Use of the Jordanian WISC-III for Twice-Exceptional Identification

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Abstract

The main purpose of this research was to investigate empirically the Wechsler Intelligence Scale for Children – the third Jordanian version (hereinafter WISC-III-Jordan) profiles to analyze cognitive factors for 'twice-exceptional' (2E) children characterizing 'mathematical giftedness with learning disabilities (MG/LDs). The paper examined whether WISC-III-Jordan, the latest adapted version in Jordan, is a useful psychometric assessment tool for providing a partial picture of the cognitive weaknesses and strengths of 2E learners. Thirty MG/LDs students (16 girls and 14 boys) and a control group of 22 'intellectually average students with learning disabilities' (Average-IQ/LDs) (10 girls and 12 boys) were administered the WISC-III-Jordan. The two experimental and control groups, aged between 11 and 12 years, were chosen from three public primary schools in Amman, Jordan. While differences between the two groups were investigated, a comparison of 17 factors was made using five cognitive classification systems: Wechsler (1974 and 1991), Horn (1989), Bannatyne (1974), Kaufman (1975, 1994), and Rapaport et al., (1945-1946), in addition to the ACID profile (Arithmetic, Coding, Information, and Digit Span). The findings revealed that the MG/LDs sample demonstrated a significant discrepancy between the verbal and performance IQ subscales, but no significant scattered subtest profile was yielded. Relative strengths were shown in four subtests: Comprehension, Arithmetic, Vocabulary, and Picture Completion. Both experimental and control groups showed relative weaknesses in three subtests: Coding, Information, and Similarities. The analysis of the cognitive systems revealed that the Rapaport et al. (1945-1946) and Kaufman (1994) models were the most powerful for discriminating between the two groups. As opposed to the ACID profile, the Bannatyne (1974) model was the only classification not found to be useful in diagnosing students with learning disabilities. Finally, while the MG/LDs group showed significant relative strength in the visual-perceptual awareness and coordination compared to the Average-IQ/LDs group, both groups showed relative weaknesses in Sequencing Ability, Visual-Motor Coordination, and Broad Speediness.

Keywords: Twice-exceptional; WISC; verbal; performance; cognitive, fluid; crystalized; visual; speediness; giftedness; learning disabilities; intelligence.

Introduction

There is a variety of definitions of twice-exceptionality (2E), which has led to inconsistency in sampling in the literature population (Al-Hroub, 2012, 2014; Baum, 2017; El Khoury & Al-Hroub, 2018). Recent broad definitions in this field allow the co-existence of high abilities and learning problems in the same individuals (Al-Hroub, 2013, 2009b, 2019; Baum, 2017; Montgomery, 2015). Recent studies of 2E have considered how the unexpected occurrence of learning problems in highly intelligent students affects their academic performance and behavior in classrooms. Therefore, several researchers (e.g. Al-Hroub, 2008, 2010b; Waldron & Saphire, 1990) have come to realize that if educators would like to understand this population of 2E children, they must better comprehend their perceptual patterns and cognitive strengths and weaknesses. According to Al-Hroub (2011), this understanding would allow practitioners to teach students through their stronger modalities on cognitive processing while providing compensatory training in weaker areas. This paper adopted broad definitions of 2E that acknowledge the coexistence of giftedness with any type of disability except for intellectual disability, such as the proposed definition by Reid, Baum, and Burke in 2014:

> Twice-exceptional learners are students who demonstrate the potential for high achievement or creative productivity in one or more domains such as math, science, technology, the social arts, the visual, spatial, or performing arts or other areas of human productivity AND who manifest one or more disabilities as defined by federal or state eligibility criteria. These

disabilities include specific learning disabilities; speech and language disorders; emotional/behavioral disorders; physical disabilities; Autism Spectrum Disorders (ASD); or other health impairments, such as Attention-Deficit/Hyperactivity Disorder (ADHD) (Reis et al., 2014, p. 222).

In the field of 2E, the current WISC-V (and its precursors, e.g., WISC-III, WISC-IV) are often used to gain an overall estimate of a student's present global intellectual strengths and weaknesses in specific areas of aptitude (Kaufman et al., 2016; Weiss et al., 2016). This has been discussed in the theoretical literature (e.g. Al-Hroub, 2012; Brody & Mills, 1997) and has been historically studied by empirical researchers (e.g., Al-Hroub, 2013; Barton & Starnes, 1989). For example, Waldron and Saphire (1990) reported that when comparing a control group of gifted students, gifted students with learning disabilities (G/LDs), known also as 2E, performed significantly less well in some perceptual areas, including visual and auditory discrimination, visual and auditory sequencing, visual-spatial skills, and short-term auditory memory. There were no significant differences between groups in visual memory skills or listening comprehension. They also noted experimental students' comparative weaknesses in reading, arithmetic, and spelling and concluded that many academic disabilities may be related to perceptual problems.

On the other hand, the emergence of solid verbal comprehension and organization factors for students with E2 would seem to bode well for meaningful interpretation of the Verbal and Performance IQs and the difference between them (Waldron & Saphire, 1990). For example, a number of researchers in this field have indicated that there is some correlative evidence to support the idea that Verbal IQ (VIQ) reflects left-hemisphere functioning, whereas the Performance IQ (PIQ) reflects right-hemisphere functioning.

Similar types of conclusions, with implications for clinical diagnosis, have been offered for the VIQ-PIQ discrepancy in WISC-R and WISC-III scores (e.g. Kaufman, 1979, 1994). These hypotheses are related to the distinction between verbal and non-verbal abilities that are historically evidenced in factor analytic studies (Kaufman, 1979) and continue to be applicable for the WISC-III, WISC-IV, and WISC-V (Kaufman et al., 2016, Weiss et al., 2016).

It has also been argued that a significant VIQ-PIQ discrepancy (PIQ > VIQ) is suggestive of LDs (e.g. Kaufman, 1994). It is also essential to understand that many children with LDs, based on their specific perceptual or cognitive deficits, may have the opposite pattern: VIQ > PIQ (Kaufman, 1994, Kaufman et al., 2016). Silver and Tipps (1993) indicated that such children may be more likely to experience memory disabilities than children who have LDs with the more common PIQ > VIQ profile. Numerous studies support the use of VIQ-PIQ discrepancy as a characteristic of LDs (Al-Hroub, 2019). For example, Al-Hroub (2011) and Newman et al. (1989) found that students with a reading disability demonstrated a significant VIQ-PIQ difference. In contrast, other researchers have not found the use of WISC VIQ-PIQ discrepancy patterns to be useful in the differentiation of children with LDs from other groups of children (e.g. Weiss et al., 2003; Weiss et al., 2016).

Furthermore, many researchers have examined the profiles of intellectually gifted children with Full-Scale IQs greater than 120 with results showing large variability in subtest scores and VIQ-PIQ discrepancy (VIQ > PIQ), and frequent high variability for very able children (Al-Hroub, 2014; Wilkinson, 1993).

Moreover, several researchers in the field of G/LDs students have focused on the VIQ-PIQ discrepancy (Al-Hroub, 2011, 2014; Waldron & Saphire, 1990). Typically, students with G/LDs have a wide 'scatter' or discrepancy within either or both the Verbal and Performance sections. The data from this research showed no consistent pattern of results. Silverman (1983) indicated that students with G/LDs may have a 15-point discrepancy between Verbal and Performance scores on the WISC. They generally also have a 7-point scatter between the highest and lowest subsets on a WISC. The WISC-III manual (Wechsler, 1991 gives values for statistical significance at the .05 and .01 levels to determine whether the VIQ-PIQ discrepancy is significant. The overall values for the discrepancy are 11 points at the .05 level and 15 points at the .01 level.

In a study conducted in the UK, Al-Hroub (2011) reported a significant (VIQ-PIQ) discrepancy of 25 points with Verbal scores higher for five mathematically gifted students with LDs at three state schools in Cambridgeshire. Al-Hroub (2011, 2019) found that significant discrepancies between Verbal and Performance scores may not be the best indicator of an LD in students. Thus, schools should not use it as the sole indicator for LDs or 2E. In addition, while discrepancies between Verbal and Performance scores on Wechsler scales have been advocated as an indicator of written output deficits, no consensus exists on the magnitude or the direction of discrepancy that would indicate giftedness with LDs or 2E (Al-Hroub, 2011).

Analysis of the WISC-III-Jordan subtests

According to previous studies, therefore, it appears that in order to understand 2E learners, researchers must engage in a more sophisticated analysis of their perceptual patterns and cognitive behaviors (Al-Hroub, 2008; 2009a).

Based on these factor analyses, many new organizational models have been proposed for interpretation of the Verbal and Performance subtests. Many of them came from theoretical reorganizations of the Wechsler subtests for identifying the special cognitive patterns and characteristics of 2E learners. Furthermore, while earlier studies tended to rely on a 15-point discrepancy between Verbal and Performance areas of intelligence to indicate an LD, many children with LDs may not have such a large discrepancy (Kaufman et al., 2016).

The primary problem with the use of an intelligence test such as the WISC-III-Jordan, to identify 'mathematically gifted students with learning disabilities' (MG/LDs) is that the disability may lower the IQ score so dramatically that the students do not qualify for inclusion in the school's criteria for gifted, even though they demonstrate strong abilities in some areas. Despite this problem, Kaufman et al. (2016) noted that careful review of the subtests provides the clinician with a profile of cognitive strengths and weaknesses. High scores on some subtests may indicate giftedness, while comparatively weak scores on others may indicate a disability. This consideration of the WISC-III-Jordan subtests and their subsequent combination into factors has been far more accurate in suggesting the presence of an LD than has the VIQ-PIQ difference.

