Turkish Journal of Psychology, June 2023, *38*(91), 56-61 DOI: 10.31828/tpd1300443320210412m000049

Summary
The Importance of Comprehensive Clinical Evaluation of a Specific Learning Disability

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The Specific Learning Disability (SLD) is a disorder defined by the fact that although a child's overall intelligence level is normal or above normal according to the standardized tests, he/she does not show an appropriate success in acquiring skills in academic fields such as reading, writing, and mathematics compared to his/her peers. It is known that in addition to the problems they experience in the academic field, impairment of executive functions such as sequencing, attention, and memory is also observed in children with SLD (Policy et al., 2008). This suggests that this disorder has a heterogeneous structure and many variables must be considered during the assessment process. Therefore, extensive assessment is emphasized in the literature and it is reported that during this assessment, the child's age, intelligence level, emotional, behavioral and social problems, sensory functionality, health, neurological problems, education and family history, concerns and functionality of the family, child's learning style, areas in which he/she experiences difficulty, and his/her strengths, weaknesses, and needs should be taken into consideration (Dorn et al., 2014; Sattler & Weyandt, 2002). When assessment is made by taking into account all factors affecting the academic performance of the child, it can be discerned whether the main reason of child's learning problems is due to learning style and behavioral problems or due to the structure of the SLD. Thus, they can be directed to an appropriate intervention program (NJCLD, 2010).

In the clinical assessment of SLD, intelligence tests are the most important of the standard measurement tools used both in distinguishing diagnosis and in determining the strengths and weaknesses of children (McGill et al., 2016). It is seen that in the assessment of SLD, the Wechsler Intelligence Scale for Children-Fourth Edition (WISC-IV) (Wechsler, 2003) is one of the intelligence scales commonly used for intellectual assessment purposes (Flanagan & Kaufman, 2009). Research on the assessments conducted with the WISC-IV reported that although general intellectual abilities of these children were within normal limits, especially the Working Memory Index (WMI) and Processing Speed Index (PSI) scores were lower compared to the other index scores (Verbal Comprehension and Perceptual Reasoning) (Giofrè & Cornoldi, 2015; Peng & Fuchs, 2016; Toffalini et al., 2017; Wilcutt et al., 2013).

In the clinical assessment of SLD, besides the use of intelligence tests, achievement tests and standard measurement instruments that measure skills such as reading, writing, and math are needed to identify which academic areas children are experiencing difficulties in and to gain information from other sources (Baştuğ & Keskin, 2012; Cornoldi et al., 2003; Korkmazlar, 1993). In addition, assessments that are considered as tertiary sources and contain the views of parents, teachers and other experts in the field are also used (Erden & Uluç, 2019; Korkmazlar, 1993) In light of all this information, it has been seen that the studies in which SLD is evaluated by gathering information from many sources are limited in our country. It has been observed that in these studies, neuropsychological tests or various scales are used in addition to the WISC-R, which is one of the older versions of WISC (Turgut-Turan et al., 2016). In these studies, it is emphasized that neuropsychological variables should also be included in the assessment process of SLD.

In this study, the WISC-IV whose norm is up to date was assessed together with the SLD-CO Battery and the information obtained from tertiary sources. Thus, it is thought that the patterns to be revealed in the comprehensive assessment of SLD by three tests whose norm are up-to-date will contribute to the literature and practice area. In this context, the primary purpose of the study is to demonstrate the usefulness of using these tools together in the clinical assessment process of the SLD. In addition, the SLD-CO Battery, WISC-IV, and the MOYA scores of children with SLD were compared with the

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same scores of children with normal development, and the distinguishing power of the scales were examined. Finally, in the context of this study, the predictive power of the subtest scores of the SLD-CO Battery and MOYA on SLD was examined.

Method

Sample

The sample of this study consists of two groups. The first group is the clinical group and includes children diagnosed with learning disabilities according to the DSM-5 diagnostic criteria. Of 97 children diagnosed with SLD, 34% (n = 33) had also Attention Deficit Hyperactivity Disorder (ADHD). The second group, on the other hand, consists of normal children who do not have any clinical diagnosis. While the clinical group (n = 97,) consists of children between 6-11 years of age (*mean* = 7.50, *SD* = 1.12), the normal group (n = 85) consists of children between 6-10 years of age (*mean* = 7.70, *SD* = 1.02) (N = 182). 70 (72.2%) of the children in the clinical group are male and 27 (27.8%) are female. 52 (61.2%) of the children in the normal group are male and 33 (38.8%) are female.

