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Neuropsychologist's Praxis in Early Childhood Education: Historical-Cultural Proposal

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ABSTRACT

Background. This theoretical paper addresses the neuropsychologist's role in early childhood education from a cultural-historical perspective, emphasising the relevance of preventive and developmental intervention in the formation of higher psychological functions.

Objective. The study aims to elucidate key categories — such as psychological age, leading activity, neoformations, and neuropsychological factors - grounded in the principles of historical-dialectical materialism, and to integrate them with contemporary advances in developmental and educational neuropsychology.

Design. Data sources included classical works by Vygotsky, Luria, Leontiev, and Elkonin, as well as studies published between 2010 and 2025 in key databases, namely Scopus, Web of Science, PsycINFO, SciELO, and PePSIC. A narrative and integrative review method was employed to synthesise theoretical and empirical contributions concerning preventive neuropsychological approaches and their implications for preschool development.

Results. The analysis highlights the importance of designing educational programmes that strengthen higher psychological functions through guided activity, social interaction, and cultural mediatisation.

Conclusion. Neuropsychological intervention in early education should be preventive of learning disabilities and developmental rather than only corrective, supporting the maturation of neuropsychological factors that underlie literacy, self-regulation, and voluntary activity. This framework bridges psychological theory, neuropsychological practice, and educational policy, reinforcing the formative and preventive role of the neuropsychologist in promoting child development

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Keywords: Cultural-historical psychology; neuropsychology; early childhood education; leading activity; prevention; developmental support; higher psychological functions

Highlights:

- Neuropsychological correction is not a simple stimulation but implies transformation and leads to child's development.
- Early neuropsychological correction might lead to development of new psychological formations and guarantee preparation to school.
- Neuropsychological correction bases on identification of specific weak brain mechanism (neuropsychological factor).
- Neuropsychological praxis, in cultural historical approach, is a complemental part of psychological praxis in infancy.
- Neuropsychological intervention directs not to isolate functions and tasks, but to the gradual formation of leading activities of psychological age.

АННОТАЦИЯ

НЕЙРОПСИХОЛОГИЧЕСКАЯ ПРАКТИКА В СИСТЕМЕ ДОШКОЛЬНОГО ОБРАЗОВАНИЯ: КУЛЬТУРНО-ИСТОРИЧЕСКИЙ ПОДХОД

Актуальность. В настоящей теоретической работе рассматривается роль нейропсихолога в системе дошкольного образования с позиций культурно-исторической психологии. Особое внимание уделяется значимости профилактической и развивающей направленности вмешательства в процессе становления высших психических функций.

Цель. Целью работы является теоретическое обоснование ключевых категорий — психологического возраста, ведущей деятельности, новообразований и нейропсихологических факторов — в контексте принципов историко-диалектического материализма, а также их интеграция с современными достижениями возрастной и педагогической нейропсихологии.

Дизайн. Источниковую базу составили классические труды Л.С. Выготского, А.Р. Лурии, А.Н. Леонтьева и Д.Б. Эльконина, а также исследования, опубликованные в период с 2010 по 2025 год в ведущих наукометрических базах данных, включая Scopus, Web of Science, PsycINFO, SciELO и PePSIC. Для обобщения теоретических и эмпирических данных, касающихся профилактических нейропсихологических подходов и их внедрения в практику дошкольного образования и развития, был использован метод нарративного и интегративного обзора.

Результаты. Проведенный анализ демонстрирует значимость разработки образовательных программ, направленных на развитие высших психических функций посредством организованной деятельности, социального взаимодействия и культурного опосредования.

Заключение. Нейропсихологическое вмешательство в системе дошкольного образования должно носить преимущественно профилактический характер в отношении возможных трудностей обучения и быть ориентированным на развитие, а не только на коррекцию уже сформированных дефицитов. Такой подход способствует созреванию нейропсихологических факторов, лежащих в основе овладения грамотой, развития саморегуляции и произвольной деятельности. Предлагаемая концептуальная рамка обеспечивает преемственность между психологической теорией, нейропсихологической практикой и образовательной политикой, подчеркивая формирующую и профилактическую функцию нейропсихолога в содействии психическому развитию ребенка.