Furthermore, there is an explanatory circumstance for children with G/LDs: the consistent findings of the *ACID profile* – low scores on Arithmetic, Coding, Information, and Digit Span - and the *SCAD profile* – low scores on Similarities, Coding, Arithmetic, and Digit Span – for a diverse group of students with LDs (Kauffman, 1994). Additionally, the utility of different cognitive classification systems was examined to identify cognitive strengths and weaknesses. Following the previous revision, the Bannatyne (1974) pattern was applied to WISC-R and WISC-III and initial investigations frequently found the spatial > conceptual > sequential pattern among children with learning and reading disabilities (Smith & Watkins, 2004). While some research has been initiated using Bannatyne's (1974) clusters, there has been little research thus far into alternative cognitive categories on the WISC for 2E, such as those proposed by Wechsler (1974, 1991) Kaufman (1975, 1994), and Rapaport et al. (1945-1946). It is difficult to select one model for potential applicability to this population because each system concerns itself with unique cognitive and/or behavioral areas.

Within these models, it is possible to select factors that allow for specific concerns about the current sample of students, such as their performance. While individual subtest scores may be important for indicating specific strengths and weaknesses, the consideration of subtest clusters in broader factors might allow educators and psychologists to note cognitive patterns supportive of effective intervention. Because of diversity within the G/LDs population, there are problems in discovering similar ability levels and common approaches to complex cognitive tasks. However, this diversity makes it imperative to conduct this cognitive study and analyze the cognitive patterns of a group of MG/LDs in Jordan. In the present study, the cognitive patterns were analyzed using five models and one profile, as follows: (a) Wechsler Model, (b) Bannatyne Recategorization Model, (c) Horn Fluid-Crystallized Theory, (d) Kaufman Factors, (e) Rapaport et al. Model; and (f) The ACID Profile (see Table 1).

Wechsler Model

The four-way analytic studies of data from the WISC-III standardization sample of 2,200 children and adolescents at four age levels between 6-7 and 14-16 years (Wechsler, 1991) recategorized the 13 subtest scores to measure the following four factors: ***(1) Verbal Comprehension Factor (VC):*** the subtests significantly loaded on this factor (Information, Similarities, Vocabulary, and Comprehension) are orally presented and require verbal responses; ***(2) Perceptual Organization Factor (PO):*** this factor is identified by four subtests (Picture Completion, Picture Arrangement, Block Design, and Object Assembly) that measure skills that require the manual manipulation or organization of pictures, objects, blocks, and the like; ***(3) Processing Speed Factor (PS):*** the two subtests (Coding and Symbol Search) loaded on the third factor basically measure the speed of a simple coding or searching process; and ***(4) Freedom from Distractibility (FD):*** the two subtests (Arithmetic and Digit Span) loaded on this factor deal with arithmetic problems and numbers so that this factor can also justifiably be named 'Numerical Ability' (Kaufman, 1994) or 'the third factor' (Prifitera & Saklofske, 1998). There has been much controversy about this factor as it is not a pure measure of distractibility or attention, even though it is often interpreted in this fashion (Kaufman, 1994).

Kaufman (1994) presented mean Factors Indices on the four WISC-III factors for samples of gifted and other children with LDs. Kaufman reported that children with reading and LDs showed a discrepancy of 10 or more points on the FD-PS. PS emerged as an area of relative weakness for gifted children, whereas the PO was shown as a relative strength for children with LDs. The relatively low VC Indices reflected the direct impact of the children's LDs. The last two factors are doublets since they are identified by only two subtests each. Therefore, they are conceptually weak compared to the first two factors and more subtests may need to be added to these factors to make them conceptually sound.

Bannatyne's Recategorization Model

Regrouping the WISC-III subtests into Bannatyne's patterns has been thought by many to identify children with LDs (Smith & Watkins, 2004). Bannatyne (1974) believed that it did not serve a constructive purpose to divide the WISC performance of children with reading disabilities into Verbal and Performance IQs. Instead, he advocated re-categorizing the subtest scores to obtain three composite scores purportedly measuring the following four factors: ***(1) Verbal Conceptualization Ability (VCI):*** the subtests of this factor (Similarities, Vocabulary, and Comprehension) allow for the identification of children with LDs and culturally disadvantaged students' potential variations within the Verbal scale; ***(2) Spatial Ability (Spa):*** this factor (Picture Completion, Block Design, and Object Assembly) is named by Kaufman (1994) as simultaneous processing of information. It represents "one of the most useful and practical sub-groupings of Wechsler's subtests" (Kaufman, 1979, p. 152), because of its flexibility in application to a variety of populations. This factor tends to be the least dependent on special cultural or educational opportunities, thereby more accurately assessing the intellectual ability of children from disadvantaged environments. Additional studies of students with LDs also indicated that they demonstrate relative factor strength in Spatial Ability subtests (Anderson et al., 1989); ***(3) Acquired Knowledge (AK)*** is similarly of interest because it includes subtests (Information, Arithmetic, and Vocabulary) that are all school-related, subject to the influence of the home environment, and involving long-term memory (Anderson et al., 1989; Lutey, 1977). Kaufman (1994) considered this category as the most valuable of Bannatyne's groupings because of the frequency with which the model is applied to children with learning problems: and ***(4) Sequencing Ability (Seq)*** is one of the most frequently considered factors (Arithmetic, Digit Span, and Coding) in Bannatyne's (1974) model. It is also called the 'Freedom from Distractibility' factor and the 'Third Factor' (Kaufman, 1975). The importance of this factor lies in its measurement of the behavioral as well as the cognitive domain and the frequency of factor occurrence in children with learning or behavioral disorders. However, it is not accurate to conclude that all students with LDs will demonstrate the increased distractibility measured by this factor, as is too frequently assumed in assessment (Kaufman, 1994).

Bannatyne (1971) reported that children with reading disabilities had their highest scores in the spatial category, intermediate scores in the conceptual category, and low scores in the sequential category (Spatial > Conceptual > Sequential). Smith and Watkins (2004) pointed out that although later studies generally agreed that the pattern existed among some children with LDs, it was not clear whether the pattern was useful in discriminating between children with LDs and those from different ethnic backgrounds.

Horn's Fluid-Crystallized Theory

Horn's expansion of the Horn-Cattell Theory of Intelligence (Horn, 1989; Horn & Hofer, 1992) distinguished between two broad constructs, Crystallized Intelligence (Gc), and Fluid Intelligence (Gf) (Flanagan et al., 2000; Kaufman et al., 2016). It also included more refined abilities, such as Visual Intelligence, Quantitative Reasoning, Short-Term Memory, Long-Term Storage, Auditory Processing, and Processing Speed (Flanagan et al., 2000).

The classification of WISC-III subtests into the Horn Model produced the following five factors: ***(1) Crystallized Intelligence (Gc)*** (Information, Similarities, Vocabulary, Comprehension, and Picture Arrangement). It refers to intellectual functioning in tasks calling on previous training, education, and acculturation; ***(2) Fluid Intelligence (Gf)*** (Picture Arrangement, Block Design, Object Assembly, Similarities, and Arithmetic). This factor cuts across the Verbal and Performance Scales, and this arrangement may account for its associations with both the VC and PO factors (Kaufman, 1994). Gf involves problem-solving and reasoning in which the key is adaptation and flexibility when faced with unfamiliar stimuli (Horn, 1989); ***(3) Broad Visualization (Gv)*** (Picture Completion, Block Design, and Object Assembly). According to Horn, (1989) *'[Gv includes] tasks that call for fluent visual scanning, Gestalt Closure, mind's-eye rotations of figures, and ability to see reversals'* (p.80). Horn's Gv grouping includes the same subtests as Bannatyne's Spatial category, and they measure the same ability, visual-spatial thinking or simultaneous processing of information (Kaufman, 1994, Kaufman et al., 2016); ***(4) Short-Term Acquisition and Retrieval (SAR or Gsm)*** (Arithmetic and Digit Span). This is similar to sequential processing of information, and according to Horn and Hofer (1992), *'[Gsm] involves processes of becoming aware of information, discriminating between different bits of information, re-training such awareness and discriminations for short periods of time, and using these awarenesses and discriminations... in performing various kinds of tasks'* (p. 62), and ***(5) Broad Speediness (Gs)*** (Coding, Symbol Search, and Object Assembly). Horn (1989) indicated that *'Gs is speediness in intellectual tasks related to carefulness, strategies (or meta-cognition), mood, and persistence'* (p. 84).

The Horn system provides a theoretical interpretation of the four WISC-III factors: VC is Gc, PO is Gv and Gf, FD is SAR (or Gsm), and PS is Gs. The association between the Horn Gv and Gf constructs and Wechsler's verbal/nonverbal dichotomy suggests certain predictions regarding the test profiles of children with LDs. Three predictions have been borne out in the bulk of research investigations using Wechsler's scales for evaluation of children with school-related deficiencies. The first prediction would hypothesize characteristic P > V and PO > VC patterns for groups of children with school-learning problems (Kaufman, 1994). Many researchers indicated that groups of children with LDs have typically obtained P > V profiles on the WISC, WISC-R, and WISC-III (Kaufman, 1994; Prifitera & Dersh, 1993).

The second prediction is that children with LDs would perform especially poorly in the subtests that Bannatyne groups together as measuring Acquired Knowledge (Information, Arithmetic, and Vocabulary) because these tasks are academically-oriented and may reflect the child's learning problem directly. The third prediction is that the Verbal deficit for children with LDs should be cumulative. Several researchers found that Verbal IQs for children with LDs decrease over time (e.g. Anderson et al., 1989; Haddad et al., 1994). However, Kaufman (1994) and Kaufman et al. (2016) indicated that support for the three hypotheses generated from the Gf-Gc theory does not imply that those two broad constructs provide the best insight into the deficits of children with LDs (Flanagan et al., 2000).

The ACID Profile

The ACID profile for WISC-III is a pattern of low scores in the ***A***rithmetic, ***C***oding, ***I***nformation, and ***D***igit Span subtests and has been advanced as a means of differentiating children with learning and reading disabilities (Prifitera & Dersh, 1993). Many researchers noticed substantially lower mean scaled scores for children with reading and LDs in the four subtests (Kaufman, 1994, Kaufman et al., 2016). Watkins et al. (1997) examined the discriminate and predictive validity of the WISC-III ACID profile among 612 students with LDs. The results indicated that the ACID profile does not efficiently separate children with disabilities from those without, and further, there is no ACID cutting score, which significantly exceeds chance discriminatory power. Likewise, the ACID profile did not robustly predict academic achievement among children with LDs.