Measures

Specific Learning Disorder Clinical Observation (SLD-CO) Battery. The Specific Learning Disorder Clinical Observation (SLD-CO) Battery constitutes the primary component of the SLD Extended Neuropsychometry (SLD-ENP) Battery. SLD-CO Battery consists of subtests assessing reading, writing, and basic math skills as well as subtests assessing fields of visual detection, ranking and sequencing, right-left discrimination, clock drawing, lateralization, and problems and impairment in fine motor skills. The SLD-CO Battery has the characteristics of a structured clinical observation instrument. The application of this battery allows the assessment of reading and writing errors via reading speed, sequencing skill through writing the letters of the alphabet in order, before-after relationship over days and months, basic arithmetic skills through addition, multiplication and arithmetic problems appropriate to class level, left-right discrimination ability over one's own body, and lateralization (Karakaş et al., 2017). Thus, the battery aims to assess learning disabilities in many ways. The subtests in the revised final version of the SLD-CO Battery included: Mathematics, Reading, Writing, Gesell Development Figures, Clock Drawing, Right-Left Discrimination, Lateralization, Questioning of Before and After Relations and Sequencing. High scores in the battery's Mathematics, Reading, Clock Drawing, Right-Left discrimination, Lateralization, Questioning the Before and Later Relations and Sequencing subtests indicate higher performance in these areas. In the Writing and Gesell Development Figures subtests, on the other hand, since the evaluation is made on the error scores, high scores in these subtests indicate low success in these areas.

Specific Learning Disability Symptom Screening List (Mathematics, Reading, Writing Assessment Scale-MOYA[1]). This is a scale built from questions to investigate risk situations, symptoms, and the child's strengths and weaknesses for SLD, and it allows us to take a detailed story. It was developed based on clinical observations and theoretical information related to SLD. In addition, by taking into account the fact that the child's behavior at home and at school and attitudes towards academic duties should be enriched and supported by the information taken from the teacher and family (Sattler & Weyandt, 2002), it was designed as 3 separate forms for parents, teachers, and children (Erden & Uluç, 2019).

Reading, writing, attention, and math scores are obtained from the three forms of the MOYA. In addition, the total score of each form is obtained from the sum of the scores of the reading, writing, attention, and mathematics subtests. High scores obtained from the subtests and total raw scores of all three forms reveal that children have problems in these areas. It was reported that a total of 945 children within the 6-12 age range were assessed for the MOYA' standardization sample and comparative analyses were conducted with the clinical sample to determine MOYA' validity and cut-off scores (Erden & Uluç, 2019). It was stated that in the factor analysis conducted, a four-factor structure emerged and that these four factors together predicted 57% of the variance. These factors were called as "coping with the number concept" "understanding and using verbal and written language", "able to maintain attention", and "error in reading and writing". However, in this study, mathematics, reading, writing, and attention subtest names, which had been used previously, were used for these factors. MOYA' internal consistency was calculated using the Cronbach alpha. The results show that the scale can be used reliably in Turkey.

Wechsler Intelligence Scale for Children-Fourth Edition (WISC-IV) (Wechsler, 2003). The WISC-IV, developed to assess the mental abilities of children within the 6-16 age range, consists of 10 core and 5 supplemental subtests. In addition to the standard scores for each subtest, four index (cluster) scores and total scale intel-

1 The Mathematics, Reading, Writing Assessment Scale was used under the name of the Specific Learning Disability Symptom Screening List during its development phase. After its psychometric measurements were completed, it was found appropriate to be called as the Mathematics, Reading, Writing Assessment Scale (MOYA) by its authors.

ligence scores are obtained using 10 core subtest scores (Wechsler, 2003). These index scores are as follows: *Verbal Comprehension Index (VCI)*, *Perceptual Reasoning Index (PRI), Working Memory Index Score (WMI)*, and *Processing Speed Index (PSI)*. Turkish standardization and norm study of the WISC-IV was conducted with a sample comprised of 2225 children by taking into account seven geographical regions, gender (country population rates) and socioeconomic level (low-medium-high) to represent each age segment equally (Öktem et al., 2016). The mean value for the index scores and FSIQ is 100 and the standard deviation is 15. For the subtest standard scores, the mean value is 10 and the standard deviation is 3 (Wechsler, 2003).

