

COGNITIVE FUNCTION OF STUDENTS WITH LEARNING DIFFICULTIES

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Abstract. Learning impairments, intellectual disabilities, autistic spectrum disorders, attention deficit hyperactivity disorder, emotional disorders, and other learning issues were all present in the children. The purpose of this study is to look at how children with learning disabilities differ in their cognitive domains. Methods: 52 students diagnosed with autism spectrum disorder (ASD), learning disability (LD), attention deficit hyperactivity disorder (ADHD), anxiety disorders, and intellectual disability were assessed using the WISC-IV intelligence scale (ID). The pupils with anxiety disorders showed normal cognitive performance, while the rest of the kids experienced cognitive deficits. 21.2 percent of individuals had an FSIQ score of less than 70, 25% had an average score, and 26.9% had a low-average score. In group LD ranged from borderline to high average, group ADHD ranged from borderline to average, and group ID was at an extremely high level.

Keywords: cognitive function, learning difficulty, ADHD, intellectual disability, learning disability, autism spectrum disorders.

1. Introduction

Schools were the most interested in cognitive function, especially teaching students with learning disabilities. The very first intelligence scale, widely recognized as such Binet-Simon scale, was created in 1905. Regarding that, research on intelligence assessment spread rapidly all across Europe and America in the twentieth century. IQ tests are being used by school psychologists as well as other experts to evaluate intellectual functioning. The Wechsler intelligence scale is a popular intelligence scale in the world and also in Vietnam. The Wechsler Intelligence Scale for Children, Fourth Edition (WISC - IV) is an individual experimental instrument for evaluating cognitive ability and problem-solving in children between the ages of 6 to 16 years and 11 months. It was created to provide an overall measure of cognitive ability and also measures of intellectual functioning in Verbal Comprehension (VC), Perceptual Reasoning (PR), Working Memory (WM), and Processing Speed (PS). The sub-scales VC, PR, WM, and PS provide scores for the Verbal Comprehension Index (VCI), Perceptual Reasoning Index (PRI), Working Memory Index (WMI), and Processing Speed Index (PSI), respectively. The VCI, PRI, WMI, and PSI around each other just provide as a whole level of intelligence, or Full Scale IQ (FSIQ). Although the full WISC-IV has 15 subtests, only ten are considered core and are used more frequently when testing intelligence. Vocabulary, Similarities, as well as Comprehension are the three major subtests for VC. PR's main subtests are Block Design, Picture Concepts, and Matrix Reasoning. Digit Span and Letter-Number Sequencing are indeed the core subtests for WM, and Coding and Symbol Search are also the core subtests for PS. In 2011, the Campus of Education, Hanoi National University in Vietnam adapted the WISC-IV. [1].

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In the Vietnamese context, many students with learning disabilities are identified at the start of first grade, but some students are discovered to have learning difficulties when they enter high school. There are numerous reasons why students struggle to learn in school. Some of them suffer from mental disorders, sensory and physical deficiencies (hearing impairments, visual impairments, motor disabilities), behavior-emotional disorders, or autism spectrum disorders. Furthermore, 5-15 percent of children with learning difficulties do not have them for the reasons listed above. That is, even without a physical or intellectual disability, these children have a limited learning ability, which would be identified as a learning disability or specific learning disorder (APA, 2013) [2]. In recent times, numerous professionals, such as psychologists, medical experts, and educators, have researched the intellectual function of children with learning disabilities. The WICS-IV scale has been used by the publishers Nguyen Thi Quy et al (2019) [3], Tran Thanh Nam (2014, 2017) [4], [5] to study the cognitive characteristics of students with attention-deficit/hyperactivity disorder and learning difficulties. According to these studies, children with ADHD have average to below-average cognitive abilities and are frequently poor at memory and coding tasks. Other studies have focused on the cognitive ability of students who have specific learning disorders, such as difficulty writing (Nguyen Thi Cam Huong, 2014) [6]. More and more educators are interested in finding ways to help children with special problems such as reading, writing, and math. Children with learning disabilities frequently have behavioral, emotional, and social skills issues (Nguyen Thi Thu Hien, 2014) [7]. According to a survey of teachers' perceptions, many primary school teachers are still confused about the different types of learning disabilities and the causes of their disorders [8]. As a result, these children require understanding and empathy from their teachers and parents. The aim of this article is to evaluate the intellectual characteristics of children who have learning difficulties in school, thus also assisting parents and teachers in recognizing the child's difficulties and providing appropriate support methods.