Kaufman Factors

During years of intensive research, Kaufman (1975, 1979, and 1994) observed and refined several factors for the WISC-R and WISC-III standardization sample, four of which are of interest in relation to the G/LDs/2E population: ***(1) Verbal Reasoning (VR)*** (Similarities and Comprehension)**,** ***(2) Right-Brain Processing (RB)*** (Picture Completion, and Object Assembly**)**, ***(3) Left-Brain Processing (LB)*** or Verbal subtests (Information, Similarities, Arithmetic, Vocabularies, and Comprehension)**,** and ***(4) Integrated Brain Functioning (IBF)*** (Coding, Picture Arrangement, Block Design, and Symbol Search)**.**

Based on Thorndike et al.'s (1926, cited in Kaufman, 1994) distinction between the higher abilities involved in insightful problem solving and the lower skills in recalling stored information, Kaufman (1994), and Kaufman et al. (2016) discussed Verbal Reasoning, and noted its importance for learning, observing that some students with vast stores of knowledge cannot respond well to problem-solving situations. Similarly, Kaufman's (1979) Right-Brain Processing, Left-Brain Processing, and Integrated Functioning factors have strong implications for teaching. Faglioni et al. (1969) found the right cerebral hemisphere to be of importance for verbal information and letter recognition, functions previously attributed to the left-brain. Pirozzolo and Rayner (1977) underscored the importance of integrated functioning by noting that while the right hemisphere allows children to recognize letters and words as gestalts, transmission to the left hemisphere allows for the conversion of these symbols into phonological and meaningful units.

Rapaport, Gill and Schafer Model

Rapaport et al. (1945-1946), with refinement by Lutey (1977), presented an important dichotomy for the non-verbal subtests. He recategorized the WISC nonverbal subtest scores to measure two factors: ***(1) The Visual Organization Group (VO)*** **(**Picture Completion and Picture Arrangement) which requires visual-perceptual awareness but little more coordination, and ***(2) The Visual-Motor Coordination subtests (VMC) (***Block Design, Object Assembly, and Coding) which are strongly dependent on the integration of perceptual-motor skills.

In a study conducted by Waldron and Saphire (1990), intellectual patterns of a group of 2E students were studied to determine cognitive factors characterizing these children. Twenty-four G/LDs and a control group of non-disabled gifted children were administered the WISC-R. Experimental and control performances were compared on 14-factor scores, using the cognitive classification systems of Bannatyne, Wechsler, Kaufman, and Rapaport et al. The findings revealed that students with G/LDs were more reliant on verbal conceptualization in short-term auditory memory and sound discrimination. They also exhibited the Organic Brain Syndrome factor to a significantly greater degree than did the control group.

In the current study, it was hypothesized that the results of the WISC-III-Jordan for MG/LDs would (a) produce a significant Verbal-Performance IQ discrepancy and yield a large amount of scattering in the subtest profiles, significantly more than the scatter found for normal populations or for groups who have only learning disabilities, (b) produce a characteristic pattern of strengths and weaknesses in the subtest profile, (c) show consistent patterning in clusters of scores when the factors of five cognitive classification models and ACID profile were used, and (d) produce a characteristic pattern of strengths and weaknesses for different factors and profiles.

Research method

Instrument

The WISC-III-Jordan is the third and latest version of WISC that was adapted to the Jordanian context (Wechsler 1996). No subsequent versions were adapted to the Jordanian context. It is an individually administered measure of intellectual functioning designed to assess children from ages 6 years, 0 months to 16 years, 11 months. It has 13 individual subtests (*M* = 10, *SD* = 3), 10 standard, and three supplementary, that combine to yield three composite scores: Verbal (VIQ), Performance (PIQ), and Full-Scale (FSIQ) IQs (*M* = 100, *SD* = 15). In addition, the WISC-III-Jordan provides four factor-based index scores: Verbal Comprehension (VC), Perceptual Organization (PO), Freedom from Distractibility (FD), and Processing Speed (PS) (*M* = 100, *SD* = 15) (Wechsler, 1996). The reliability of the scale was studied by the test-re-test method for all of the subtests. Verbal, Performance, and Full-Scale IQs showed high-reliability coefficients of 0.95, 0.94, and 0.96 respectively across all ages. Reliability was also measured by inter-rater/scorer agreement. Verbal, Performance, and Full-Scales IQs have average reliability coefficients of 0.94, 0.88, and 0.95 respectively across all ages (Wechsler, 1996).

Participants and Procedure

The present study involved 52 students (*mean chronological age* = 11 years, 1 month; *mean Full IQ score* = 120.3, *SD* = 15.3) nominated by their primary Arabic and mathematics teachers in an identification process for mathematically gifted students with learning disabilities (MG/LDs). The teachers nominated the 52 students from a total population of 800 Jordanian students across Grade 5 and 6 at three public primary schools in Amman, Jordan. The selected schools were those of middle socio-economic backgrounds and contained a high number of students, which helped make it possible to choose the sample from as big a population as possible. All students were from relatively middle socio-economic backgrounds, and Arabic was the first and spoken language at home.

In the process of identification, the 52 nominated students were divided into two groups based on their: (a) intellectual abilities; (b) meeting the criterion of 2E or not. Students in both groups were diagnosed with specific learning disabilities as described below. The first group consisted of 30 MG/LDs (16 girls and 14 boys). The 30 MG/LDs students were those identified by the multidisciplinary assessment process outlined below as meeting the criteria for 2E, the namely mathematically gifted student with learning disabilities. In chronological age, this group of MG/LDs ranged from 10 years 0 m to 11 years 11 m (*M* = 11 years 1 m), and in the WISC-III-Jordan they ranged from 127 to 147 (*M* = 131.3, *SD* = 4.4) in Full-Scale IQ.

The second group was made up of 22 (10 girls and 12 boys) average IQ/LDs students. The 22 subjects in this group met the following criteria. First, they had been previously identified by their primary school teachers as students manifesting ‘specific learning disabilities’. Second, their Full-Scale IQ score was in the average range. They ranged in WISC-III-Jordan Full-Scale IQ from 88 to 119 (*M* = 105.3, *SD* = 11.4), and in chronological age from 10 years 5 m to 12 years 0 m (*M* = 11 years 0 m). More specifically, both research groups were identified according to the following criteria:

- To score above the cut-off 120 IQ score on the WISC-III-Jordan. The reason for using the third edition of WISC is that the fourth and fifth editions were not translated and adapted to the Jordanian context. In research studies of the gifted, it is usual to confine the ‘gifted’ sample to those who have at least one IQ score of 130 or above (Montgomery, 2015). Silverman (1989) suggested the level for inclusion into these gifted education programs should be dropped by 10 points in the case of those with an LD. Accordingly, students in this research who scored 120 or above on the Full-Scale IQ were labeled **‘gifted IQ’**, while others whose IQ scores ranged from 88 to 119 were labeled **‘average IQ’** students.

- To show high mathematical potential on a Dynamic Assessment mathematical achievement test. A pre- and post-intervention method was used to determine whether students who exhibit performance deficits in mathematics have cognitive strengths that are not readily observed. The mathematical areas that the test covered were: (a) calculation operations, (b) ordering of decimals, (c) rounding up, (d) geometry, (e) algebra, and (f) problem-solving. Only students who revealed: (1) high intellectual ability (gifted IQ scores on the WISC-III-Jordan), (2) high mathematical abilities in all of the above-mentioned areas, and (3) high variance of performance between the pre- and post-tests were labeled **'mathematically gifted'**.
- To show specific learning disabilities on the Diagnostic Scale of Arabic Language Basic Skills (Waqfi, 1997), and performing poorly on the Group of Perceptual Skills Tests (Waqfi & Kilani, 1998). The main three areas that the scale-covered were reading, spelling, and writing. Both groups have revealed age delay and specific learning disabilities in all three areas, and therefore they were labeled **'students with LDs'.**

A multi-disciplinary assessment team consisting of two professionals identified the two research groups. The team consisted of (a) a psychologist who used his expertise to administer the WISC-III-Jordan and dynamic mathematics tests; and (b) a learning disabilities diagnostician who had wide experience of evaluating students with LDs in Jordan.

All of the 52 subjects were administered the Verbal and Performance subtests of the WISC-III-Jordan. A psychologist administered the Scale using standardized procedures. In order to be eligible for the study sample as gifted students, subjects had to have a Full-Scale IQ score at or above 120. Completed data were available for the 10 standard WISC-III subtests. Means and standard deviations were computed for all the 10 subtests to examine the subtest profile. To avoid over-testing the students the three optional WISC-III-Jordan subtests were not administered and, consequently, not analyzed. The selected sample consisted of students who had a Full-Scale IQ score at or above 120. It should also be noted that Kaufman (1994) found essentially no differences between age or gender groups in the size of scattering indices (the highest scaled score on a particular scale minus the lowest scaled score on that scale). Accordingly, both the groups in this study were analyzed together.

Data analysis

The main purpose of the WISC-III-Jordan analysis was to examine cognitive profiles of mathematically gifted-IQ/LDs students as compared with average-IQ/LDs students. To achieve this, four analytical approaches were adopted as follows:

Approach One: Verbal-Performance IQs Discrepancy and Scatter/Range Indices

In this approach, means and standard deviations were computed for the 10 standard WISC-III-Jordan subtests to examine subtest profiles, and the three IQ Indices VIQ, PIQ, and Full-Scale IQs were determined. To evaluate inter-scale and intra-scale variability, two scatter indices were computed for both research groups. The inter-scale index revealed the magnitude of the Verbal-Performance IQ discrepancy (V-P) regardless of the direction of the difference. The intra-scale index was the scaled range/scatter: a child's highest score on the scale minus his or her lowest score on the scale (Schiff et al., 1981). Scaled score scatters/ranges were computed for VIQ, PIQ, and Full-Scale IQs. Means and standard deviations obtained for the two research groups on these scatter indices were then compared statistically using a *t*-test for independent samples.

