Psychology in Russia: State of the Art
Volume 11, Issue 2, 2018

Russian Psychological Society
Lomonosov Moscow State University

Luria's syndrome analysis for neuropsychological assessment and rehabilitation

Yulia Solovieva* & Luis Quintanar

Faculty of Psychology, Puebla Autonomous University, Mexico

*Corresponding author. E-mail: Yulia.solovieva@correo.buap.mx

Introduction. Neuropsychology, as a science, studies various possible relationships between psychological processes and the brain in cases of both normality and diverse pathologies. Such relationships might be established and understood in different manners.

Background. A.R. Luria proposed a unique and specific approach by identifying different brain units. His conception is not completely understood, and is even less used in diagnosis and rehabilitation today. His conception of the systemic and dynamic representation of human actions in functional brain systems is the background for our study. Psychological conceptions of the stage-by-stage formation and orientation for action, and their use in rehabilitation, are taken into account.

Objective. The objective of our report is to share our application of Luria's methodology of syndrome analysis through the presentation of the results of assessment and rehabilitation.

Design. Our study presents a unique case, along with data on the person's assessment and rehabilitation, specifically, a qualitative assessment of an adolescent patient with severe brain injury.

Results. The assessment identified severe problems in the patient's programming and self-control functions, together with spatial disorganization. The process of neuropsychological rehabilitation, as applied in two stages, showed positive effects on the activity and personality of the patient. Goals, stages, and examples of formation of actions in rehabilitation, with their results, are described.

Conclusion. We conclude that the systemic and dynamic approach in neuropsychology might be applied to assessment and rehabilitation. We discuss the necessity of establishing bridges between the psychological theory of actions (rather than functions) and the systemic representation of actions by functional brain systems.

***Keywords*:** neuropsychological rehabilitation, concepts of neuropsychology, functional diagnosis, qualitative neuropsychology, brain injury rehabilitation.

Introduction

Luria's neuropsychological theory is well known within the scientific community. A huge number of citations of his work can be found in publications on neuropsychology. At the same time, his theoretical conception isn't completely understood,

ISSN 2074-6857 (Print) / ISSN 2307-2202 (Online)

doi: 10.11621/pir.2018.0207
http://psychologyinrussia.com

and is even less used in the practice of diagnosis and rehabilitation today. The citations are frequently related only to his concept of three functional brain units, which he described as follows. The first unit is related to subcortical systems of general brain activation; the second to the posterior cortex responsible for perception and memory; and the third unit is responsible for programming and control, which is called "executive functions" in modern literature (although this term was introduced by Lezak (1982) and never used by Luria himself). Luria's other important concepts — such as functional systems, neuropsychological factors, and neuropsychological syndromes — are frequently missing in Western literature. Such omissions, in our opinion, change the whole sense of Luria's conception of brain functioning and the complex representation of cultural psychological processes in central nervous system.

It is necessary to remember that A.R. Luria's neuropsychological theory didn't appear in a vacuum. In our opinion, historical and cultural neuropsychology was created as a branch of the general conception of historical and cultural psychology founded by L.S. Vigotsky (Akhutina, 2016; Solovieva & Quintanar, 2017; Toomela, 2014). Luria himself stressed the relationship of all his work to the theory of Vigotsky (Akhutina, 2003).

According to Luria's theory, higher psychological processes can't be actually "localized" in the brain in the sense of rigid and unique connections between mental processes and specific brain zones. First of all, psychological processes should be understood as cultural by nature, originating in the activities of communication, learning, play, and so on. During the first stage of development, such psychological processes are shared between different participants, typically between adult and child, and are inter-psychological. Later on, depending on individual development and passing through a number of stages, these psychological processes become independent self-regulated activities and intra-psychological processes. The duration of the whole process might differ depending on different social, historical and cultural contexts; the functional stage of the individual's central nervous system; previous development; educational level; and other aspects.

For example, take the writing process, which is used by Luria and his followers on many occasions (Luria, 1975; Akhutina, 2001, 2004, 2016 a). The same psychological processes, such as writing, may have different brain representations depending upon the grade of acquisition of this activity — i.e., when it is learned at school. Writing is represented as a complex functional system when it is first learned at school. The same process becomes more automatic and reduced in the structure of its components by the time the pupil finishes school. Different components or neuropsychological factors must be taken into account within the analysis in the process of writing, such as regulation and control, spatial synthesis, and so on.

The use of external tools might also be mentioned as an important factor in the dynamics of brain organization (Kotik-Friedgut & Solovey, 2003). Some systems of writing might depend mostly on spatial and visual processes, and less on kinesthetic and phonemic discrimination. Cultural features, bilingualism, or knowledge of diverse languages are important conditions for shaping the functional system of writing (Kotik-Friedgut, 2006). Nevertheless, the majority of publications never takes into account the functional or cultural context of the acquisition of the writ-

ing skill, and presents it as a unique function of the brain's organization. The same situation occurs with reading (Solovieva & Quintanar, 2014) and other abilities, such as drawing (Solovieva & Quintanar, 2017a).

From this point of view, the task of neuropsychology isn't to describe the precise localization of one or another function in the brain, but to study different kinds of psychological processes in the brain, in light of the cultural and social differences of the subjects and patients with brain damage. On the one hand, the general theory of the cultural and historical origin of psychological processes helps us to understand the specific difficulties of patients with brain damage at different ages and stages of psychological development. On the other hand, neuropsychological assessment and rehabilitation help us to understand complex functional changes in the representation of psychological activities in the human brain.

One of the important objectives of neuropsychological assessment in cases of brain injury is to discover the specific neuropsychological syndromes involved. Luria himself has described the classification of different types of aphasia in adult patients with acquired brain injury (Luria, 1947; Tsvetkova, 2016 a, b; Ardila, 2010; Akhutina, 2016 b). Yet, it is necessary to recognize that cases of acquired brain damage in adults don't represent all the possibilities for applying syndrome analysis in cases of brain damage or developmental disabilities and dysfunctions. The aim of our present article is to show the usefulness of the methodology of Luria's syndrome analysis in one case of acquired brain damage in an adolescent patient. This case is interesting because it shows new methodological possibilities for using syndrome analysis for assessment and rehabilitation. This is also interesting because we present the case of an adolescent whose psychological age differs from that of primary school children and whose treatment diverges from traditional work with adult patients with brain damage.

The concept of psychological age, proposed by Vigotsky (1984) and developed by Leontiev (2009) and Elkonin (1995), with the inclusion of the activity conception, shows its importance for neuropsychological assessment and rehabilitation in this case. Consideration of a person's dominant activity at a certain age serves as the basis for creating a program for the patient's rehabilitation and development. The objective of our report is to share the experience of applying Luria's methodology of syndrome analysis, and to show how the procedures of systemic functional diagnosis must lead to systemic procedures in rehabilitation.