2. Content

2.1. Literature review

2.1.1. Students with learning difficulties in schools

The DSM-5 briefly described some disorders related to learning problems in this study (APA, 2013).

Anxiety disorders are characterized by excessive fear and anxiety, as well as related behavioral disturbances. Anxiety is the emotional response to a real or perceived imminent threat, whereas fear is the emotional response to a future threat. These two states obviously overlap, but they also differ, with fear being associated with surges of autonomic arousal required for fight or flight, thoughts of immediate danger, and escape behaviors, and anxiety being associated with muscle tension and vigilance in preparation for future danger and cautious or avoidant behaviors. Pervasive avoidance behaviors can sometimes reduce the level of fear or anxiety. Attention Deficit/Hyperactivity Disorder (AD/HD) is a neurodevelopmental disorder characterized by symptoms of inattention, uncontrolled activity, and hyperactivity, which affect the child's learning, emotional development, and social skills. The prevalence is 5% in children and 2.5% in adolescents.

Autism spectrum disorder (ASD) is characterized by persistent deficits in social communication and social interaction across multiple contexts, including deficits in social reciprocity, nonverbal communicative behaviors used for social interaction, and skills in developing, maintaining, and understanding relationships. In addition to the social communication deficits, the diagnosis of autism spectrum disorder requires the presence of restricted, repetitive patterns of behavior, interests, or activities. Because symptoms change with development and

may be masked by compensatory mechanisms, the diagnostic criteria may be met based on historical information, although the current presentation must cause significant impairment. In recent years, reported frequencies for autism spectrum disorder across Vietnam have approached 0.5 - 1% of the population (Nguyen Thi Hoang Yen and Tran Van Cong, 2017) [9].

Intellectual disability (ID) is a disorder with onset the during developmental period that includes both intellectual and adaptive functioning deficits in the conceptual, social, and practical domains. Intellectual disability refers to a general decline in mental abilities that affects adaptive function in the three domains (concept, social, and practical domains). The characteristics of children with intellectual disabilities are below-average intellectual function ($IQ < 70$), and limited adaptability in conceptual, social, and practical domains. Intellectual disability is divided into 4 levels: mild, moderate, severe, and profound. The degree of intellectual disability affects a child's ability to learn and live independently to varying degrees. The prevalence of intellectual disability is 1% of the population.

Specific learning disorder (LD) is a neurodevelopmental disorder of biological origin that underlies cognitive abnormalities associated with behavioral manifestations. Biological origins include the interaction of genetic, epigenetic, and environmental factors that influence the brain's ability to perceive or process verbal or non-verbal information in a manner that is efficient and accurate. An essential feature of a specific learning disorder is persistent difficulties in important academic skills (Criterion A), which begin during the formal school years (i.e., the developmental stage). Reading single words accurately and fluently, reading comprehension, expressive writing and spelling, arithmetic calculations, and mathematical reasoning are all important academic skills. Specific learning disorders affect 5-15 percent of school-age children and about 4% of adults.

In the last 20 years, the term “inclusive education” has gained popularity in Vietnam. Schools have been accepting disabled students. Identifying, comprehending, and supporting students with learning disabilities remains a challenge for schools and teachers.

2.2. Methods

2.2.1. Methods

Profiles of 52 children with learning difficulties from grades 1 to 9 were reviewed and analyzed. There are 42 male students (80.8 percent) and 10 female students among the 52 children (19.2 percent). These students were all diagnosed at the hospital. According to parent reports, the children perform poorly, learn slowly, do not pay attention in class, resist, and have a lack of harmony with their peers and teachers.