Approach Two: Subtests Scaled Deviations

In this approach, the numbers of subtests that deviated significantly from each student's corresponding Verbal and Performance mean scaled score were computed. Deviations of the scaled subtest scores of the MG/LDs group were then compared with those from the Average-IQ/LDs group. In order to measure this 'relative strength', both Verbal and Performance scaled score averages were computed. For each of the subtests included, the corresponding Verbal or Performance mean was then subtracted from the student's subtest score. The differences were then added together to form the student's relative factor strength. For example, for the Information subtest, relative factor strength is given by (Information – Verbal average).

Approach Three: Factor Averages for the WISC-III-Jordan

In this approach, 17-factor scores were computed from each child's WISC-III-Jordan scores in order to evaluate the cognitive abilities of students in various areas. Since complete data were available for the 10 standard WISC-III-Jordan subtests, it was possible to compute those 17-factor scores for every student in the mathematically gifted-IQ with LDs and average-IQ with LDs samples. The factors used and their component subtests are listed in Table 1.

Table 1: Factor components of five cognitive models and two profiles.

Models	Models' Factors	Factors' Subtests
Wechsler (1991)	Verbal Comprehension (VC)	Information, Similarities, Vocabulary & Comprehension
	Perceptual Organization (PO)	Picture completion, Picture Arrangement, Block Design & Object Assembly
	Processing Speed (PS) ❷	Coding & (Symbol Search) ❶
	Freedom from Distractibility (FD)❷	Arithmetic & (Digit Span) ❶
Bannatyne (1974)	Verbal Conceptualization Ability (VCI)	Similarities, Vocabulary & Comprehension
	Spatial Ability (Spa) ❹	Picture Completion, Block Design & Object Assembly
	Acquired Knowledge (AK)	Information, Arithmetic & Vocabulary
	Sequencing Ability (Seq)	Arithmetic, (Digit Span) ❶ & Coding
Horn (1989)	Crystallized Intelligence (Gc)	Information, Similarities, Vocabulary, Comprehension & Picture Arrangement
	Fluid Intelligence (Gf)	Picture Arrangement, Block Design, Object Assembly, Similarities & Arithmetic
	Broad Visualization (Gv) ❹	Picture Completion, Block Design & Object Assembly
	Short-Term Acquisition (Gsm) ❷	Arithmetic & (Digit Span) ❶
	Broad Speediness (Gs)	Coding, (Symbol Search) ❶ & Object Assembly
ACID Profile		Arithmetic, Coding, Information & (Digit Span) ❶
(SCAD Profile) ❸		(Symbol Search) ❶, Coding, Arithmetic & (Digit Span)
Kaufman (1994)	Verbal Reasoning (VR)	Similarities & Comprehension
	Right-Brain Processing (RBP)	Picture Completion & Object Assembly
	Left-Brain Processing (LBP)	Information, Similarities, Arithmetic, Vocabularies & Comprehension
	Integrated Brain Functioning (IBF)	Coding, Picture Arrangement, Block Design & (Symbol Search) ❶
Rapaport et al. (1946)	Visual Organization (VO)	Picture Completion & Picture Arrangement
	Visual-Motor Coordination (VMC)	Block Design, Object Assembly & Coding

❶ Digit Span and Symbol Search are optional subtests. They were not administered and not used in the calculation of the Verbal, Performance and Full) IQ scores and the 17 factors.

❷ Since Digit Span and Symbol Search subtests were not administered, three factors, Processing Speed (PS), Freedom from Distractibility (FD), and Short-Term Acquisition (Gsm) were left with one subtest as 'singlet' factors, which made them unusable in the present study.

❸ In the SCAD profile, two optional subtests were not administered. Accordingly, it was not considered desirable to use it as 'doublet' factor.

❹ Spatial Ability and Broad Visualization factors include the same subtests; however, the two factors are included as, for clarity, it is important to compare each factor within its model and under its name.

For each factor, the difference between the average score and the discrepancies of nine pair scores were compared for both research groups. The aim of using these nine-paired factors was to examine fluctuations in the WISC-III-Jordan profiles that might assist in understanding the cognitive patterns, which distinguished the MG/LDs group from the Average-IQ/LDs group. The nine-paired factors and their relation to the five Cognitive Models are listed in Table 2

Table 2: Nine paired factors and their relation to the five cognitive models.

Cognitive Model	Paired Factor
Wechsler (1991)	1. Verbal Comprehension – Perceptual Organization
Bannatyne (1974)	2. Verbal Conceptualization – Spatial Ability 3. Verbal Conceptualization – Sequencing Ability 4. Spatial Ability – Sequencing Ability
Bannatyne (1974), and Kaufman (1994)	5. Acquired Knowledge – Verbal Reasoning
Horn (1989)	6. Crystallized Intelligence – Fluid Intelligence
Kaufman (1994)	7. Right-Brain Processing – Left-Brain Processing 8. Right-Brain Processing – Integrated Brain Functioning
Rapaport et al. (1946)	9. Visual Organization – Visual Coordination

Approach Four: The Relative Factor Strengths/Weaknesses of the WISC-III-Jordan

In this approach, the relative factor strength/weakness was computed for each factor for each student and the two groups were compared using *t*-tests. Kaufman (1994) suggested the 'relative factor strength' method that was used in this research to assess the strengths and weaknesses of each student for a particular factor relative to that individual student's overall abilities. This relative strength/weakness method allows for an understanding of the peaks and valleys of the individual student's profile (Kaufman, 1994). In order to measure this 'relative strength/weakness', both Verbal and Performance scaled score averages were computed. For each of the subtests included in the studied factor, the corresponding mean was then subtracted from the student's test scores. The differences were then added together to form the student's relative factor strength/weakness. For example, for the Fluid Intelligence factor, the relative factor strength is given by (Picture Arrangement – Performance average) + (Block Design – Performance average) + (Object Assembly – Performance average) + (Similarities – Verbal average) + (Arithmetic – Verbal average). Large positive relative factor strength indicates that the student excels in this factor relative to her or his overall abilities, whereas a large negative value indicates a relative weakness in the factor.

Results

Means and standard deviations for the subtest scaled scores were computed and are presented for the two groups in Table 3. The WISC-III-Jordan subtest scores of the MG/LDs and Average-IQ/LDs students were compared to determine whether there were any significant differences between the two groups. The independent sample *t* tests indicated that there were significant group differences for the Comprehension [$t\ (50) = 5.42$, $p < .01$], Arithmetic [$t\ (50) = 6.03$, $p < .01$], Vocabulary [$t\ (50) = 4.57$, $p < .01$], Picture Completion [$t\ (50) = 4.46$, $p < .01$], Information [$t\ (50) = 6.13$, $p < .01$], Similarities [$t\ (50) = 6.65$, $p < .01$], Block Design [$t\ (50) = 4.01$, $p < .01$], and Picture Arrangement [$t\ (50) = 5.33$, $p < .01$] subtests. On the other hand, the independent sample *t*-tests indicated that there were no significant group differences for Object Assembly [$t\ (50) = 1.84$, $p = .071$] and Coding [$t\ (50) = 1.72$, $p = .092$] subtests.

Table 3: Means and Standard Deviations of WISC-III-Jordan Subtest Scaled Scores for MG/LDs Sample and Average-IQ/LDs Group.

WISC-III-Jordan	MG/LDs (n = 30)		Average-IQ/LDs (n = 22)		Independent sample *t*-tests
Subtests	***Mean***	***SD***	***Mean***	***SD***	***df* = 50**
Comprehension (Com)	15.23	1.76	12.22	2.25	5.42 **
Arithmetic (Ari)	14.87	1.87	11.73	1.83	6.03 **
Vocabulary (Voc)	14.67	2.17	11.59	2.68	4.57 **
Picture Completion (PC)	13.97	2.06	10.81	3.03	4.46 **
Information (Inf)	13.37	1.47	10.59	1.79	6.13 **
Similarities (Sim)	13.27	1.70	9.68	2.19	6.65 **
Block Design (BD)	12.40	2.13	9.90	2.33	4.01 **
Picture Arrangement (PA)	12.20	2.16	9.00	2.11	5.33 **
Object Assembly (OA)	11.40	2.04	10.22	2.54	1.84
Coding (CD)	10.07	1.46	9.31	1.67	1.72

* Significant at level $p < .05$ ** Significant at level $p < .01$

Because the rank ordering of subtests supplies an important means of identifying gifted students with LDs (Al-Hroub, 2007; Kaufman, 1994), the rank ordering of WISC-III-Jordan subtests was compared. The rankings for the two groups were somewhat similar, with Comprehension, Arithmetic, and Vocabulary having the highest scores in each group and Coding, the lowest score for the MG/LDs sample, and the second-lowest for the Average-IQ/LDs group. While the order of average subtest scores for the two groups was very similar, the range of mean scores for the MG/LDs sample (15.23 - 10.07 = 5.16) was substantially wider than the corresponding range for the Average-IQ/LDs group (12.22 – 9.31 = 3.22).

Approach One: Verbal - Performance IQs Discrepancy and Scatter/Range Indices

The differences between the WISC-III-Jordan VIQ, PIQ, and FSIQ scores were computed for all of the students. Table 4 reports the means and standard deviations of Verbal, Performance, and Full-Scale IQ Indices scores for the present MG/LDs sample and also the Average-IQ/LDs group. The results show that there were significant differences for the three IQ Indices scores as follows: Verbal Scale IQ [t (50) = 9.14, $p < .01$], Performance Scale IQ [t (50) = 6.78, $p < .01$], and Full Scale IQ [t (50) = 11.04, $p < .01$], with a high Cohen's effect size for the Verbal (d = 2.48), Performance (d = 1.86), and Full Scale IQ (d = 2.91), which indicate that the difference has high practical significance. In general, the data from Table 4 show that while the composite IQ scores, Verbal, Performance, and Full Scale, of the Average-IQ/LDs group, were generally lower than the MG/LDs sample, and the scores for two specific subtests (Coding and Object Assembly) in Table 3 were somewhat similar across the two groups.