Before starting our concrete presentation of this case, however, we would like to explain precisely how we understand the method of syndrome analysis proposed by A.R. Luria (1947, 1982).

Syndrome analysis

Among the new specific terms and concepts proposed by Luria, perhaps the most complex is the concept of the neuropsychological syndrome. We would like to emphasize again that this concept is practically never mentioned in publications, unlike Luria's concept of three functional units of the brain.

On the majority of occasions, neuropsychologists provide assessments of isolated brain functions with the aid of psychometric procedures. Their diagnosis refers to such terms as attention or memory disorders, dyslexia. and so on. All these terms are really far distant from the conception of systemic and dynamic represen-

tation of human actions in functional brain systems. Equally bad or worse is the situation where rehabilitation is directed toward isolated therapies, such as conductive exercises for isolated functions.

Traditionally, a clinical syndrome is understood as a combination of symptoms or signs, which can be detected in patients. Within cases of learning disabilities, syndromes are connected to one or another function which has been damaged in the patient. The damage to a function is determined by the presence of symptoms or difficulties in that function. For instance, symptoms of lack of attention, difficulties with concentration, and distribution of attention, are all labelled under the syndrome of "attention deficit disorder."

Such a practice eliminates the distinction between "symptoms" and "syndromes." As we will see, symptoms of lack of concentration and distribution of attention lead to a diagnosis of the syndrome of "attention deficit." At the same time, it is obvious that symptoms of difficulties with attention might be related to entirely different causes or reasons. For example, lack of motivation might be a cause for absence of attention. Lack of understanding might be another cause. The absence of or difficulties with attention might be caused by a diversity of reasons.

The situation becomes more complex if we take into account the level of the functional state of the central nervous system, instead of considering it on only one level. It is well known that, from the point of view of brain mechanisms, a variety of causes, expressed at different levels, might lead to difficulties with attention (Solovieva & Cols., 2016; Machinskaya & Cols., 2014, 2016). For example, organic or functional difficulties with the third, first, or both the first and third brain units can cause difficulties with attention (and not only attention). In one recent publication, we presented the case of a child with symptoms of attention deficit disorder, who had positive functioning of all brain units but a low level of psychological preparation for school learning and negative aspects of social situation of development (Solovieva & Cols., 2017). Yet, classification of learning disabilities continues to talk about the syndrome of attention deficit disorder and the impossibility of differentiating between "symptoms" and "syndromes."

The traditional approach is to try to identify isolated processes, for example, problems with particular brain structures or brain systems. From this standpoint, attention, memory, or thinking may present negative symptoms (difficulties or absence) related directly to the same brain structures. Usually, when one is speaking about syndromes, isolated functions are taken as the basic level and unit of analysis. Such functions usually are: memory, attention, executive functions, thinking, perception, and language. The symptoms and syndromes of the difficulties refer simultaneously to the same functions, and are reflected in the present official classifications (DSM-V, 2014).

An alternative approach would be to identify a new level of analysis of the difficulties: the psychophysiological or neuropsychological level (Luria, 1947). This level is not related to processes or functions, but to functional brain mechanisms, which appear as the combination of primary structures and cultural human activity. An example of such mechanisms might be the general level of cortical activation, of spatial integration, or of programming and control.

The same mechanism usually belongs to different functional systems. For instance, the mechanisms of programming and control take part in solving math-

ematical problems and in the writing process. While assessing a patient's difficulties, we wouldn't speak of attention problems, or difficulties with writing or with mathematics, but of the syndrome of difficulties of programming and control as the unique cause of the patient's difficulties. All cultural actions within the learning process or intellectual activity will suffer as the consequence of insufficient programming and control. Any action which doesn't require programming and control — for instance, automatic and memorized information such as direct counting from 1 to 10 — will be intact in the patient's functioning.

We propose to follow Luria's theory by using functional brain mechanisms as an essential level of neuropsychological analysis, and as the basis for finding neuropsychological syndromes for assessment and rehabilitation (Akhutina & Pilayeva, 2012; Mikadze, 2008; Glozman, 2013; Glozman, & Potanina, 2004; Solovieva & Quintanar, 2015, 2016).

It is important to stress that the determination of a patient's weak factor is not sufficient to determine his/her whole syndrome; a different level of analysis is necessary. As in Luria's proposal for classification of aphasia, different levels for analysis of neuropsychological syndromes were established (Luria, 1947, 1970, 1973). These levels are: 1) the level of the central nervous system; 2) the level of neuropsychological factor or mechanism; 3) the level of intellectual activity of the patient; and 4) the level of verbal activity.

Using these levels, a scheme for qualitative analysis of a syndrome, instead of a psychometric or isolated method of assessment of cognitive functions (Wechsler, 1987), might be proposed. The first level, the level of the central nervous system, should be confirmed by specific techniques such as neurological, neuropsychological, or electrophysiological testing. The second level in this schema is the most important for establishing a neuropsychological syndrome. This is the level of psychophysiological mechanisms as a neuropsychological factor, which has to be evaluated functionally during the assessment process. Another level of analysis is the level of the patient's practical and intellectual activity at his/her corresponding psychological age.

An analysis of psychological age is essential for planning a program for rehabilitation. This age level may include actions of school learning or symbolic actions at preschool age (Solovieva & Quintanar, 2015). The fourth level, the level of verbal activity, is also important and interesting for syndrome analysis and proposing further neuropsychological rehabilitation. At this level, the neuropsychologist can characterize the patient's verbal activity, oral and written comprehension, and production, according to the central neuropsychological factor established at the second level.

The levels of analysis within the system of neuropsychological syndrome are:

1) Which neuroanatomical structure of the central nervous system is involved.
2) Deficient neuropsychological factor/ factors.
3) Practical and intellectual actions corresponding to the psychological age and personality of the patient.
4) Oral and written comprehension and production, disturbed as the consequence of the weak neuropsychological factor.

Each level should be characterized according to each child's positive and negative aspects of development and learning. Such levels could be studied in an interdisciplinary manner, including by specialists in neuroimaging or electrophysiology (Solovieva et al. 2013; Machinskaya, Sokolova & Krupskaya, 2007; Solovieva & Cols., 2016). We understand that the logic of syndromic analysis is rare in neuropsychological practice, and that the use of the psychometric perspective is much more popular. Future studies would allow us to identify other syndromes precisely, and to improve the whole qualitative methodology. Such a methodology differs essentially from the quantitative approach, and could not be easily applied for statistical analysis of data, or for psychometric assessment of large populations (Plaisted et al., 1983; Teeter, 1986; Roselli et al. 2004, 2010).

It is obvious that our approach to syndrome analyses requires specific instruments for assessment. All protocols and instruments for qualitative analysis should be specifically tailored for each different language and psychological age.