Procedure

Prior to the data collection phase, ethics committee approval was obtained. This study constitutes a part of the project No. 117K959 supported by TUBITAK. The data of the children in the clinical group were collected from Ankara Yıldırım Beyazıt University Yenimahalle Education Research Hospital Child and Adolescent Psychiatry Clinic and from children who were being trained at the special education rehabilitation centers and diagnosed with SLD. Children in the normal group were reached through the relatives of the children diagnosed with SLD due to their easy accessibility. Prior to the application, the parents of the children were informed about the research with an informed consent form and it was stated that their participation was on a voluntary basis. The diagnosis of learning disability was made as a result of clinical evaluations performed by the hospitals' child and adolescent mental health professionals based on the DSM-5 diagnostic categories and those diagnosed with SLD were directed to participate in the study. As a method frequently used in clinics, writing errors were determined by examining children's notebooks, reading texts pre-determined according to grade levels were read and math skills were evaluated as number, four operations and problem solving skills. In addition, teachers were asked to evaluate children's reading, writing and math skills and academic skills. It was decided that the children included in the normal sample did not have any signs of learning disability, based on the notifications of parents and teachers about the child and their school success scores. The WISC-IV test was administered by certified psychologists. Children with intellectual disability and borderline intellectual level (FSIQ < 80) and children identified as gifted (FSIQ ≥ 120) were not included in the study. For both groups, children with any neurological, psychiatric, or sensory-motor problems were not included in the study (ADHD was excluded for the clinical group).

Results

In this study, among the children diagnosed with SLD, those with ADHD comorbidity were also included in the sample. Accordingly, it was evaluated that 34% (n = 33) of 97 children whose primary diagnosis was SLD had ADHD comorbidity. Only children with a diagnosis of SLD (n = 64) and children with SLD+ADHD (n = 33) were considered as two separate groups, and the first comparisons of scale scores were made through these groups.

As a result of the comparisons made with the independent sample t-test analysis for groups, no significant difference was found between the subtest scores of the SLD-CO Battery of the children with only SLD diagnosis and the subtest scores of the children in the SLD+ADHD group, except for writing and sorting the months. Accordingly, the error scores of the children with only SLD diagnosis in the writing subtest were found to be significantly higher than the error scores of the children with SLD+ADHD ($t = 2.10$, $p < .05$). In the comparisons made on MOYA scores, both teachers ($t = 3.95$, $p < .001$) and parents ($t = 3.71$, $p < .001$) gave significantly higher score to the children diagnosed with SLD+ADHD compared to the children with only SLD diagnosis in the attention sub-dimension. Among the WISC-IV index scores, the Processing Speed Index of children with SLD+ADHD was found to be significantly lower than of children with only SLD diagnosis ($t = 2.09$, $p < .05$), no significant differences were found between other index scores. In the light of the findings of the comparison between SLD+ADHD and only SLD diagnosed groups and the information in the literature, it was decided that these two groups should be considered as a single group under the name of the group with SLD diagnosis.

The independent samples t-test analysis was performed to determine whether there were significant differences between the scores that children with SLD took from the SLD-CO Battery and the similar scores of children in the normal group. The findings showed that all reading skill scores of children with a diagnosis of SLD were significantly lower than those of children in the normal group (reading speed, reading accuracy, reading comprehension, fluent reading, and reading skill total). In the areas of writing skill, children with SLD also received significantly higher writing error scores than normal children (dictation writing, writing by looking, free writing, and writing skill total). When the differences between the math skills of the two groups were examined, it was determined that the total scores of the children with SLD were significantly lower than the scores of normal children.

When the scores that the two groups obtained from the other tests of the SLD-CO Battery were compared,

it was found that the error scores that the children with SLD took from Gesell Development Figures were significantly higher than the error scores of the normal children. In addition, the scores that children with SLD took from the subtests in which their abilities of clock drawing, right-left discrimination, and sequencing (sequencing of days, months, alphabets, and numbers) were measured were significantly lower than the scores of the normal children. However, any significant difference could not be identified between the hand-eye lateralization and total lateralization scores of the children with SLD and similar subtest scores of the normal children.

The independent samples t-test analysis was performed to determine whether there were significant differences between the scores that children with SLD took from the MOYA and the similar scores of the children in the normal group. When all subtests and total scores of MOYA filled by teachers and parents were compared, the scores given to children with SLD were found to be significantly higher than the scores given to the normal children. These findings show that MOYA offers significant results in distinguishing the symptoms of SLD.