Table 4: Means and Standard Deviations of WISC-III-Jordan Scaled Indices Scores for MG/LDs Sample and Average-IQ/LD Group.

WISC-III-Jordan	MG/LDs (n = 30)		Average-IQ/LDs (n = 22)		Independent sample t-tests	Cohen's d
IQ Indices	***Mean***	***SD***	***Mean***	***SD***	***df* = 50**	
Verbal Scale IQ	126.77	5.91	107.60	9.22	9.14 **	2.48
Performance Scale IQ	114.03	6.56	99.64	8.76	6.78 **	1.86
Full Scale IQ	122.57	3.17	104.32	8.29	11.04 **	2.91

* Significant at level $p < .05$ ** Significant at level $p < .01$

Cohen (1988) suggested that d=0.2 be considered a 'small' effect size, 0.5 represents a 'medium' effect size and 0.8 a 'large' effect size.

Table 5 presents the WISC-III-Jordan scatter/range indices for the MG/LDs sample and the Average-IQ/LDs group. The differences in the MG/LDs group were compared with the differences in the Average-IQ/LDs group. The analysis of the subtest scatter/range indices results indicates that the mean VIQ-PIQ discrepancy of 12.73 points for the MG/LDs sample is more than one and a half times the value of 7.95 points for Average-IQ/LDs students, but it is not significantly greater than the Average-IQ/LDs mean [t (50) = 1.72, p = .092].

Table 5: Comparisons between WISC-III-Jordan Scatter Indices for MG/LDs Sample and Average-IQ/LDs Group.

WISC-III-Jordan Scatter Indices	MG/LDs Sample (n = 30)		Average-IQ/LD Group (n = 22)		Independent sample *t*-tests (*df* = 50)	Size Effect	
	Mean Difference	*SD*	Mean Difference	*SD*		*Cohen's* d (2)	r
(VIQ-PIQ) discrepancy (Regardless of direction)	12.73	11.04	7.95	8.06	1.72	0.49	0.24
(VC-PO) discrepancy	8.63	10.90	5.91	8.70	.967	0.27	0.14
Verbal Scaled Score Ranges (5 subtests) (1)	4.40	1.73	4.50	1.90	-.20	-0.06	0.03
Performance Scaled Score Ranges (5 subtests) (1)	5.57	2.27	5.45	1.82	.19	0.054	0.027
Full IQ Scale (1)	7.70	1.84	6.68	1.59	2.09*	0.59	0.28

* Significant at level $p < .05$ ** Significant at level $p < .01$

➊ Scaled-score range is an indicator of subtest scatter within the Verbal and Performance Scale. It equals the child's highest scaled score on a particular scale (i.e. verbal/performance) minus his or her lowest scaled score on the scale. Data from the normative standardization sample were taken from Kaufman, (1994).

The MG/LDs sample mean was also 1.73 points significantly higher than the 11.0 mean for the standardization sample, ignoring the direction of the difference (Wechsler, 1991, Table B.2, p.266). In contrast, the mean VIQ-PIQ discrepancy of 7.95 points for the Average-IQ/LDs group was less than the 10.0 mean for the WISC-III standardization sample. However, Kaufman (1994) indicated that values of about 9 to 10 points for VIQ-PIQ discrepancies (with a large SD of 7 to 8 points) have been virtual constants for Wechsler's scales from preschool to adult level. As a result, the VIQ-PIQ discrepancies between the MG/LDs sample and Average-IQ/LDs group were statistically significantly different from the standardized sample of the WISC-III.

In fact, 60% of the MG/LDs sample, and 36 % of the Average-IQ/LDs group had a significant VIQ > PIQ difference ($p < .05$) of the value of 11 points or greater, but one child from both groups had a significant discrepancy ($p < .05$) in favor of PIQ.

The results in Table 5 also show that there is no significant difference in the Verbal Comprehension-Perceptual Organization discrepancy [t (50) = .967, p = .338]. However, Kaufman (1994) indicated that the overall values may be significant and interpreted if the overall values for VC-PO discrepancies are 12 points at the .05 level, or 16 points at the .01 level.

Further, analysis of the Table 5 results shows that both the MG/LDs sample and the Average-IQ/LD group had remarkably similar scatter with no significant differences in Verbal [t (50) = -.20, p = .844] and Performance Scaled Score Ranges [t (50) = .19, p = .849]. However, the average Full-Scale Range for the MG/LDs sample was 7.70, whereas it was 6.68 for the Average-IQ/LD group. As Table 1 shows, the scaled-score range of the two groups on the Full Scale showed a significant difference at the .05 level [t (50) = 2.09, $p < .05$]. The findings also show a medium Cohen's effect size (d = 0.59) and stet correlation (r = 0.28), which indicate that the difference has medium practical significance. Indeed, Kaufman (1976) found a 7-point scatter/range for the regular Full Scale to be 'virtually a built-in constant' (p. 35) as he compared this measure between levels, IQ, sex, and race of the standardization sample. Only the MG/LDs sample obtained average Full Scaled Score Ranges higher than 7 points.

Approach Two: Subtest Scaled Deviations

Table 6 displays percentages of cases for whom each scaled subtest score deviated significantly when compared with the five-test Verbal or six-test Performance scale mean. Deviations or relative strengths or weaknesses are reported as percentages of students' subtest scaled scores when compared with the average of students' scores on the five Verbal/Performance subtests. For instance, for the Similarities subtest, relative factor strength/weakness is given by (Similarities – Verbal average), whereas for Coding it is (Coding – Performance average).

Based on Table 6 the MG/LDs sample and Average-IQ/LDs group demonstrated two relative strengths in Arithmetic and Comprehension in their Verbal means. The Vocabulary was a particular strength of the MG/LDs sample. In contrast, both groups demonstrated two relative weaknesses (weaker for the Average-IQ/LDs group) in Information and Similarities in their Verbal means. By a considerable margin, the Similarities subtest was the largest relative weakness for both groups, particularly for the Average-IQ/LDs group (double the MG/LDs group percentage).

Table 6: Deviations of the WISC-III-Jordan Subtests Scaled Scores for the MG/LDs Sample and the Average-IQ/LDs Students.

WISC-III-Jordan		**Deviations for MG/LDs Sample (n = 30)**			**Deviations for Average-IQ/LDs Group (n = 22)**		
		S %	**W %**	**S – W %**	**S %**	**W %**	**S – W %**
Verbal Subscales	Information	----	3.33	**W** 3.33 %	----	9.09	**W** 9.09 %
	Similarities	----	13.33	**W** 13.33%	----	27.27	**W**27.27%
	Arithmetic	6.66	3.33	**S** 3.33 %	4.54	----	**S** 4.54 %
	Vocabulary	13.33	3.33	**S** 10.00 %	9.09	9.09	----
	Comprehension	6.66	----	**S** 6.66 %	9.09	3.33	**S** 6.66 %
Performance Subscales	Picture Completion	13.33	3.33	**S** 10.00 %	13.63	4.54	**S** 9.09 %
	Coding	----	10.00	**W** 10.00 %	----	4.54	**W** 4.54 %
	Picture Arrangement	3.33	----	**W** 3.33 %	----	4.54	**W** 4.54 %
	Block Design	6.66	6.66	----	9.09	4.54	**S** 4.55 %
	Object Assembly	----	3.33	**W** 3.33 %	9.09	4.54	**S** 4.55 %
Verbal IQ (VIQ)		----	----	----	9.09	9.09	----
Performance IQ (PIQ)		10.00	----	**W** 10.00 %	9.09	4.54	**S** 4.54 %

S: Strength W: Weakness

As Table 6 also shows, only one relative strength was demonstrated within the Performance mean for the MG/LDs sample (Picture Completion), and three for the Average-IQ/LDs group (Picture Completion, Block Design, and Object Assembly). Picture Completion demonstrated the largest deviation and had a similar relative strength to the Performance mean for both groups. Conversely, the MG/LDs sample demonstrated relative weaknesses for three Performance subtests (Coding, Block Design, and Object Assembly), and of these subtests, Coding was the weakest. For the Average-IQ/LDs group, students showed two identical relative weaknesses in the Coding and Picture Arrangement subtests in their Performance subtests.

A comparison of the percentage of cases who showed significant deviations in overall Verbal or Performance scores is also reported. For the Verbal scale, both groups showed no relative strength or weakness. In contrast, the MG/LDs sample in the Performance scale demonstrated a relative strength of 10%, whereas the Average-IQ/LDs group demonstrated a slightly lower relative strength of 4.54%.

Approach Three: Factor Averages of the WISC-III-Jordan

In order to evaluate the abilities of the 52 students in various areas, 17-factor scores were computed from each student's WISC-III-Jordan scores. Comparisons were made to determine whether the two groups differed from each other in any of the factor scores. As explained above, it was not possible to compute all the factors listed in the models outlined earlier in the paper, as some of these rely on scores from optional subtests, which were not administered in the present study.

Since a rank ordering of factors might allow better identification of gifted students with LDs by indicating stronger and weaker cognitive areas (Kaufman, 1994), the average score for each of the factors was computed and ranked. Apart from the Visual Organization (VO) factor, the ordering of the factors was very similar for the MG/LDs sample and the Average-IQ/LDs group. Verbal Conceptualization (VCI), Acquired Knowledge (AK), Verbal Comprehension (VC), Left-Brain Processing (LB), Verbal Reasoning (VR), and Crystallized Intelligence (Gc) were the highest factor scores in both groups, while Integrated Brain Functioning (IBF), Visual-Motor Coordination (VMC), and Broad Speediness (Gs) were the lowest.