The usefulness of a qualitative approach consists in the possibility of clinical-personified assessment of unique cases, which is very helpful for proposing strategies of correction and development. It is also useful for establishing a clear relationship between the levels of the patient's nervous system, neuropsychological syndrome, psychological activity, and personality. The important advantages of such a complex integrative approach to clinical cases with development and learning disabilities is that it integrates information on different levels of analysis: i.e., the brain neural structures involved in brain damage, the brain functional mechanisms as neuropsychological factors, and the activity and personality of each specific patient.

The Clinical Case

This study concerned the case of an adolescent patient with traumatic brain injury. The participant was 12 years old at the moment of the accident. The boy was run over by a bus on the street. He was admitted to the hospital presenting a loss of consciousness, multiple bone fractures, and optic nerve detachment. This situation led to vision loss in the left eye.

The computed tomography (CT) scans (see Figure 1) showed severe cerebral edema, frontal hemorrhagic contusion, intravenous hemorrhage, left lamellar epidural subdural hematoma, and a left papillary laminar fracture, as well as fractures of the homolateral maxillary at the lateral wall level, left maxillary, sphenoidal ethmoidal homosenus, and left orbital floor.

The patient remained in an induced coma for 18 days and remained in the hospital as an inpatient for two months. After the event, the patient was not able to talk properly or walk independently. Severe problems with spatial orientation were evident. The patient received motor and language therapy for four months. During this period of time, the patient suffered from an anxiety crisis, and presented constant changes of mood, impulsivity, and irritability. These symptoms were controlled with psychiatric medical treatment.

One year after the traumatic brain injury, the patient attended the Neuropsychological Service at the University Hospital provided by the Master Program in Neuropsychological Diagnosis and Rehabilitation of the Faculty of Psychology of

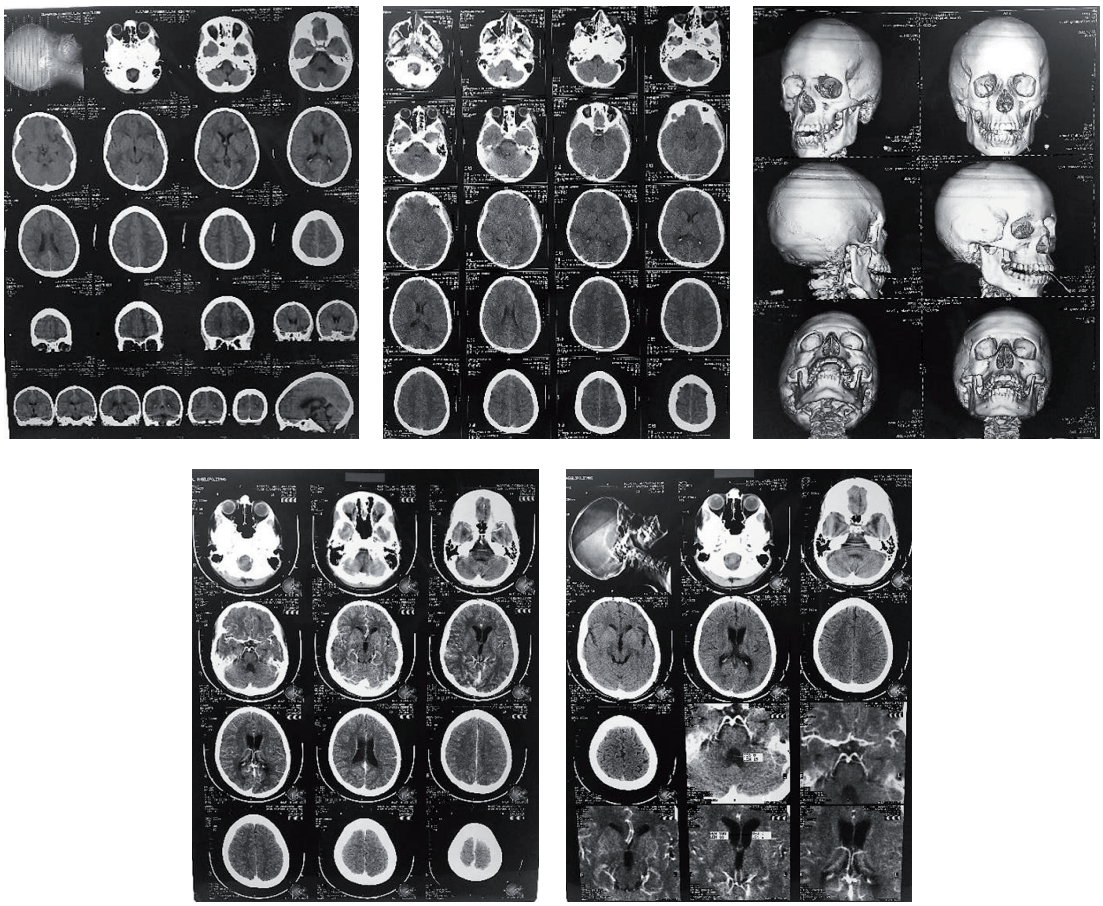

Figure 1. CT scan 3 months after the accident

Puebla Autonomous University. He could hardly be involved in the learning process, and personal problems with communication with family and friends persisted. The patient had difficulties with concentration of attention, self-regulation, planning, mental flexibility, abstraction, visual-spatial ability, and language production and comprehension.

Method

Neuropsychological assessment proceeded for four individual sessions. After that, a program for neuropsychological rehabilitation was designed and applied in 70 individual sessions over two periods of four months, with a six-month interval in-between. Later on, final neuropsychological assessment was provided. Qualitative analyses of the mistakes and achievements were carried out in light of the findings of syndrome analysis.

The following instruments and protocols for qualitative assessment were used:

- Brief neuropsychological assessment for adults (Quintana & Solovieva, 2013).
- Assessment of school success (Solovieva & Quintanar, 2012).
- Neuropsychological assessment of spatial integration (Solovieva & Quintanar, 2012).

- Neuropsychological assessment of voluntary activity (Quintanar & Solovieva, 2010).
- Neuropsychological assessment of verbal activity (Quintanar & Solovieva, 2010).
- Clinical assessment with the Aphasia Puebla-Sevilla test. (Quintanar, Solovieva & León-Carrión, 2013).
- Assessment of intellectual activity (Solovieva, 2014).

All these instruments were created on the basis of A.R. Luria's neuropsychological theory, particular features of the Spanish language, and the concept of the zone of proximal development (Vigotsky, 1984). In the case of neuropsychological assessment, this latter concept refers to allowing flexibility in the order and procedure of implementing assessment tasks; the ability to repeat tasks; and external help from the psychologist, through wide-ranging verbal and non-verbal communication with the patient. These features of assessment are never considered during the computerized or psychometrical procedure, which is especially relevant considering the psychological age of the patients. In our case, the psychological age was that of a teenager, a time when the patient was especially affected by, and sensitive to, any kind of negative attitude toward his difficulties or disabilities.