2.2.2. Data analysis

Before proceeding with the analyses, the frequencies means, and standard deviations for the IQ index and subtest scores were calculated and checked for scatter, skewness, and kurtosis. Data were initially analyzed using one-sample t-tests to determine differences from the normal population mean expectations. ANOVAs with repeated measures were used to investigate within-group differences in index and subtest scores. Pearson correlations were used to assess the relationship between IQ and type of disorder after confirming that the data was sufficiently normally distributed.

2.3. Results and discussion

2.3.1. Results

2.3.1.1. Descriptive Statistic

An examination of the data revealed no issues with skewness, kurtosis, outliers, or the presence of a bimodal distribution.

Table 1. Students with learning problems

Disorders	Frequency	Percent
Learning disability	25	48.1
ASD	17	32.7
Intellectual disability	4	7.7
AD/HD	4	7.7
Anxiety	2	3.8
Total	52	100.0

Table 1 demonstrated that students with learning difficulties at school are quite diverse. There are 48.1 percent of students with learning difficulties, 32.7 percent with autism spectrum disorder, 15.4 percent with intellectual disability and ADHD, and 3.8 percent with anxiety disorder among the 52 students with learning difficulties. As a result, the percentage of children with LD is the highest, while the proportion of children with anxiety disorders is the smallest. WISC-IV index and subtest scores are summarized in Table 2. The age of participants ranged from 6 to 15 years old ($M=8.73$, $SD=2.19$), and the scores on the WISC-IV index and sub-tests ranged from very low to very high.

When individual differences in index scores were examined, 21.2 percent of participants scored below 70 on the FSIQ, 25 percent scored at the average level, and 26.9 percent scored at the low-average level. The proportion of students with high or high-average grades was significantly lower (1 percent and 5.8 percent). Examining the differences in four component scores on the WISC-IV scale (Verbal comprehension index -VCI, Perceptual reasoning index -PRI, Working memory index -WMI, and Processing speed index -PSI), the extremely low level accounted for 23.1 percent on VCI, 11.5 percent on PRI, 36.5 percent on WMI, and the same percentage on PSI as on VCI.

A one-way ANOVA test revealed a significant difference between the Full Scale IQ score and the composite scores: [FSIQ: $F= 8.895$, $Sig =.000$; VCI: $F= 7.784$, $Sig =.000$; PRI: $F= 6.13$, $Sig =.000$; WMI: $F= 5.331$, $Sig =.001$; PSI: $F= 3.63$, $Sig =.012$].

When differences from the population mean were examined at the subtest level, the scores for Block design ($t(51) = -1.925$, $p =.06$) and Matrix reasoning ($t(51) = -.257$, $p =.799$) were the same as the normative sample score (10 points). On the other subtests, a significant number of people scored two standard deviations or more below the population mean (i.e., a scaled score of 4 or lower).

Table 2. Descriptive Statistic

	N	Minimum	Maximum	Mean	Std. Deviation
Age	52	6	15	8.7327	2.18612
FSIQ	52	40	123	82.13	19.919
VCI	52	45	127	84.19	19.768
PRI	52	47	131	94.81	20.210
WMI	52	50	128	77.65	21.324
PSI	52	50	122	82.27	18.536
BD	52	1	15	9.00	3.747
SI	52	1	17	6.71	4.263

DS	52	1	14	5.83	3.787
PCn	52	1	16	8.81	3.815
CD	52	1	15	6.65	3.803
VC	52	1	17	7.29	3.691
LN	52	1	16	6.63	4.632
MR	52	1	17	9.87	3.783
CO	52	1	15	7.35	3.803
SS	52	1	18	6.92	3.829
Valid N (listwise)	52				

2.3.1.2. Differences in cognition between students with different disorders

According to the data, the participants' cognitive abilities ranged from extremely low to moderate. The low-moderate level accounted for the greatest percentage, followed by the moderate and borderline levels. The proportion is estimated to account for 32.69 percent at the average and high levels, 46.15 percent at the low-moderate and borderline levels, and 21.15 percent at the extremely low level.