Comparisons were made to determine whether the two groups differed from each other in any of the factor scores. Table 7 shows the average scores in each of the 17 factors for each group of students. The range of the averages is larger for the MG/LDs sample (14.39 -10.73 = 3.66) than for the Average-IQ/LDs group (11.30 - 9.41 = 1.89).

The differences for the MG/LDs sample were compared with those for the Average-IQ/LDs group. Table 7 shows that the mean scores for the MG/LDs sample were all significantly greater than those for the Average IQ/LDs group at the significance level $p < .01$.

Table 7: Comparisons of WISC-III-Jordan Factor Averages for the MG/LDs Sample and the Average-IQ/LDs Group.

Factor	MG/LDs (n = 30)		Average-IQ/LDs (n = 22)		Independent sample *t*-tests
	Mean	***SD***	***Mean***	***SD***	***df* = 50**
1. Verbal Conceptualization (VCI)	14.39	1.25	11.17	1.77	7.69**
2. Acquired Knowledge (AK)	14.30	1.14	11.30	1.66	7.71**
3. Left-Brain Processing (LBP)	14.28	.95	11.16	1.44	9.38**
4. Verbal Reasoning (VR)	14.25	1.22	10.95	1.79	7.92**
5. Crystallized Intelligence (Gc)	13.75	.83	10.62	1.41	10.06**
6. Verbal Comprehension (VC)	14.13	1.16	11.02	1.58	8.20**
7. Visual Organization (VO)	13.08	1.50	9.91	2.03	6.49**
8. Fluid Intelligence (Gf)	12.83	.95	10.11	1.13	9.38**
9. ACID Profile	12.77	.70	10.55	1.24	8.22**
10. Right-Brain Processing (RBP)	12.68	1.49	10.52	2.01	4.45**
11. Spatial Ability (Spa) ❶	12.59	1.34	10.32	1.72	5.36**
12. Broad Visualization (Gv) ❶	12.59	1.34	10.32	1.72	5.36**
13. Perceptual Organization (PO)	12.49	1.13	9.99	1.41	7.09**
14. Sequencing Ability (Seq)	12.47	1.05	10.52	1.30	5.97**
15. Integrated Brain Functioning (IBF)	11.56	.99	9.41	1.30	6.79**
16. Visual-Motor Coordination (VMC)	11.28	1.12	9.82	1.31	4.35**
17. Broad Speediness (Gs)	10.73	1.16	9.77	1.31	2.80**

* Significant at level $p < .05$ ** Significant at level $p < .01$

❶ Broad Visualization grouping includes the same subtests as Spatial Ability, and they measure the same ability, visual-thinking, or simultaneous processing of information (Kaufman, 1994). However, it is important, for clarity, to compare each factor within its model and under its name.

Table 8 shows the average score in each paired factor for each group of students. Using paired sample *t*-tests, nine paired factors were compared for both groups. For each paired factor, the differences were examined to determine whether there were any significant differences between the MG/LDs sample and the Average-IQ/LDs group.

Regarding the Wechsler (1991) classification of the Verbal Comprehension and Perceptual Organization paired factor, the results showed a VC-PO discrepancy (VC > PO) for both groups. However, although the VC-PO discrepancy of 8.63 (2.16 mean difference × 4 subtests) points for the MG/LDs sample [$t\ (29) = 4.34$, $p < .01$] and 5.91 (1.48 mean difference × 4 subtests) points for the Average-IQ/LDs group [$t\ (21) = 3.19$, $p < .01$] were both statistically significant, the discrepancy was not more than 12 points at the .05 level or 16 points at the .01 level that was required for them to be considered abnormal (Kaufman, 1994).

Table 8: Comparisons of Paired Factors for MG/LDs Sample and Average-IQ/LDs Group.

Cognitive Models	Paired Factors	MG/LDs Sample (n = 30)			Average-IQ/LDs Group (n = 22)		
		Mean Difference	*SD*	Paired Sample *t*-test (df =29)	Mean Difference	*SD*	Paired Sample *t*-test (df =21)
Wechsler (1991)	Verbal Comprehension-Perceptual Organization	2.16	2.72	4.34**	1.48	2.17	3.19**
Bannatyne (1974)	Verbal conceptualization - Spatial Ability	1.80	2.18	4.53**	.85	1.88	2.12*
	Verbal conceptualizations - Sequencing Ability ❶	1.92	1.70	6.21**	.64	1.49	2.03
	Spatial Ability - Sequencing Ability ❶	.12	1.61	.42	-.20	1.92	-.50
Bannatyne (1974) & Kaufman (1994)	Acquired Knowledge - Verbal Reasoning	.05	1.40	.20	.35	1.88	.87
Horn (1989)	Crystallized Intelligence – Fluid Intelligence	.92	1.37	3.68**	.51	1.00	2.38*
Kaufman (1994	Right Brain Processing - Left Brain Processing	-1.60	2.04	-4.29**	-.64	2.05	-1.47
	Right Brain Processing – Integrated Brain Functioning	1.13	1.53	4.04**	1.11	2.11	2.47*
Rapaport et al. (1946)	Visual Organization-Visual Motor Coordination	1.79	1.76	5.58**	.09	2.17	.20

* Significant at level *p* < .05 ** Significant at level *p* < .01

❶ Sequencing Ability constitutes three subtests (Arithmetic, Coding, and Digit Span). The Digit Span subtest was not administered as it is an optional subtest. To compare the averages of Bannatyne's patterns with each other, therefore, one-third of the total score of Arithmetic and Coding subtests were calculated and added to their sum.

Following Bannatyne's (1974) revised model, the results showed students' scores on the following categories: Spatial category (Block Design, Object Assembly, and Picture Completion), Conceptual category (Similarities, Vocabulary, and Comprehension), and Sequential category (Digit Span, Arithmetic, and Coding). However, the results in Table 7 showed that the MG/LDs sample had an average pattern of *(Conceptual (m=14.39) > Spatial (m=12.59) > Sequential (m=12.47)),* whereas the Average-IQ/LDs group had a different average pattern of *(Conceptual (m=11.17) > Sequential (m=10.52) > Spatial (m=10.32))*. These results were found to differ from Bannatyne's (1971) pattern *(Spatial > Conceptual > Sequential)* for learning and reading disabilities. The Bannatyne WISC-III-Jordan pattern was found only in 10% of the MG/LDs sample and 13.6% of the Average-IQ/LDs group.

Using the paired *t*-test, Table 8 shows that apart from Spatial Ability-Sequencing Ability paired factors [*t* (29) = .42, *p* = .681], Bannatyne's other paired factors had a significant mean difference for the MG/LDs sample as follows: Verbal Conceptualization-Spatial Ability paired factor [*t* (29) = 4.53, *p* < .01] and Verbal Conceptualization-Sequencing Ability [*t* (29) = 6.21, *p* < .01]. In contrast, only one Verbal Conceptualization-Spatial Ability paired factor showed a significant difference [*t* (21) = 2.12, *p* < .05] for the Average-IQ/LDs group, whereas there were no significant differences for the two paired factors: Verbal Conceptualization-Sequencing Ability [*t* (21) = 2.03, *p* = .055] and Spatial Ability-Sequencing Ability [*t* (21) = -.50, *p* = .622].

Results of the Bannatyne (1974) and Kaufman (1994) classification of the Acquired Knowledge Ability-Verbal Reasoning paired factor showed a discrepancy between the two factors. However, this paired factor showed no significant difference for the MG/LDs sample [t (29) = .20, p = .846] or for the Average-IQ/LDs group [t (21) = .87, p = .395].

In the investigation of Horn's theory of the Crystallized-Fluid paired factor, the results showed a Gc-Gf discrepancy (Gc > Gf) for both groups. However, the Gc-Gf showed a significant difference for the MG/LDs sample [t (29) = 3.68, p < .01] at a greater level of statistical significance than for the Average-IQ/LDs group [t (21) = 2.38, p < .05].

Results of Kaufman's (1994) Right-Brain Processing (RBP) – Left-Brain Processing (LBP) and Right-Brain Processing (RBP) – Integrated Brain Functioning (IBF) paired factors showed discrepancies between the two factors for both groups as follows: (RBP < LBP) and (RBP > IBF). For the MG/LDs sample, a significant difference was shown in the two paired factors as follows: Right-Brain Processing - Left-Brain Processing [t (29) = -4.29, p < .01], and Right-Brain Processing – Integrated Brain Functioning [t (29) = 4.04, p < .01]. Conversely, there was no significant difference for the Average-IQ/LDs group in Right-Brain Processing – Left-Brain Processing [t (21) = -1.47, p = .156], and a significant different in Right-Brain Processing - Integrated Brain Processing [t (21) = 2.47, p = .022].

Finally, the result of the Rapaport et al. (1946) Model for Visual Organization (VO)-Visual-Motor Coordination (VMC) showed a discrepancy (VO > VMC) between the two factors for both groups. Similarly to Kaufman model's results, the MG/LDs sample showed a significant difference in the Visual Organization-Visual-Motor Coordination paired factor [t (29) = 5.58, p < .01], whereas no significant difference was shown for the Average-IQ/LDs group [t (21) = .20, p = .846].

Approach Four: The relative factor strengths/weaknesses of the WISC-III-Jordan factors

In order to measure the 'relative strength' or the 'relative weakness', both Verbal and Performance scaled score averages were computed. For each of the subtests included in the studied factor, the corresponding mean was then subtracted from the student's test scores. The differences were then added together to form the student's relative factor strength or weakness. For instance, for the Crystallized Intelligence factor, the relative factor strength/weakness is given by (Information – Verbal average) + (Similarities – Verbal average) + (Vocabulary – Verbal average) + (Comprehension – Verbal average) + (Picture Arrangement – Performance average).