Qualitative assessment revealed that the patient had severe difficulties with two functional brain mechanisms: programming and control, and spatial integration. The specific and typical mistakes noticed in all tasks and interaction during assessment were the following: verbal and mental perseverations; inversions; misunderstanding of complex grammatical structures; the inability to organize written sentences and texts; the inability to understand texts; and the inability to follow rules and order in all kinds of complex intellectual tasks.

An EEG was also applied with posterior qualitative analysis of the data (Machinskaya & Cols, 2014, 2016). The results of the EEG analysis showed the presence of local pathological patterns in both the anterior frontal and posterior (TPO) zones of complex information integration (frontal and posterior zones).

After assessment, the program for neuropsychological rehabilitation was created and applied in the two periods during one year, with the six months interval in-between.

Program of rehabilitation

Both periods of rehabilitation consisted of 35 individual sessions carried out two times per week, for a total of 70 sessions. The duration of each session was between 60 and 90 minutes, depending on the condition of the patient and other external considerations.

The program was designed according to the theoretical principles of activity theory (Leontiev, 1960, 2003; Asmolov, 2000) and the psychological concept of orientation (Galperin, 1998). This theory, applied to neuropsychological rehabilitation, opens up the broad potential for creative design of the tasks during the various stages of the program; planning of the sequence of the stages of the program with corresponding goals; and flexible and creative implementation of the tasks with constant emotional and intellectual interaction between the psychologist and the patient. The tasks took into consideration the fact that combining of learning activity with personal communication with adults and classmates is the predominant

activity at an adolescent age. Self-regulation, self-verification, and self-emotional criticism were the criteria for marking the patient's progress.

The achievements made in each session were evaluated continuously, allowing the restructuring of the program if necessary; all necessary changes and modifications were applied throughout our work. All tasks were structured with a degree of increasing complexity, following the stages for formation of intellectual actions proposed by Galperin (1992), and used in our previous studies related to development and correction in cases of adolescent patients (Solovieva, Bonilla & Quintanar, 2006, 2012). The stages used in our program were the stages of materialized, perceptive, and verbal actions.

The main goal of our program of neuropsychological rehabilitation was to re-establish two of the brain mechanisms involved: self-control and self-regulation of the voluntary action during complex intellectual activity, and integration of spatial information at different levels (materialized symbolic, perceptive, and verbal).

Period 1

The first period of rehabilitation was dedicated to introducing the strategies for regulation and control in practical day-to-day tasks and intellectual actions. External control provided by the psychologist during joint actions directed to concrete interesting goals was guaranteed. Spatial integration was also included as a component of the rehabilitative tasks. The stages of actions during this first part of neuropsychological rehabilitation were: materialized actions, perceptive actions, and verbal actions.

As an example of the tasks used on materialized, perceptive, and verbal level, the work with geographic maps might be mentioned. Our previous experience had shown that geographic maps and schemas are very useful for reflexive understanding of spatially meaningful information (Rodríguez et al., 2011).

In order to improve his ability for spatial representation, the patient was asked to locate continents, countries, oceans, and cities on maps. At the materialized stage, the patient had to show the direction and location of a geographic object (a city or a country, and so on) with the aid of external means: a plastic arrow or compass. The patient had to verbalize whether the city was above, below, to the left, or to the right in relation to another geographic object. At the perceptive stage, the patient had to paint with a chosen color the direction from one geographic point to another. A specific "orientation card" was used to facilitate the connection between the verbal expressions of "left=west"; "right=east"; "below=south"; "above=north."

At the level of verbal actions, the patient had to identify the relationship of one geographic point to another one using both kinds of verbal expressions: spatial prepositions with geographic terms. The patient was asked to write down these expressions as sentences describing the geographic relations. Different kinds of maps of cities, countries, continents, and the world were used during the sessions. Different routes were used to reach a point on the map. Localization of the geographic objects in a coordinate system was introduced and used.

Other activities used during rehabilitation for this purpose were the drawing of schematic symbolic models following the coordinate system, and the prediction of the position of colored circles after rotating the circle. The patient was asked to move a circle containing a sequence of colors at the materialized stage; to draw the corre-

Figure 2. The model of a circle for training in rotation

sponding colors at the perceptive stage, and to say and write down the change at the verbal stage (see Figure 2). The perceptive stage required drawing of positions of colors according to mental rotation. The verbal stage implied oral explanation of the positions of the colors, and writing it down with appropriate sentences.

Figure 2 shows an example of a pattern used during the rehabilitation. In this task, the patient had to identify the order of the colors and to reproduce them in an empty circle. At first, simple models were used; more colors and more complex shapes were used later on.

Figure 3 shows a more complex example for the training of materialized, perceptive, and internal (mental) rotation. These levels of the tasks correspond to the proposed levels of formation of action in activity theory, and the conception of the formation of action by stages adapted for interactive tasks (Galperin, 1998; Solovieva, 2014).

In these examples, we can see that the Figures 2 and 3 show circles with a given color pattern. The patient has to move, to imagine, and to express orally the next position of each color from another perspective (back, forward, left, right) during rotation.

The tasks of identifying different features, the classification of objects according to spatial features, and the building of models with blocks with no obvious division between elements were also used. Similar tasks were proposed by A.R. Luria for developing creativity through constructive tasks as a kind of advanced intellectual action for work with pre-school children (Luria in Solovieva & Quintanar, 2013).

Figure 3. The model of complex circle for training of rotation

Period 2

The second period of rehabilitation was dedicated to re-establishing the patient's self-regulation and control in more complex intellectual tasks. Spatial integration was included in the verbal actions of producing sentences and texts, including the development of a plan for each text.

Each activity was guided by the psychologist, who provided external "orientation cards" to enhance self-organization, planning, and structure (Talizina, 2009). Each card contained the steps to be followed in order to solve each task. At first, the cards included detailed steps. Next, the cards indicated only general key steps for the tasks. After some sessions, when the patient could remember the content of the cards, he was

asked to perform the task without any card and only mention the steps out loud. Similar groups of tasks with different variants were used in order to guarantee the best level of generalization and independent self-regulation on a verbal level (Talizina, 2008).

The goal of each activity was established at the beginning of the task, and the patient was encouraged to verify and correct his own work. The types of activities proposed for this purpose were mainly mathematical, according to the patient's needs. Talizina's (2001) methodology for "training of mathematical skills" was followed, with some modifications in light of the needs and motivations of our patient. The purpose of these tasks was the development of basic mathematical concepts, and to guarantee the reflexive understanding of the procedure for solving arithmetic problems independently.