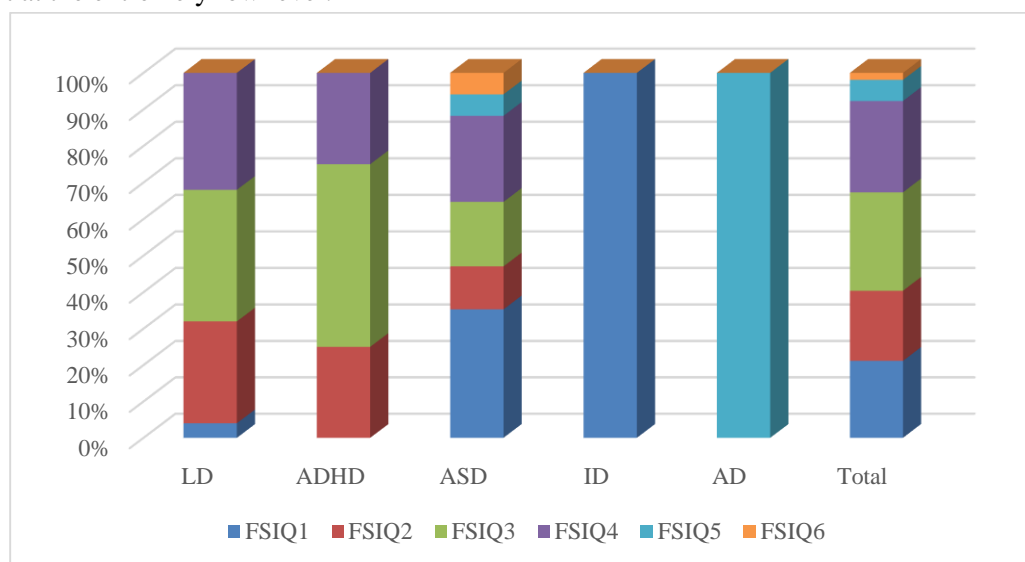


Figure 1. Correlation between cognitive level and type of disability

LD: Learning Disability, ADHD: Attention Deficit Hyperactivity Disorder, ASD: Autism spectrum disorder, ID: Intellectual disability, AD: Anxiety disorder; FSIQ: Full-Scale Intelligent Quotient, FSIQ1: Extremely low, FSIQ2: Borderline, FSIQ3: Moderately low, FSIQ4: Moderate, FSIQ5: Moderate high, FSIQ6: High

Cognitive capacity in the attention deficit hyperactivity disorder group ranged from borderline to low-moderate to moderate. Nobody scored two or more points below average. The extremely low level accounted for the highest percentage of autism spectrum disorder cases (35.3 percent). However, the percentage of high average in this group was quite high (23.5 percent), and some children achieved high and high average levels in cognitive function.

While the cognitive function of the intellectual disabilities group was extremely low, the cognitive function of the anxiety disorder group was above average. Research results show that students with problems in school had very different cognitive abilities, not all of them are retarded,

even some children have high abilities. However, with nearly 70% of students having cognitive function below average, it is evident that students who struggle in school are primarily due to their limited cognitive abilities.

2.3.1.3. Differences in component scores

Analysis of the proportion of disorders and the WISC-IV component scores using the crosstabs formula reveals that the intellectual disabilities group accounted for the highest percentage at an extremely low level. On the component scales, the various disorders displayed varying strengths and weaknesses.