Ключевые слова: Культурно-историческая психология; нейропсихология; дошкольное образование; ведущая деятельность; профилактика; психолого-педагогическое сопровождение развития; высшие психические функции

Основные положения:

- Нейропсихологическая коррекция не сводится к простой стимуляции, но предполагает качественное преобразование, которое опосредует психическое развитие ребёнка.
- Ранняя нейропсихологическая коррекция способствует формированию новых психологических новообразований и обеспечивает готовность к школьному обучению.
- Нейропсихологическая коррекция базируется на выявлении специфического ослабленного мозгового механизма (нейропсихологического фактора).
- Нейропсихологическая практика в рамках культурно-исторического подхода является неотъемлемой частью психологической практики в раннем и дошкольном детстве.
- Нейропсихологическое вмешательство направлено не на изолированное развитие отдельных функций и задач, а на постепенное формирование ведущих видов деятельности, соответствующих психологическому возрасту.

RESUMEN

LA PRAXIS DEL NEUROPSICÓLOGO EN LA EDUCACIÓN INFANTIL:
UNA PROPUESTA HISTÓRICO-CULTURAL

Antecedentes. Este artículo teórico aborda el rol del neuropsicólogo en la educación infantil desde una perspectiva histórico-cultural, enfatizando la relevancia de la intervención preventiva y evolutiva en la formación de las funciones psicológicas superiores.

Objetivo. El estudio pretende dilucidar categorías clave — tales como la edad psicológica, la actividad rectora, las neoformaciones y los factores neuropsicológicos — fundamentadas en los principios del materialismo histórico-dialéctico, e integrarlas con los avances contemporáneos en la neuropsicología evolutiva y educativa.

Diseño. Las fuentes de datos incluyeron obras clásicas de Vygotsky, Luria, Leontiev y Elkonin, así como estudios publicados entre 2010 y 2025 en bases de datos relevantes, a saber: Scopus, Web of Science, PsycINFO, SciELO y PePSIC. Se empleó un método de revisión narrativa e integradora para sintetizar las contribuciones teóricas y empíricas concernientes a los enfoques neuropsicológicos preventivos y sus implicaciones para el desarrollo en la etapa preescolar.

Resultados. El análisis destaca la importancia de diseñar programas educativos que fortalezcan las funciones psicológicas superiores mediante la actividad guiada, la interacción social y la mediatización cultural.

Conclusión. La intervención neuropsicológica en la educación temprana debe ser preventiva de las dificultades de aprendizaje y de carácter evolutivo, más que meramente correctiva, favoreciendo la maduración de los factores neuropsicológicos que subyacen a la lectoescritura, la autorregulación y la actividad voluntaria. Este marco articula la teoría psicológica, la práctica neuropsicológica y la política educativa, reforzando el papel formativo y preventivo del neuropsicólogo en la promoción del desarrollo infantil.

Palabras clave: Psicología histórico-cultural; neuropsicología; educación infantil; actividad rectora; prevención; apoyo evolutivo; funciones psicológicas superiores

Disposiciones clave:

- La corrección neuropsicológica no es una mera estimulación, sino que implica transformación y conduce al desarrollo del niño.
- La corrección neuropsicológica temprana puede conducir al desarrollo de nuevas formaciones psicológicas y garantizar la preparación para la escolarización.
- La corrección neuropsicológica se basa en la identificación de mecanismos cerebrales específicamente deficitarios (factor neuropsicológico).
- La praxis neuropsicológica, en el enfoque histórico-cultural, es una parte complementaria de la praxis psicológica en la infancia.
- La intervención neuropsicológica no se dirige a funciones y tareas aisladas, sino a la formación gradual de las actividades rectoras propias de la edad psicológica.

RESUME

PRAXIS DU NEUROPSYCHOLOGUE DANS L'EDUCATION DE LA PETITE ENFANCE: UNE PROPOSITION HISTORICO-CULTURELLE

Origines. Cet article théorique examine le rôle du neuropsychologue dans l'éducation de la petite enfance à partir d'une perspective historico-culturelle, en mettant l'accent sur l'importance des interventions préventives et développementales dans la formation des fonctions psychologiques supérieures.