The following steps for solving the problems were offered to the patient:

1. Analyze the problem by identifying important data with different colors, according to your choice.
2. Find the final question and missing information.
3. Establish the significant relationships between the elements of the problem.
4. Explain in your own words the content of the problem.
5. Write down the steps for solving the problem with symbols or a diagram.
5. Solve the problem by steps according to the diagram.
6. Write down the result.
7. Compare the result to the original posing of the problem.

The content of the "orientation card" was applied to the process of problem solving. All tasks were performed as joint activities between the psychologist and the patient, so that the patient was never left alone with his difficulties or hesitations. The adult provided all necessary help at all moments, both in understanding the content of the "orientation card," and the content of each problem to be solved during the process of rehabilitation. The tasks were presented with the help of external symbols at the first stage, with the help of perceptive symbols at the second stage, and only at the level of written and oral language at the third stage.

The tasks for abstract thinking, inference, and judgment

The complex tasks involved analysis of the content of artistic paintings and literary texts. "Orientation cards" were also used for these tasks in order to provide the steps needed for perceptive and verbal analysis of the content of visual and verbal narrative information.

In the case of the analysis of the artistic paintings, a list of questions was presented to the patient such as:

1. What are the interesting and important elements you find in the painting?
2. Where are these elements located and in what relation one to another?
3. Who (what) is the main character (feature) in the picture?
4. Which elements are relevant (irrelevant) in this painting?
5. What can you say about the natural elements (historical events)?
6. What can you say about the emotions expressed by the characters?
7. What is happening in the picture?

After such a detailed analysis, guided by the psychologist, the written description and a title for the painting were elaborated. The patient was always asked his opinion about the content and the title, so that he could make any necessary correction or improvement of his answers at all times, and even in later sessions.

In the analysis of the content of literary text, similar "orientation cards" were provided and used constantly. The patient was asked to read each paragraph of the text carefully, underline unknown words, and clarify their meanings in the dictionary. The patient had to write down a sentence for the content of each part of the text, including the main idea for each paragraph. The patient was asked to make inferences and hypotheses during the reading of each part of the text, to relate one part to another, and to verify his ideas as he progressed with the reading of the text. The patient was asked to identify relevant elements of the text, and to state his personal judgment about the characters, emotions, situations, and events of the story.

Different kinds of narrative and artistic texts were used in the rehabilitation. The patient himself took an active part in selection of the texts.

Complex grammatical structures

As the patient had severe problems with understanding complex grammatical structures of oral and written speech, specific tasks were designed to improve his written and oral language abilities. Among such tasks were the following: classification and comparison of grammatical categories of words by their semantic, morphological, and grammatical features; identification of root words and the exploration of their grammatical meaning while adding or subtracting suffixes and prefixes to nouns; transforming words from nouns to verbs or adjectives; solving word analogies; and analyzing sentences according to the syntactic functions of the words in the sentences (Solovieva, 2016). Creation of own variants of categories of words with posterior inclusion in sentences with different syntactical functions were used. "Orientation cards" with the essential features of each term and its grammatical or syntactic category were always included.

Results

Neuropsychological assessment was carried out after both the first and the second periods of rehabilitation. Important positive changes were observed at the end of each period of rehabilitation. Some examples of the fulfillment of the tasks of neuropsychological assessment before rehabilitation, and after the first and second period of rehabilitation, are presented below. The tasks permitted us to identify mistakes of simplification of the elements and problems with the patient's spatial integration in our initial assessment, and also after the first period of rehabilitation. Positive changes and the disappearance of

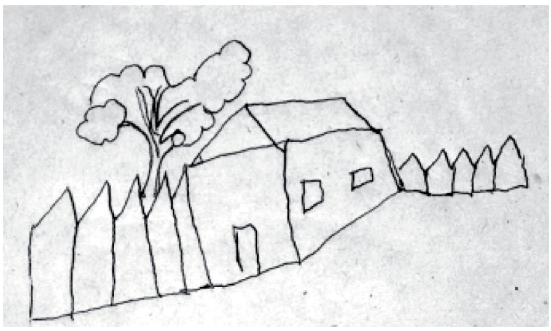

Figure 4. The copy of a house during initial assessment

Figure 5. The copy of the house after thefirst period of rehabilitation

Figure 6. The copy of the house after the second period of rehabilitation

mistakes may be noticed in the fulfilment of the tasks after the second period of rehabilitation.

Figure 4 shows examples of the fulfillment of the task of copying the drawing of a house during the initial assessment, and after the first period of rehabilitation. Figure 5 presents the same task, while Figure 6 shows positive changes in the patient's copying after the second period of rehabilitation.

As a result of the first period of rehabilitation, the patient became able to fulfill tasks of regulation and control in activities such as playing table games and solving simple problems. The patient could understand and independently compose sentences describing spatial relations. At the same time, specific difficulties with construction and productions of written texts, solution of mathematical problems, and self-organization persisted.

After the second period of rehabilitation, the patient was able to organize his own complex verbal written expression. Such ability is essential for learning in general. Figure 7 presents an example of independent writing by the patient as the

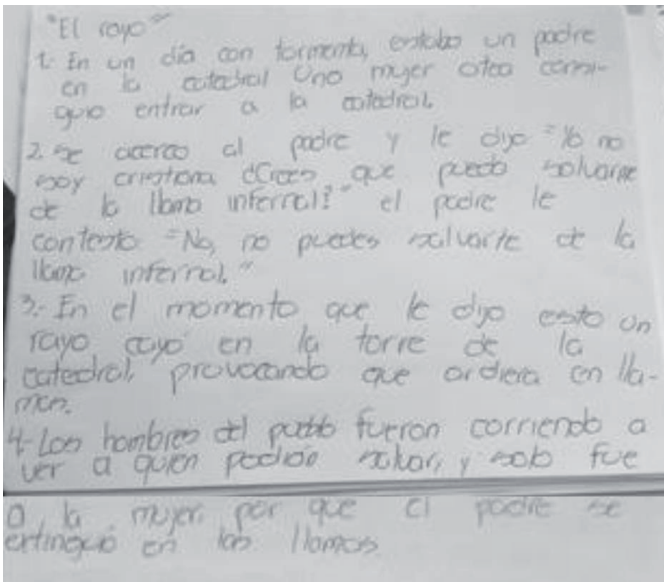
"El rayo"
1. En un día con tormenta, entraba un padre en la catedral. Una mujer otra comi-
guo entrar a la catedral.
2. se acerco al padre y le dijo "Yo no soy cristiana ¿Crees que puedo salvarme de la llama infernal?" el padre le contesto "No, no puedes salvarte de la llama infernal."
3. En el momento que le dijo esto un rayo cayó en la torre de la catedral, provocando que ardiera en lla-
mas.
4. Los hombres del pueblo fueron corriendo a ver a quien podrían salvar, y solo fue
a la mujer, por que el padre se extinguió en las llamas.