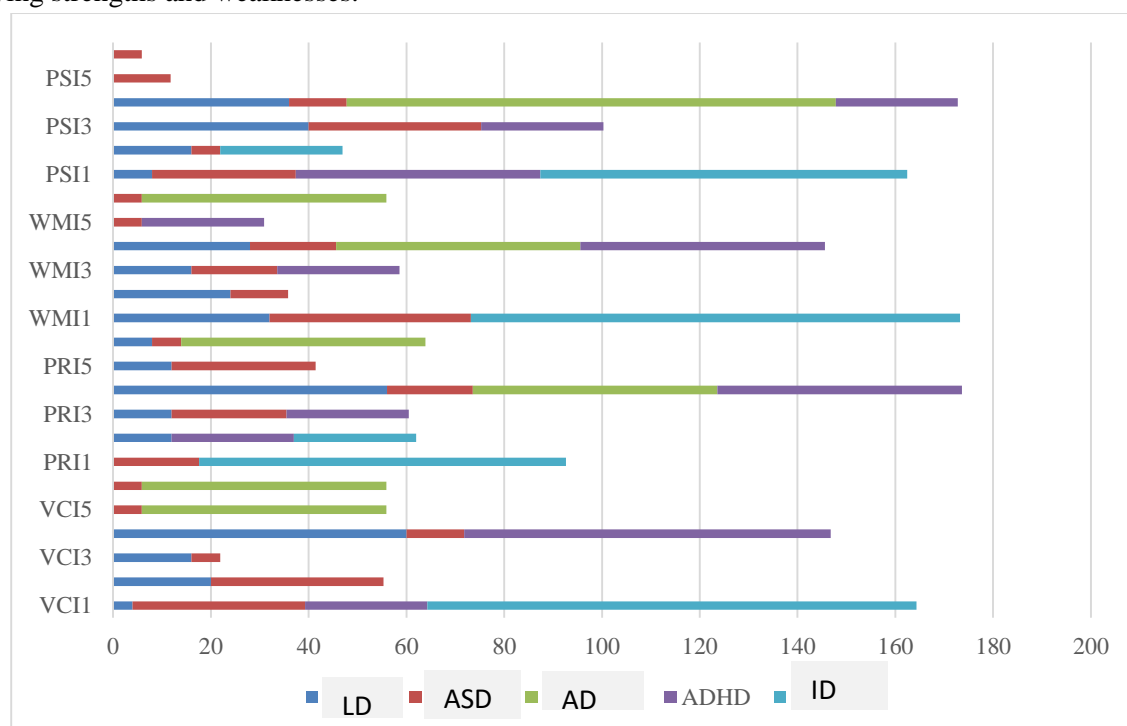


Figure 2. Correlation of disorders and component scores

LD: Learning Disability, ADHD: Attention Deficit Hyperactivity Disorder, ASD: Autism spectrum disorder, ID: Intellectual disability, AD: Anxiety disorder

The anxiety disorders group scored high and high-moderate on the Verbal comprehension scale. At a very low level, the remaining groups accounted for a certain proportion, including 100% of ID, 35.3 percent of children with autism spectrum disorder, 25% of ADHD, and 4% of the LD group.

Children with autism spectrum disorder dominate at a high average level on the Perceptual reasoning scale, followed by learning disorders. Children with anxiety disorders dominate at the highest level, followed by children with learning disorders and autism spectrum disorders.

In addition to the ID group, ADHD and ASD groups had a relatively high rate on the Working memory scale at the extremely low level (32 percent and 41 percent). Only the ADHD and ASD groups achieved a high average score. Only children with anxiety disorders and ASD achieved a high level, with the anxiety disorder group accounting for a higher rate.

Only the ASD group scored high and moderate on the Processing speed scale. The group of children with anxiety disorders had the highest rate on average. The extremely low ID group had the highest percentage (75 percent), followed by ADHD (50 percent), and LD had the lowest percentage (8 percent).

In summary, the children with anxiety have cognitive ability and component scores that are all average or higher, whereas the other group has a range of intellectual functions ranging from low to high, and both have difficulty receiving, in whole or in part.

2.3.1.4. Component scores and subtest scores of students with learning problems

**** Learning disability***

According to the results of the data analysis, the scale scores, component scores, and subtests of 25 children with specific learning disabilities were as follows:

Full-Scale IQ score: 62 – 106 (M=85.72, SD = 11.389)

Verbal Comprehension Index - VCI: 48-107 (M=89.44, SD = 12.663)

Perceptual Reasoning Index - PRI: 73-121 (M = 98.04, SD = 13.01)

Working Memory Index - WMI: 50-104 (M=77.08, SD = 17.84)

Processing Speed Index - PSI: 62-109 (M=86.56, SD = 13.35)

As a result, the overall scale score of the learning disabilities group is low - average. The short-term memory mean score is the lowest, while the perceptual thinking scale mean score is the highest.