The independent samples t-test analysis was conducted to determine whether there were significant differences between the scores that children with SLD achieved on the WISC-IV index scores and the similar scores of children in the normal group. As a result of the comparison between the groups, all WISC-IV index scores of the children with SLD were found significantly lower compared to the similar scores of the normal children.

Discussion

In this study, in the clinical assessment of children with a diagnosis of SLD, the distinguishing ability of the diagnosis of SLD was tested in the context of information obtained from multiple sources. In comparisons conducted between the groups, it was revealed that the scores that the children with SLD took from the SLD-CO Battery, WISC-IV, and MOYA scales were significantly different compared to the similar scores of the normal children.

In the study, children with SLD showed significantly lower performance in all areas of reading skill obtained from the SLD-CO Battery (reading speed, reading accuracy, reading comprehension, and fluent reading) compared to the normal children. Similarly, in terms of total reading scores, normal children performed significantly higher than the children with SLD. The reading skills-related findings of this study are consistent with the literature (Feretti et al., 2009; McLean et al., 2011; Sarıpınar & Erden, 2010). In the logistic regression analysis carried out to determine the power of the SLD-CO Battery to predict SLD, reading skills were identified to be a significant variable in the model and it was found that the power of reading skill to accurately classify SLD-diagnosed and normal children was 92.8%. All these findings reveal that the distinguishing power of the reading subtest of the SLD-CO Battery is good in assessing reading disorder, which is the main problem in SLD.

In the analyses conducted on the SLD-CO Battery writing errors, it was determined that children with SLD obtained significantly greater error scores in all three writing areas (dictation, writing by looking, and free text writing) than the normal children. This suggests that this finding of the study reveals similar results to studies in the literature (Costa et al., 2016; Katusic et al., 2009; Turgut et al., 2010). In addition, in the logistic regression analysis conducted to determine the power of the SLD-CO Battery to predict SLD, writing skills appeared to be a significant variable in the model, and it was found that the power of the writing skill to classify the SLD-diagnosed and normal children was high. Based on these findings, it can be said that the distinguishing power of the writing subtest of the SLD-CO Battery is good in the assessment of the writing disorder.

Another skill assessed under the SLD-CO Battery was in the area of mathematics. The results of the mathematics subtest of the SLD-CO Battery revealed that the total math skill score of children with SLD was significantly lower compared to the children who developed normally. Logistic regression analysis revealed that the mathematics subtest of the SLD-CO Battery was also significant and that the power of the math skill to accurately classify normal and children with SLD was high. All these findings suggest that the distinguishing power of the mathematics subtest of the SLD-CO Battery is good.

In addition to the subtests that assess reading, writing and math skills in the SLD-CO Battery, Gesell Development Figures, Clock Drawing Test, Right-Left Discrimination test, Sequencing skills test (sequencing of days, months, and numbers), Alphabet Skill test and Lateralization test were applied in the context of this battery. A result of the analyses, it was observed that children with SLD showed significantly lower performance than normal children in all the tests (except the lateralization) (Since the Gesell Development Figures test was interpreted over error scores, children with SLD took significantly more error scores than normal children). These findings reveal that children with SLD do not only experience difficulties in the academic area but also in the skill areas measured in other tests. This finding is also in line with the heterogeneous structure presented by theoretical approaches describing SLD in the literature (Bender, 2014; Moats & Lyon, 1993).

In this study, it was observed that in the context of the SLD-CO Battery, only the hand-eye lateralization and total lateralization scores were not significantly different between the two groups. A similar finding has also been identified in other studies in our country (Gürsoy, 2018; Turgut et al., 2010). As a result, it can be said that the claim that the use of the left hand and the preference for cross and mixed hand-eye is common in the SLD is not very valid.

Another assessment instrument used within the scope of this research was the MOYA. In the results of the study, it was observed that compared to the normal children, higher scores were given to the children with SLD in the total, reading, writing, mathematics, and attention subtests obtained from both the MOYA parent and teacher forms. Based on the reports of teachers and parents, this suggests that children with SLD experience more problems in the academic areas in question. This finding was also supported by the logistic regression results, which revealed that the total score of both MOYA teacher and parent forms strongly predicted SLD. When the studies in which MOYA is used in our country are examined, it is seen that their findings are consistent with the findings of this study (Gürsoy, 2018; Oguzhan, 2017). As a result, it is seen that the use of MOYA, in which information related to the symptoms of SLD or children's learning problems is obtained from teachers who have the opportunity to observe children better and from parents who know their children closely, provides useful information in the clinical diagnostic process.