Figure 7. Independent writing at the end of the second period of rehabilitation

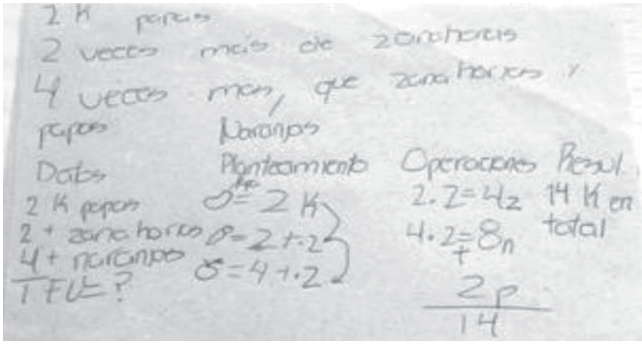

Figure 8. Solution of the problem after the second period of rehabilitation

result of the work on this stage. It is possible to note the adequate organization of ideas and of space in the text, written independently by the patient, in which he describes what he did during his vacations (the text is in Spanish).

The patient also became able to create and to solve mathematical problems independently after the second period of rehabilitation. Figure 8 shows an example of problem-solving by the patient according to an external symbolic scheme for reaching the solution. Such problems weren't accessible to the patient during initial assessment.

The results show how the process of rehabilitation allowed the patient to achieve positive reintegration into school activities and communication with his family and friends. The patient became able to complete individual tasks at home; he became more responsible and motivated in all kinds of practical and intellectual activities in his life. Negative emotions disappeared. The patient became reflective, self-critical, and involved in his own achievements and difficulties. Impulsive behavior disappeared. His parents have described positive changes in their day-to-day communication with him.

Discussion

The results of this study permit us to confirm the usefulness of Luria's proposal of the concept and method of the neuropsychological syndrome for assessment and rehabilitation. The concept of the neuropsychological syndrome is useful both for assessment in cases of acquired brain injury, and for the creation and implementation of a program for rehabilitation. Implementation of this methodology was possible and useful for a patient of the psychological age of adolescence.

The patient's neuropsychological syndrome identified in our study, according to established levels of analyses, was as follows:

1) Damage to the neuroanatomical structure of central nervous system of an adolescent with brain lesions in both the left anterior and posterior cortical regions;
2) Weak neuropsychological mechanisms: regulation and control, and spatial integration;
3) Practical and intellectual actions corresponding to the psychological age and personality of the patient: all types of secondary school intellectual ac-

tions, which include active self-regulation and spatial integration (specifically difficulties with written production and problem solving);

4) Complex verbal actions disturbed as the consequence of the weak neuropsychological factor: difficulties in understanding and self-expression in oral and written sentences and texts with complex grammatical and syntactical structures.

It is possible to note how the same neuropsychological factors (mechanisms) take part in a variety of the difficulties presented by the patient. There is no need for a separate assessment of language, memory, attention, reading, writing, or executive functions in our patient. We believe that neuropsychological factors of regulation and control and spatial integration, applied to psychological age of an adolescent, are quite enough to understand the neuropsychological syndrome of our patient, and to provide a useful program for rehabilitation. We insist that such an approach is close to the one expressed in all known publications of Luria, and in his famous short novels dedicated to the history of only one patient (Luria, 1987).

One particularly interesting feature of this patient's syndrome was the presence of two central neuropsychological factors: difficulties with regulation of control and with spatial integration. The first difficulty was the consequence of the brain lesion in anterior brain region, while the second one was related to posterior brain region. Both lesions were located in cortical areas of the left hemisphere. Classical cases of patients with aphasia or patients with frontal syndrome presented in Luria's publications were adults with local brain damage, or a series of ischemic events with unique neuropsychological factors identified as the psychophysiological reason for the difficulties (Luria, 1947). Our study presents the case of combined neuropsychological factors in an adolescent patient with acquired brain damage.

At the same time, it is necessary to remember that Luria's theory didn't appear in a vacuum. His theory is a logical continuation of Vigotsky's conception of the zone of proximate development as a cultural development shared between an adult and a child. In our case, the zone of proximate development was provided by the psychologist in goal-directed tasks at different levels of actions. All actions were significant and motivated actions for the age of adolescence.

We want to stress here that creation of such tasks would be impossible without the continuation of the great ideas of Vigotsky in the works of representatives of his activity theory (Leontiev, 1975; Galperin, Zaporozhets, Elkonin, 1987; Talizina, Solovieva & Quintanar, 2010). The central concepts of this theory, such as identifying the central dominant activity of each psychological age, the role of the activity of verbal and non-verbal communication, and the formation of intellectual actions by steps and external-internal orientation, were created during the same historical period as the main concepts of Luria's neuropsychological theory. We believe that modern conceptualization of these ideas should be one of the important tasks for neuropsychologists and psychologists in general.

We dedicate our work to the memory of A.R. Luria and P.Ya. Galperin, who constantly guide us in our work with patients of different ages in Latin America, on the 115th anniversary of their births.

Conclusions

1. Luria's syndrome analysis is a qualitative neuropsychological method, and should be understood as the basis for assessment and rehabilitation.
2. Syndrome analysis is useful for extra space work with adolescent patients with acquired brain injury.
3. Formation of joint cultural activity as the origin of psychological development and also of neuropsychological rehabilitation in cases of brain injury. Specific stages and goals should be considered for the elaboration of concrete programs.
4. Subject-object (subject) participation in motivated activity according to psychological age should be taken into account while working with adolescents with brain injury.

References

Akhutina, T.V. (2001) Neuropsychological approximation to diagnosis and correction of learning difficulties in acquisition of writing. In: M.G. Chrakovskaya (Ed.) *Modern approach to diagnosis and correction of speech disorders.* San Petersburg, University of San Petersburg., 195–213.

Akhutina, T.V. (2003). L.S. Vygotsky & A.R. Luria: Foundations of neuropsychology. *Journal of Russian and East European Psychology DOI: 10.2753/RPO1061-0405370213*, *41*(3–4), 159–190. https://doi.org/10.2753/RPO1061-0405370213

Akhutina, T.V. (2004). Writing: Assessment and remediation. In T.V. Akhutina, J.M. Glozman, L.I. Moskovich, & D. Robbins (Eds.), *A.R. Luria and Contemporary Psychology: Festschrift celebrating the centennial of his birth.* New York: Nova Science Publishers: 125–144.