**** Sub-test results***

Matrix reasoning had the highest average score (M=10.32, SD=2.32), followed by Picture Concept (M=10.28, SD=2.62). Meanwhile, the Digit Span scores (M= 5.56, SD=3.15) were the lowest. The remaining sub-tests (Similarities, Coding, Symbol Search, Vocabulary, and Block Design) have scores ranging from low to moderate (M = 7.04 - 8.72).

As can be seen, students with learning disabilities frequently have memory weaknesses and perceptual thinking strengths. These students are better at problem solving and visualizing concepts.

**** Autism Spectrum Disorder***

**** Index scores and component scores:***

Full Scale IQ score FSIQ = 43-123 (M= 80.53, SD = 22.24)

VCI = 48-127 (M = 79.06, SD = 21.4)

PRI = 51-131 (M = 97.59, SD = 23.03)

WMI = 50-122 (M = 76.41, SD = 21.95)

PSI = 50-122 (M = 80.18, SD = 22.69)

As a result, the ASD group's mean cognitive ability score ranged from extremely low to high. The majority of students with autism spectrum disorder had VCI and WMI scores that were borderline, and their processing speed was low to moderate. Although perceptual reasoning is a strength of these students, the mean score of these 17 students is also only moderate. Just a few students have high or very low cognitive function.

**** Sub-tests Scores***

Examining the results of each subtest shows that students with ASD have scores varying from extremely low (min = 1) to high and very high (max = 15-17). Whereas Block Design has the highest score (M = 10.59, SD = 3.81), Matrix Thinking has the lowest (M = 10.24, SD = 4.59). Picture Concept ranked third (M=8.18, SD=4.08). All other items were rated as low-moderate (M=6.00 – 6.59).

Thus, in the ASD group, the mean WISC-IV score ranges on all scales ranged from very low to high. However, it is clear that in this group of students, picture thinking outperforms linguistic thinking and short-term memory. These students, in particular, have a higher ability in spatial contact, hand-eye coordination, and non-verbal problem solving.

** Attention Deficits/ Hyperactivity Disorder*

** Index scores and component scores:*

Full scale IQ- FSIQ = 76-102 (M= 83.75, SD = 12.285)

VCI = 69-101 (M = 79.06, SD = 21.4)

PRI = 51-131 (M = 97.59, SD = 23.03)

WMI = 50-122 (M = 76.41, SD = 21.95)

PSI = 50-122 (M = 80.18, SD = 22.69)

When the mean cognitive ability score of students with ADHD was examined, the FSIQ score was low-moderate. The average score for the four component scales vary from very borderline to moderate, with the PRI score being the highest (M=97.59, SD = 23.03) as well as the WMI score being the lowest (M=76.41, SD = 21.95).

** Sub-test scores*

In a statistical analysis of mean sub-test scores in the ADHD group, the LN is the highest (M=10.00, SD =.816), followed by an MR (M=9.50, SD=3.0). The CD has the lowest score (M=4.75, SD = 2.99). Numerous students with ADHD have limited ability to plan and focus on an assignment at the same time. Their working memory and auditory attention popped up to be better compared to their visual attention.

** Intellectual disability group*

** Index scores and component scores:*

FSIQ = 40-51 (M= 44.75, SD = 5.62)

VCI = 45-63 (M = 51.00, SD = 8.124)

PRI = 47-71 (M = 56, SD = 10.893)

WMI = 50 (M = 50.0, SD = 0.0)

PSI = 50-70 (M = 58.0, SD = 8.83)

Students with intellectual disabilities have a deficit in intellectual functioning. The cognitive function data analysis revealed that all students had extremely low scores. The composite scale's mean score was less than three standard deviations lower than the population (M= 44.75, SD = 5.62). However, a detailed examination of each exercise in the scales reveals that the mean score of the matrix reasoning is the highest of the ten exercises, followed by the scores of the block design, vocabulary, and comprehension. There are students who scored 9 points on matrix reasoning in particular.