The relative factor strength or weakness was computed for each factor for each student and the two groups were compared using t-tests and signed-rank tests, as appropriate. Table 9 shows that the MG/LDs sample had relative factor strengths higher than the Average-IQ/LDs group in Visual Organization with a significant difference [t (50) = 2.18, p < .05] and Perceptual Organization with no significant difference [t (50) =.80, p = .43].

In contrast, although the Average-IQ/LDs group showed higher relative strengths than the MG/LDs sample in the following four factors: Spatial Ability [t (50) = -.27, p = .79], Broad Visualization [t (50) = -.27, p = .79], Right-Brain Processing [t (50) = .51, p = .61] and Acquired Knowledge [t (50) = -.13, p = .90], none of them showed a statistically significant difference.

No significant differences were found between the two groups for Verbal Conceptualization [t (50) = .37, p = .71] and Left-Brain Processing [t (50) = .50, p = .62], although both factors showed a relative factor strength for the MG/LDs sample, and a relative factor weakness for the Average-IQ/LDs sample.

Table 9: Comparisons between Relative Strengths and Weaknesses for MG/LDs Sample and Average-IQ/LDs Group.

Factor	Relative Strengths & Weaknesses for MG/LDs Sample (n = 30)		Relative Strengths & Weaknesses for Average-IQ/LDs (n = 22)		Independent sample *t*-tests *
	Mean	***SD***	***Mean***	***SD***	***df* = 50**
Visual Organization (VO)	1.79 (S)	2.77	.15 (S)	2.58	2.18 *
Perceptual Organization (PO)	1.22 (S)	3.27	.61 (S)	1.66	.80
Spatial Ability (Spa)	1.21 (S)	3.42	1.45 (S)	2.62	-.27
Broad Visualization (Gv)	1.21 (S)	3.42	1.45 (S)	2.62	-.27
Right-Brain Processing (RBP)	.99 (S)	2.69	1.37 (S)	2.59	-.51
Acquired Knowledge (AK)	.08 (S)	1.73	.17 (S)	3.48	-.13
Verbal Conceptualization (VC)	.35 (S)	1.75	-.24 (W)	3.74	.37
Left-Brain Processing (LBP)	.03 (S)	.61	-.41 (W)	4.79	.50
Verbal Reasoning (VR)	-.05 (W)	1.68	-.58 (W)	3.09	.80
Crystallized Intelligence (Gc)	-.55 (W)	2.37	-1.73 (W)	4.73	1.18
Verbal Comprehension (VCI)	-.56 (W)	1.74	-.89 (W)	4.46	.75
Fluid Intelligence (Gf)	-.97 (W)	4.30	-1.45 (W)	3.52	.43
Sequencing Ability (Seq)	-1.53 (W)	2.38	-.04 (W)	2.02	-2.38 *
Integrated Brain Functioning (IBF)	-1.89 (W)	2.76	-1.28 (W)	2.48	-.82
ACID	-2.43 (W)	1.97	-.69 (W)	2.68	-2.70 **
Visual-Motor Coordination (VMC)	-2.69 (W)	3.11	-.05 (W)	2.65	-3.21 **
Broad Speediness (Gs)	-2.91 (W)	2.35	-.13 (W)	2.21	-4.32 **

*Significant at level $p < .05$ **Significant at level $p < .01$

(S): Strength (W): Weakness

All of the last nine factors showed relative factor weaknesses for the two groups. However, the differences between the two groups were statistically significant in the four following factors: Sequencing Ability [t (50) = -2.38, $p < .05$], ACID [t (50) = -2.70, $p < .01$], Visual-Motor Coordination [t (50) = -3.21, $p < .01$], and Broad Speediness [t (50) = -4.32, $p < .01$]. The MG/LDs sample exhibited greater relative weaknesses in the above four factors. However, no significant differences were found between the two groups in Verbal Comprehension [t (50) = .75, p = .46], Crystallized Intelligence [t (50) = 1.18, p = .24], Fluid Intelligence [t (50) = .43, p = .67], Broad Visualization [t (50) = -.27, p = .79], Verbal Reasoning [t (50) = .80, p = .43], or Integrated Brain Functioning [t (50) = -.82, p = .41].

Conclusions and discussion

The distinct WISC-III-Jordan profile of the two groups showed certain similarities and differences. Some of these similarities and differences support findings from previous work, but in other cases, the claims made in the previous literature are not supported by this sample.

The results obtained from this study showed that although students in both groups had LDs, only the MG/LDs sample demonstrated a significant difference between WISC-III-Jordan Verbal and Performance IQ scores. This finding supports the argument that the traditional use of a 15-point (at the .01 level) or an 11-point (at the .05 level) discrepancy between Verbal and Performance IQ scores may not be the best indicator of the existence of an LD (Clampit & Silver, 1990; Kaufman, 1994; Kaufman et al., 2016), but it could be a good indicator of the co-existence of an LD and mathematical giftedness (Al-Hroub, 2007, 2011). However, Bray et al. (1998) noted that although a discrepancy of 11 points between Verbal and Performance IQ scores is significant at the .05 level for all ages, "it occurs in 40.5% of the standardization sample on the WISC-III" (p. 212).

However, in the present two groups, there was a clear tendency for VIQ to be higher than PIQ among most MG/LDs and all Average-IQ/LDs students to whom the WISC-III-Jordan was administered. This supports the proposal that gifted and reflective children (MG/LDs sample) tend to have VIQ > PIQ (Kaufman, 1994), but it contradicts the PIQ > VIQ as an indicator of LDs. These findings are also of interest in the context of the relationship between dyspraxia and dyslexia. Relatively low VIQ has been considered an indicator of dyslexia and relatively low PIQ of dyspraxia (Weschler, 1991).

It may be that low-Performance IQ children are more likely to be nominated by teachers as students with G/LDs, whereas children with low Verbal IQs may be more likely to be referred to another service. Riordan (2001) argued that children with low Verbal IQs may present earlier in life, perhaps due to speech delay or language impairment, and be referred to speech therapy rather than to any other service.

These results support the right hemisphere theory of attention (Garcia et al., 1997), but only to the extent that there is evidence that PIQ and VIQ reflect right and left hemispheric function respectively (Prifitera & Saklofske, 1998; Prifitera et al., 2005). Although observations and tests on patients with known localized brain injuries have linked verbal ability with the left hemisphere and performance with the right, some authors (e.g., Warrington et al., 1986; Whelan, 1998) suggest that, whereas a low VIQ relative to PIQ may be an accurate indicator of left hemisphere dysfunction, a low PIQ relative to VIQ is a more non-specific indicator of brain damage or dysfunction.

A comparison between the two study groups of the rank ordering of performance in individual WISC-III-Jordan subtests did not show strong differences. Most of the subtest averages were close to each other. Accordingly, there is no evidence that rank ordering of WISC-III-Jordan subtests is an effective method of identifying students with G/LDs, but it could be concluded that because the two study groups both had LDs, this similar rank ordering could therefore be an indication of an LD.

It is important to note that Coding and Picture Arrangement were the lowest of the three means of the WISC-III-Jordan scaled subtest scores for the two study groups. However, these results indicate that, in individual cases, such delay in the Perceptual subtests, particularly in Coding and Picture Arrangement, may provide evidence in favor of weak visual-motor coordination and processing speed, sequential reasoning, planning, and social knowledge (Kaufman, 1994; Wechsler, 1991), which are considered to be some of the characteristics of students with LDs. It should also be noted that Arithmetic was the second-highest mean for both groups. This result is consistent with the sampling of the present study in which teachers were asked to nominate 'mathematically' G/LDs.

When the two groups were compared for their range or scatter between the highest and lowest subset scores in the WISC-III-Jordan, the ranges for the MG/LDs sample were wider than the corresponding range for the Average-IQ/LDs group (5.16 > 3.22). However, these findings do not support Silverman's (1983) contention that a 7-point scatter between highest and lowest subset scores in a WISC-R may be a good indicator of the existence of LDs in gifted students. The results of a study reported in the WISC-III manual (Wechsler, 1991) showed that WISC-III IQ scores were lower than their respective WISC-R IQ scores to the extent of 2, 7, and 5 points for the VIQ, PIQ, and Full-Scale IQ respectively. Because scores in the WISC-III are typically lower than scores in the WISC-R, some students, originally diagnosed as gifted (i.e. their Full score was 120 to 124), using the WISC-R are likely to be diagnosed as average students using the WISC-III, and their scatter in the WISC-III subtests would be lower.

When comparing the two groups, a number of relative strengths and weaknesses appeared in relation to particular subtests. For the two study groups, Picture Completion was the largest relative strength, and Vocabulary had similar relative strength, particularly for the MG/LDs sample. Similarities subtest was the largest relative weakness for both groups and weaker for the Average-IQ/LDs students.

However, the results of this comparison provide evidence that both groups showed strong attention to visual detail, alertness to detail, and visual discrimination, while they found it difficult to think abstractly, scoring lower on verbal abstract reasoning, abstract reasoning, verbal categories, and concepts.

A comparison of the rank ordering of performance of the two study groups on individual WISC-III-Jordan factors scores did not show strong differences. For example, both groups showed strength in Vocabulary Conceptualization, Acquired Knowledge, and Left-Brain Processing, and they showed a deficit in Integrated Brain Functioning, Visual-Motor Coordination, and Broad Speediness. Apart from Visual Comprehension, most of the factor averages were very close to each other. Thus, there is no evidence that the similarity of the high-rank ordering of WISC-III-Jordan factor scores is an effective method of identifying giftedness. In contrast, the similarity of the low factor scores may indicate the existence of an LD. The range among factors was greater for the MG/LDs sample than the Average-IQ/LDs group (3.66 > 1.89), supporting the findings of Waldron and Saphire (1990).