Akhutina, T.V. & Pilayeva, N.M. (2012). *Overcoming learning disabilities. A Vigotskian-Lurian neuropsychological approach*. Cambridge, Cambridge University Press. DOI: 10.1017/S0956796812000081

Akhutina, T.V. (2016). Luria's classification of aphasias and its theoretical basis. *Aphasiology*, 30(8), 878–897. https://doi.org/10.1080/02687038.2015.1070950

Akhutina, T.V. (2016). Development of the Russian neuropsychological school according to the literature and archival sources. History of clinical and fundamental neurophysiology in Russia: Contribution to European neuroscience. *Abstracts of International Seminar FENS, 93–95. M.: MSMSU.*

American Psychiatric Association. (2014). *Guía de consulta de los criterios diagnósticos del DSM-5®*: Spanish Edition of the Desk Reference to the Diagnostic Criteria From DSM-5®. American Psychiatric Pub.

Ardila, A. (2010). A proposed reinterpretation and reclassification of aphasia syndromes. *Aphasiology*, 24, 363–394. https://doi.org/10.1080/02687030600741667

Asmolov, A.G. (2000). *Del otro lado de la conciencia: problemas metodológicos de la psicología no clásica.* Moscú: Sentido.

Elkonin, D.B. (1995). *Desarrollo psicológico en las edades infantiles*. Moscú: Academia de Ciencias Pedagógicas y Sociales.

Galperin, P.Ya. (1992). Stage-by-stage formation as a method of psychological investigation. *Journal of Russian and East European Psychology*. https://doi.org/10.2753/RPO1061-0405370213

Galperin, P.Ya., Zaporozhets, D., & Elkonin, D. (1987). Problems of the formation of knowledge and abilities in schoolchildren and new methods of teaching in school. In V.V. Davidov,

& A. Márkova (Eds.) *The evolutionary and pedagogical psychology of the USSR. Anthology*, 300–316. USSR: Progress.

Galperin, P.Ya. (1998). *Psicología como ciencia objetiva.* Moscú, Academia de las Ciencias Pedagógicas y Sociales de Rusia.

Glozman, J.M. (2013). *Developmental Neuropsychology*. London: Routledge.

Glozman, J.M. & Potanina, A.Y. (2004). La concepción de A.R. Luria acerca de los tres bloques cerebrales para la corrección de la disgrafia y la dislexia. En: *Materiales de VII Conferencia Internacional de Psicología, Pedagogía y Sociología de lectura. Parte I*, 13–17. Moscú: Ciencia.

Kotik-Friedgut, B. & Solovey, P. (2003). How to learn language to learn it better? Jerusalem, Lira.

Kotik-Friedgut, B. (2006). Development of the Lurian Approach: A Cultural Neurolinguistic Perspective. *Neuropsychology Review*, *16*(1), 43–52. https://doi.org/10.1007/s11065-006-9003-9

Leontiev, A.N. (1960). The needs and motives of the activity. In A.A. Smirnov, S.L. Rubinstein, A.N. Leontiev, & B.M. Tieplov (Eds.). *Psychology,* 341–354. Mexico: Grijalbo.

Leontiev, A.N. (2003). Génesis de la actividad. En: A.N. Leontiev. *Formación de la psicología de la actividad*, 373–385. Moscú: Sentido. Serie: Clásica viva.

Leontiev, A.N. (1975). *Activity, consciousness, personality*. Moscow, Moscow State University.

Leontiev, A.N. (2009). *Bases psicológicas del desarrollo del niño y de la enseñanza*. Moscú, Sentido.

Lezak, M.D. (1982). The problem of assessing executive functions. *International Journal of Psychology*, 17, 281–297. https://doi.org/10.1080/00207598208247445

Luria, A.R. (1947). *Traumatic aphasia*. Moscow: Academy of Medicine Sciences.

Luria, A. (1970). The functional organization of the human brain. *Scientific American*, 222, 406–413. https://doi.org/10.1038/scientificamerican0518-66

Luria, A.R. (1973). The origin and cerebral organization of man's conscious action. In: S. Spair & A. Nitzburg (Eds.) *Children with learning problems: Readings in a developmental-interaction*. New York, Brunner/Mazel, 109–130.

Luria, A.R. (1975). *Basic fundamentals of neurolinguistics*. Moscow: Moscow State University.

Luria, A.R. (1987). *The man with a shattered world*. Cambridge, MA: Harvard University Press. https://doi.org/10.1086/292375

Luria, A.R. (1982). *Scientific autobiography*. Moscow: Moscow State University.

Machinskaya, R.I., Sokolova, L.S., & Krupskaya, E.V. (2007) Formation of the functional organization of the cerebral cortex at rest in young schoolchildren varying in the maturity of cerebral regulatory systems: II. Analysis of EEG a-rhythm coherence. *Human Physiology*, 33, 2, 129–138. https://doi.org/10.1134/S0362119707020016

Machinskaya, R., Semenova, O., Absatova, K., & Subogrova, G. (2014). Neurophysiological factors associated with deficit in children with ADHD symptoms: EEG and neuropsychological analysis. *Psychology and Neuroscience*, 7(4), 461–73. https://doi.org/10.3922/j.psns.2014.4.05

Machinskaya, R., Subogrova, G., & Semenova, O. (2016). An interdisciplinary approach to analysis of the cerebral mechanisms of learning difficulties in children. Experience of studies of children with signs of ADHD. *Neuroscience & Behavioral Physiology*, *45*(1), 58–73. https://doi.org/10.1007/s11055-014-0040-1

Matute, E. (2012). *Tendencias actuales de las neurociencias cognitivas*. México, Manual Moderno.

Mikadze, Yu. M. (2008) *Child neuropsychology*. Moscow, Piter Press.

Plaisted, J., Gustavson, J., Wilkening, G., & Golden, C. (1983) The Luria-Nebraska neuropsychological battery-children's revision: Theory and current research findings. *Journal of Clinical Child Psychology*, 12, 13–21. https://doi.org/10.1080/15374416.2016.1266649

Quintanar, L. & Solovieva, Yu, (2010). *Evaluación neuropsicológica de la actividad verbal*. México, Universidad Autónoma de Puebla.

Quintanar, L., Solovieva, Yu., & León-Carrión, J. (2013). *Evaluación Clínico Neuropsicológica de la Afasia Puebla-Sevilla*. México: Universidad Autónoma de Puebla.

Rodríguez, F., Solovieva, Yu., Bonilla, R., Pelayo, H., & Quintanar, L. (2011). Rehabilitación neuropsicológica en un caso de afasia semántica. *Revista Neuropsicología Latinoamericana*, 3(2), 39–49. https://doi.org/10.5579/rnl.2011.0067

Rains, D. (2004). *Principios de neuropsicología humana*. México Ed. McGraw Hill.

Rosselli, M., Matute, E., & Ardila, A. (2010). *Neuropsicología del desarrollo infantil*. México, Manual Moderno.