In the study, another skill of the groups that was compared with each other is children's intellectual abilities measured by WISC-IV. As a result of comparisons made on index scores, it was found that all index scores (VCI, PRI, WMI and PSI) and FSIQ of the children with SLD were significantly lower than the normal children. These findings indicate that even though their general intelligence levels were normal, children with SLD achieved lower scores compared to the normal children. However, this finding should not create the impression that children with SLD have lower normal mental ability scores than others. Instead, it should be thought that this is a finding depending on the fact that the poor performance of children with SLD in areas such as working memory and processing speed especially in tests like WISC-IV that address cognitive structure as versatile affects their general intelligence level score. In other words, the fact that FSIQ scores of children with SLD were found lower than the normal children can be considered as an expected state due to the effect of the low working memory score. This study is the first in terms of using many scales in the clinical assessment of SLD in our country and comparing scores obtained from scales, whose norms are up-to-date, in normal and children with SLD. On the other hand, in our country, it is also important to determine the areas where children have weakness and strengths with detailed evaluation both in the diagnosis and in the planning of the intervention program. From this point of view, this research not only reveals the integrative aspect of detailed assessment, but also provides important data on the use of standard measurement tools such as the WISC-IV, SLD-CO Battery and MOYA instead of different assessment methods and personalized tools. Thus, by determining the general intelligence level of the child with WISC-IV, findings regarding intellectual disability, which is an exclusion criterion for SLD, will be obtained and detailed information about other cognitive structures of a child will be obtained. The information obtained from the SLD-CO Battery and the skills such as reading, writing and mathematics required in the comprehensive evaluation of the SLD are considered as a standard. Information obtained from the MOYA scale will be gathered from tertiary sources and it will be possible to compare them with the findings of the SLD-CO Battery. As a result, it is thought that by using all the scales used in this study together, the comprehensive and holistic assessment process that is persistently emphasized in the literature has been partially approached. As stated before, the basic components of the comprehensive assessment can be summarized as obtaining information from many sources (the use of standard and non-standard measuring instruments), taking into consideration all of the components in the definition of SLD (exclusive and inclusive factors), assessing the simple and complex cognitive abilities, and integrating information obtained from these measurements (NJCNS, 2010). It is thought that with these scales used in this research, many of the basic components in question will have been provided. As a result, the picture, emerging by the integration of all the information obtained from these scales, describes a child's existing learning problems. If the obtained information indicates that these problems are caused by SLD, it is thought that the job of practitioner will be easier in the process of making a clinical diagnosis.

Although this study makes significant contributions to the literature, it has some limitations. The first of these limitations is that children within the SLD group could not be classified according to their subtypes due to the insufficient sample size. In other words, evaluations were not made on a classification including reading, writing, and mathematics disorders. It is thought that in the future, conducting research with large and comprehensive samples by subjecting the SLD group to a separate classification will reveal useful results. Another limitation of the study, on the other hand, is that some children with SLD had ADHD comorbidity. However,

although the sample size was limited in this study, the scores obtained from all scales were compared between the children diagnosed only with SLD and the children diagnosed with SLD+ADHD. In the results obtained, it was found that children with only SLD diagnosis had more difficulty in writing and sequencing skills than children with SLD+ADHD in the subtests of the SLD-CO Battery. This may indicate that in cases where ADHD accompanies SLD, there is no increase in basic symptoms such as reading, writing and mathematics. However, when the MOYA subtests were examined, it was reported that the group with SLD+ADHD had more attention problems than the group with only SLD diagnosis, according to the reports of both teachers and parents. This reveals that the distinguishing power of the attention subtest of the MOYA is good in evaluating the attention problems accompanying the learning disability. In other words, in the evaluation of ADHD accompanying SLD, MOYA's attention subtest can give an idea to the clinician in the context of the information obtained from the teacher and parents. In the comparison made in the context of WISC-IV index scores, it was found that the Processing Speed scores of children with a diagnosis of SLD+ADHD were significantly lower than those of children with only a diagnosis of SLD. This finding obtained with a limited sample reveals that the processing speed score is more affected by the WISC-IV scores, especially if ADHD accompanies SLD.

In other words, even though it is an early finding, it can be interpreted that the decrease in PSI performance in children with SLD+ADHD may be related to the attention problems accompanying SLD. However, it is thought that in future studies, both comparing the children diagnosed with SLD within themselves and comparing them by classifying according to their ADHD comorbidity status will provide more comprehensive and important information.