades. Using the performance norms on the DBT, the students with VLD and those with NVLD can be diagnosed according to the following criterion;

Students with VLD

The students who receive a total score in the field of VLD tests earned less than the average minus one standard deviation ($M-1SD$). Simultaneously, their total score in the field of NVLD tests was greater than the average minus one standard deviation ($M-1SD$) of points.

Students with NVLD

The students who receive a total degree of NVLD tests earned less than the average minus one standard deviation ($M-1SD$). At the same time, their total scores in the field of VLD tests were greater than the average minus one standard deviation ($M-1SD$) of points.

This criterion is flexible because it can be changed according to the study environment and size of the sample with the help of standard deviation value. For example, 0.5 SD, 1 SD, 1.5 SD, or 2 SD can be used in the former equation, but this study has used 1 SD in accordance with the SD value and the environment conditions.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of this study, certain recommendations can be offered. First, when students with learning disabilities are studied, their realistic classification of learning disabilities (verbal and nonverbal learning disabilities) should be considered. Second, there should be more reliance on integrated and comprehensive test batteries for diagnosing students with VLD and NVLD, with a consideration for their developmental and academic processes output. Third, there is the need for more research towards the standardization of the Arabic DBT of VLD and NVLD with respect to different cultures. Finally, in researching the standardization of the Arabic DBT of VLD and NVLD, there is the need to delineating the differences among age groups.

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