As can be seen, students with intellectual disabilities perform better in terms of understanding and thinking about pictures than in terms of verbal comprehension, working memory, and processing speed. Aside from that, they can gain vocabulary and life experiences. For students with intellectual disabilities, working memory is the most difficult area to master. This discovery is an important recommendation for teachers and parents to use appropriate teaching methods.

** Anxiety group*

FSIQ = 119 (M=119, SD = 0)

VCI = 115-121 (M = 118.00, SD = 4.24)

PRI = 100-127 (M = 113.5, SD = 19.092)

WMI = 104 – 128 (M = 116.0, SD = 16.97)

PSI = 103-109 (M = 106.0, SD = 4.243).

Thus, the anxiety group's index score was high-moderate ($M=119$), and their strong points were verbal comprehension and working memory. Students with anxiety disorders have normal cognitive functions, as can be seen.

2.4. Discussion

WISC-IV profiles of students with learning disabilities revealed that the mean working memory scale score was the lowest of any area.

The majority of students with ADHD have moderate cognitive function, but a small number have low functioning. This finding was also consistent with previous studies conducted by Tran Thanh Nam (2017) and Nguyen Thi Quy et al (2019). According to Fang Huang et al. (2016) [10], students with ADHD and learning difficulties have worse cognitive function than students with ADHD alone. The weakest areas were linguistic thinking and working memory. J. Dockrell et al. (2018) [11] discovered that students in the ADHD group had lower working memory and processing speed scores than their peers.

Students with autism spectrum disorder demonstrated a wide range of cognitive functions, ranging from extremely low to high. Perceptual reasoning was the group's strength, while verbal comprehension and working memory were its weaknesses. The Block Design has the highest mean score, followed by Matrix Reasoning. Comprehension and Letter-number Sequencing had the lowest mean scores ($M=6.00$). Meanwhile, Rafael E. Oliveras-Rentas et al. (2011) [12] discovered that students with high-functioning autism spectrum disorder have strengths in Matrix Reasoning but deficits in Comprehension and Processing Speed.

Despite their extremely low cognitive function, ID students can learn through a visually supported system.

We found no issues with intelligence function in students with anxiety disorders. They did, however, show academic declines that concerned their parents and teachers. They used to not pay attention in class, to withdraw, to have few friends, and so on.

3. Conclusion

52 WISC-IV profiles of students with learning disabilities were analyzed, including 25 LD, 17 ASD, 4 ID, 4 ADHD, and 2 anxieties. Results showed that the mean working memory scale score was the lowest in any area. Except for students with anxiety disorders, all other students had cognitive difficulties, according to the findings. The strength of the anxiety disorders group is Verbal comprehension. The ASD group dominates at a high level of Perceptual reasoning and Processing speed. 100% of ID, 35.3 percent of children with autism spectrum disorder, 25% of ADHD, and 4% of the LD group have very low levels on the Verbal Comprehension scale.

Each student, however, has unique strengths and weaknesses. Students with cognitive issues frequently have higher perceptual abilities than language ability, working memory, or processing speed. Learning about these students' cognitive functioning will allow parents and teachers to better understand their students as well as establish appropriate expectations, behaviors, and supports for them.

Children with learning difficulties are diverse, and they face a great deal of pressure from their parents, teachers, and peers. Students with learning disabilities, autism spectrum disorders, intellectual disabilities, attention deficit hyperactivity disorder, and anxiety disorders were among those who struggled in school. Schools should administer an early-year assessment to incoming students to determine who requires assistance. To meet the diverse needs of students in the classroom, teachers should use a universal design for learning (UDL) approach in the educational process. Teaching methods should emphasize the use of visual aids in order to improve students' memory and attention abilities. Furthermore, teachers should foster a friendly, open, and non-

judgmental environment, as well as provide encouragement, in order to maximize teaching efficiency. Parents of elementary and secondary school students must work with teachers to understand their children's needs and abilities, and they must always accompany and encourage their children to increase motivation and academic achievement.

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