Comparisons of nine paired factors related to the various models indicated some intriguing differences between the two groups in relation to some models. For *Verbal Comprehension (VC) versus Perceptual Organization (PO),* the results showed a VC-PO discrepancy (VC > PO) for both groups, with a higher discrepancy for the MG/LDs sample. This discrepancy was not, however, at the level to be considered as abnormal (Wechsler, 1991) thereby supporting the findings of Waldron and Saphire (1990). This result indicates that students in both groups tend to have higher skills in responding verbally to orally presented questions than in manual manipulation or organizing pictures, objects, or blocks.

This study investigated the diagnostic utility of the Bannatyne WISC-III-Jordan pattern in students with LDs for both groups. Similar to previous research on the Bannatyne pattern, (Prifitera & Dersh, 1993; Smith & Watkins, 2004) the WISC-III-Jordan pattern *(Spatial > Conceptual > Sequencing)* was found in only 10% of the MG/LDs sample, and 13.6% of the Average-IQ/LDs group. Thus, it missed 90%, and 86.4% respectively of the students with LDs in both groups. This finding suggests that the presence of the Bannatyne WISC-III-Jordan pattern would not lead to decisions that are useful in diagnosing children with LDs. Despite that, a different pattern *(Conceptual > Spatial > Sequencing)* was found in 33.3% of the MG/LDs sample, and 27.2% of the Average-IQ/LDs group. It missed 66.7% and 72.8% respectively of the students with LDs in both groups. However, it is not to be claimed that this pattern indicates LDs or giftedness, but results showed that, compared with the Bannatyne pattern, it missed fewer cases. However, these findings should be interpreted with caution because Digit Span was a missing subtest from the Sequential factor. In addition, Arithmetic, which is included in the Sequential factor, was the second-highest scoring subtest for each group.

For *Acquired Knowledge (AK) versus Verbal Reasoning (VR),* students showed a low discrepancy (AK > VR) for both groups but with no significant differences to indicate LDs. This result disagrees with Kaufman's (1994) claim that the deviation of Acquired Knowledge scores from Verbal Reasoning scores could imply an LD. Hence, one can conclude that a good knowledge base may support the Verbal Reasoning items in Similarities and Comprehension. Besides, students in both groups scored highly in the Acquired Knowledge factor although Prifitera and Dersh (1993) found that a low score in this factor gave a prediction of the existence of LDs.

The study also investigated the Horn theory of *Crystallized Intelligence (Gc) versus Fluid Intelligence (Gf)* and found a significant difference in Gc-Gf discrepancy (Gc > Gf) for both groups. Further, a comparison between the two groups showed a higher discrepancy for the MG/LDs sample. This result might indicate that MG/LDs students have more extensive cultural experiences than Average-IQ/LDs students. Since the association between the Gc-Gf and LDs suggests that Crystallized Intelligence is greater than Fluid Intelligence (Kaufman, 1994; Prifitera & Dersh, 1993), support of this hypothesis does imply that the Gc-Gf constructs provide a good insight into the deficits of children with LDs.

For *Right-Brain Processing (RBP) versus Left-Brain Processing (LBP),* only the MG/LDs sample showed a significant difference (LBP > RBP). As mentioned earlier, there is evidence that PIQ and VIQ reflect right and left hemispheric function respectively (Prifitera & Saklofske, 1998). However, this indicates that students in the MG/LDs group tend to be more verbal, analytical, and problem-solving (Kaufman, 1994).

Results showed also that for *Right-Brain Processing (RBP) versus Integrated Brain Functioning (IBF)* there was a significant difference (RBP > IBF) for the MG/LDs sample at the .01 level and the Average-IQ/LDs students at the .05 level. Kaufman (1994) indicated that discrepancy between students' scores in the RBP-IBF groupings of Performance subtests may well reflect a difference in the efficiency of their application of different styles of problem-solving.

Results for the Rapaport Model showed that for *Visual Organization (VO) versus Visual-Motor Coordination (VMC) groups* a significant difference (VO > VMC) was also found only in the MG/LDs sample. It is important to note from this result that students in the MG/LDs sample have problems in the motor domain (fine-motor coordination) more than in the cognitive domain (visual-motor integration and nonverbal concept formation). In contrast, the results show that students in the Average-IQ/LDs group have a problem in both the motor and cognitive domains.

When comparing the two groups' relative strengths in each of the 17 factors, the MG/LDs sample was stronger in the Visual Organization factor (Rapaport et al., 1945-1946) and Perceptual Organization (Wechsler, 1991) than the Average-IQ/LDs group. While the Average-IQ/LDs group was also relatively strong in these areas, it did not demonstrate the same degree of reliance on these two factors. In contrast, the Average-IQ/LDs group was stronger (but with no significant difference) than the MG/LDs sample in the Spatial Ability factor (Bannatyne, 1974), Broad Visualization (Horn, 1989), Right-Brain Processing (Kaufman, 1994), and Acquired Knowledge (Bannatyne, 1974) factors. The presence of these factors may be masking the mathematical talent that the MG/LDs group possesses. It is important to note that both groups were weak in the ACID profile, but the Average-IQ/LDs group was weaker than the MG/LDs sample. However, this lower mean in the ACID profile provides evidence of LDs, supporting previous studies (Prifitera & Dersh, 1993).

Implications for practice

Several inferences may be drawn from the current study. Generally, the WISC-III-Jordan continues to be an important assessment tool for the measurement of intelligence in gifted children with LDs, as with all children. It has been shown to have utility in understanding a wide range of cognitive patterns of the MG/LDs sample and the Average-IQ/LDs group. In addition, the research findings have shown *some support* for use of the WISC-III-Jordan as a diagnostic indicator of 'gifted with LDs', and its clinical usefulness in discriminating between the MG/LDs and the Average-IQ/LDs groups.

In relation to the VIQ-PIQ discrepancy in the WISC-III-Jordan, the largest number of Jordanian students in both groups expressed their intelligence more effectively in verbal tasks than in performance tasks. However, a variety of confounding factors should be addressed. These factors include the presence of fine motor problems and limited exposure to non-verbal teaching methods in Jordanian schools. More specifically, a classical mathematics lesson at a Jordanian school typically begins with a verbal presentation of a mathematical concept on the board at the front of the class and ends with students attempting to apply the concept. According to this 'classical' vision of what it means to teach and learn mathematics, students' understanding is essentially procedural, and to 'know mathematics' means that students know a significant number of procedures that permit them to transform a symbolic expression into a succession of other expressions. For this reason, Jordanian students in both study groups encountered major challenges in responding motorically to the pictorial items. This implies that despite the presence of a VIQ-PIQ discrepancy in the MG/LDs sample, this should not be viewed as conclusive evidence for identifying LDs in gifted students in Jordanian schools. More notably, Jordanian students in both research groups need to be exposed to instructional methods, such as coloring fractions, using small colored cubes to describe their problem solving, or use them to help in their answers to stimulate other senses rather than relying solely on seeing and hearing. The purpose of using such instructional models is that many students in both research groups appeared to have problems in some areas of mathematics due to Visual-Motor Coordination compared to Visual Organization (Rapaport et al., 1945-1946), and Perceptual Organization compared to Verbal Conceptualization (Wechsler, 1974). Since both factors, Visual-Motor Coordination and Visual

Organization require manual manipulation or organization of pictures, objects, and blocks, students in both research groups need to be offered concrete aids more often and for far longer than students with no LDs.

On the other hand, students in the MG/LDs sample have shown more areas of strength and weakness than students who are of Average-IQ and have LDs. This may suggest important differences in the appropriate teaching methods that should be provided to these students. For example, The MG/LDs/2E sample exclusively showed strong cognitive abilities in verbal potential (Bannatyne, 1974) and converting letters into phonologically meaningful units (Kaufman, 1994). Furthermore, the results showed that students in the MG/LDs sample have much stronger (i.e. Visual Organization) or weaker (i.e. Broad Speediness) cognitive abilities in certain factors. Suter and Wolf (1987) have reported that whatever the choice of service pattern, teaching methods would need to accommodate the student's strengths and weaknesses by using alternative strategies and techniques for instruction and evaluation. Therefore, the setting should always be flexible and meet the student's specific academic, cognitive, and perceptual needs. For example, students in the MG/LDs group might stay in the regular classroom by forming small subgroups with peers who share their '2E'. In other cases, students in the MG/LDs group can join special programs for gifted students, which enables them to challenge their high mathematical abilities and reach their potential. Furthermore, a part-time resource model can be, as Al-Hroub (2010a) and Baum (2004) stated an appropriate placement with more severe LDs. This model is appropriate for students in both research groups as they showed severe problems in copying the correct symbols in a controlled period.

In relation to the cognitive classification models, the Kaufman and Rapaport et al. models were found to be the most powerful in discriminating between the two groups. However, this finding should be interpreted cautiously, since the small sample in the current study does not show a cross-section of Jordanian society. Further research using a variety of educational contexts from different areas in Jordan, and in different primary and secondary schools, might reflect more accurately the cognitive, perceptual, and behavioral characteristics of gifted children with LDs in Jordan. Furthermore, it would also be useful to carry out further research into other areas of giftedness such as art, music, and leadership, for students who also have LDs. The opportunity to generalize or differentiate the cognitive, perceptual, and behavioral characteristics of each domain in giftedness would be wider and more specified. Finally, further research could also use the fifth edition of the Wechsler Intelligence Scale for Children WISC-V in identifying the cognitive characteristics of the students. However, the fifth edition is still not translated and revised to the Jordanian context.

Assessment beyond IQ tests for 2E

The main implication in this study is that using a comprehensive model of assessment is essential for the identification of 2E learners. The WISC provide a partial picture about the cognitive characteristics of this population of students. It does not provide some essential information about their untapped potential due to the constraints of using psychometric and timed tests. The details analysis of the use of WISC provides evidence that such psychometric tools are ill-equipped to identify all aspects and characteristics of those who have high abilities and deficits. Therefore, we always consider and use multi-dimensional assessment models, which combines psychometric with dynamic assessments (e.g., Al-Hroub, 2014; 2019). Exploring the use of IQ tests is important to explore their utility and limitations, and therefore we conducted this study.

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