Rosselli, M., Matute, E., Ardila, A., Botero, V., Tangarife, G., Echevería, S., & Ocampo, P. (2004). Evaluación Neuropsicologica Infantil (ENI): una batería para la evaluación de niños entre 5 y 6 años de edad. Estudio normativo colombiano. *Revista de Neurología*, 38, 8, 720–731.

Solovieva, Y., Bonilla, M. del R., & Quintanar, L. (2006). Análisis Neuropsicológico de los Problemas de Aprendizaje en Adolescentes. *Revista de Ciencias Clínicas*, *7*(2), 55–63.

Solovieva, Yu. & Quintanar, L., (2009). Introducción a la lectura desde el enfoque histórico-cultural. En: E.A. Escotto,, M. Pérez y M.A. Villa (Eds.) *Desarrollo y alteraciones del lenguaje, neuropsicología y genética de la inteligencia.* México, UNAM, 137–159.

Solovieva, Yu. & Quintanar, L. (2012). *Evaluación neuropsicológica en la edad escolar*. México, Universidad Autónoma de Puebla.

Solovieva, Yu. & Quintanar, L. (2013). *Evaluación neuropsicológica infantil breve*. México, Universidad Autónoma de Puebla.

Solovieva, Yu. & Quintanar, L. (2013). *Antología del desarrollo en la edad preescolar.* México: Trillas.

Solovieva, Yu. (2014). *La actividad intelectual en el paradigma histórico-cultural*. México: CEIDE.

Solovieva, Yu. & Quintanar, L. (2014a). Syndromic analysis of ADHD at preschool age according to A.R. Luria's concept. *Psychology and Neuroscience*, 7, 4, 443–452. https://doi.org/10.3922/j.psns.2014.4.03

Solovieva, Yu, & Quintanar, L. (2014b). Principios y objetivos para la corrección y el desarrollo en la neuropsicología infantil. En: H. Patiño & V. López (Eds.) *Prevención y evaluación en Psicología*. Manual Moderno, 61–74.

Solovieva, Yu., Bonilla, R., & Quintanar, L. (2014). Corrección neuropsicológica de problemas de aprendizaje escolar en la adolescencia. En: M. Perez, A. Escotto, J. Arango & L. Quintanar *Rehabilitación neuropsicológica. Estrategias en trastornos en la infancia y del adulto*. México: Manual Moderno: 77–96.

Solovieva, Yu. & Quintanar, L. (2016). Análisis sindrómico en casos de problemas de desarrollo y aprendizaje: siguiendo a A.R. Luria. In: D.F. Da Silva, J.H. Ávila, H. Góis, J. Leonel, N. Ferreira, Yu. Solovieva & L. Quintanar (Eds.) *Neuroscience to Neuropsychology: The study of the human brain (vol. I)*, 387–414. Barranquilla, Ed. Corporación Universitaria Reformada.

Solovieva, Yu. & Quintanar, L. (2015). Qualitative syndrome analysis by neuropsychological assessment in preschoolers with attention deficit disorder with hyperactivity. *Psychology in Russia: State of the Art,* 8, 3, 1–12. https://doi.org/10.11621/pir.2013.0202

Solovieva, Yu. & Quintanar, L. (2017b). Stages for introduction of drawing actions in pre-school age. *Journal of Education and Culture Studies*, *1*(1), 12–24. https://doi.org/10.22158/jecs.v1n1p12

Solovieva, Yu., Machinskaya, R., Quintanar, L., Bonilla, R., & Pelayo, H. (2013) *Neuropsicología y electrofisiología del TDA en la edad preescolar*. México, Universidad Autónoma de Puebla.

Solovieva, Yu. (2016). *Enseñanza del lenguaje escrito*. Mexico: Trillas.

Solovieva, Yu. & Quintanar, L. (2017a). Psychological concepts of activity theory in child neuropsychology. *Journal of Education and Cultural Studies*, *1*(1), 25–41. https://doi.org/10.22158/jecs.v1n1p25

Solovieva, Yu., Rivas, X., Méndez-Balbuena, I., Machinskaya, R., & Pelayo, H. (2016). Neuropsychology and electroencephalography to study attention deficit hyperactivity disorder. *Rev. Fac. Med*, *64*(3), 427–434. https://doi.org/10.15446/revfacmed.v64n3.54924

Solovieva, Yu., Torrado, O., Maravilla, L., & Rivas, X. (2017). Análisis neuropsicológico diferencial en dos casos diagnosticados con TDAH. *Informes psicológicos*, 17(1), 121–141.

Talizina, N.F. (2001). *Formation of abilities of mathematical thinking*. San Luis Potosí: Autonomous University of San Luis Potosí.

Talizina, N.F. (2008). Psychological mechanisms of generalization. *Acta Neurológica Colombiana*, 24(2), Supplement., 76–88. https://doi.org/10.22379/issn.2422-4022

Talizina, N.F. (2009). *The theory of activity applied to teaching*. Mexico: Universidad Autónoma de Puebla.

Talizina, N., Solovieva, Y., & Quintanar, L., (2010). The approach of the activity in psychology and its relation with the historical-cultural approach of L.S. Vygotsky. *Educational News*, (230), 4–8.

Teeter P. (1986) Standard neuropsychological test batteries for children. In: J. Obrzut & G. Hynd (Eds.) *Child neuropsychology*, 187–227. Orlando: Academic Press. https://doi.org/10.1016/B978-0-12-524042-0.50013-9

Toomela, A. (2014). There can be no cultural-historical psychology without neuropsychology. And vice versa. In: A. Yasnitsky, R. Van Der Veer, & M. Ferrari (Eds.). *The Cambridge Handbook of Cultural-Historical psychology*, 315–349. New York: Cambridge University Press. https://doi.org/10.1017/S0956796812000081

Tsvetkova, L. (2016a). Bases teóricas, objetivos y principios de la enseñanza rehabilitatoria. In Y. Solovieva & L. Quintanar (Eds.). *Rehabilitación Neuropsicológica Historia, teoría y Práctica*, 177–191. México: Universidad Autónoma de Puebla.

Tsvetkova, L.S. (2016b). Hacia una teoría de la enseñanza rehabilitatoria. In Y. Solovieva & L. Quintanar (Eds.). *Bases teóricas, objetivos y principios de la enseñanza rehabilitatoria*, 167–176. México: Universidad Autónoma de Puebla.

Vygotsky, L.S. (1984) *Problems of child psychology. Selected Works. Vol. 4*. Moscow, Pedagogy.

Weschler, D. (1987) *Weschler Memory Scale-Revised*. New York, Psychological Corporation.

Original manuscript received November 15, 2017
Revised manuscript accepted March 9, 2018
First published online June 30, 2018