Objectif. Cette étude vise à clarifier des catégories fondamentales — telles que l'âge psychologique, l'activité directrice, les néoformations et les facteurs neuropsychologiques — fondées sur les principes du matérialisme historico-dialectique, et à les articuler avec les avancées contemporaines de la neuropsychologie du développement et de l'éducation.

Méthode. Les sources de données comprenaient les travaux classiques de Vygotski, Luria, Leontiev et Elkonine, ainsi que des études publiées entre 2010 et 2025 dans les principales bases de données scientifiques, notamment Scopus, Web of Science, PsycINFO, SciELO et PePSIC. Une méthode de revue narrative et intégrative a été utilisée afin de synthétiser les contributions théoriques et empiriques relatives aux approches neuropsychologiques préventives et à leurs implications pour le développement préscolaire.

Résultats. L'analyse met en évidence l'importance de concevoir des programmes éducatifs qui renforcent les fonctions psychologiques supérieures grâce à l'activité guidée, à l'interaction sociale et à la médiation culturelle.

Conclusion. L'intervention neuropsychologique dans l'éducation de la petite enfance devrait être davantage préventive à l'égard des difficultés d'apprentissage et orientée vers le développement plutôt que simplement corrective. Elle doit soutenir la maturation des facteurs neuropsychologiques qui sous-tendent l'acquisition de la lecture et de l'écriture, l'autorégulation et l'activité volontaire. Ce cadre établit un lien entre la théorie psychologique, la pratique neuropsychologique et les politiques éducatives, tout en renforçant le rôle formatif et préventif du neuropsychologue dans la promotion du développement de l'enfant.

***Mots-clés*:** Psychologie historico-culturelle; neuropsychologie; éducation de la petite enfance; activité directrice; prévention; soutien au développement; fonctions psychologiques supérieures

Points principaux:

- La correction neuropsychologique ne constitue pas une simple stimulation ; elle implique une transformation et favorise le développement de l'enfant.

- Une correction neuropsychologique précoce peut conduire à l'émergence de nouvelles formations psychologiques et garantir une meilleure préparation à l'entrée à l'école.
- La correction neuropsychologique repose sur l'identification d'un mécanisme cérébral spécifique déficitaire (facteur neuropsychologique).
- Dans l'approche historico-culturelle, la praxis neuropsychologique constitue une composante complémentaire de la praxis psychologique durant l'enfance.
- L'intervention neuropsychologique ne vise pas l'isolement des fonctions ou des tâches, mais la formation progressive des activités directrices correspondant à chaque âge psychologique.

Introduction

The understanding of child development from a cultural-historical perspective is one of the main contributions of Soviet psychology to the behavioural and educational sciences. This was formulated by Vygotsky (1995) and expanded by Luria (1979), Leontiev (1983), and their followers in Russia and other countries (Solovieva et al., 2020). This approach conceives psychological development as a historical process mediated by the appropriation of cultural forms of action and thought. From this perspective, the role of the adult and the social environment goes beyond the mere provision of stimuli, consisting instead in creating concrete conditions for symbolic mediatisation that promote the emergence of higher psychological functions.

In neuropsychology, Luria (1979) demonstrated that psychological functioning depends on the dynamic organisation of complex functional systems composed of cooperative interactions among brain regions and sustained by social and linguistic experience. This conception breaks with localisationist models and establishes a bridge between the neurophysiological and cultural dimensions of development, allowing learning difficulties to be understood as disturbances in mediated activity systems rather than isolated deficits.

In recent decades, this tradition has been revisited in studies on the relations between culture, cognition, and neurodevelopment (Ivanova et al., 2023; Veraksa, 2024; Zakharova, 2023), which reinforce these, and functions such as self-regulation, language, and imagination emerge from the child's active participation in social practices mediated by signs and cultural tools. Thus, education becomes the principal space for functional eorganization and the formation of consciousness, as it articulates maturing brain systems with the symbolic conditions of culture.

From this understanding arises the need for a school-based neuropsychology focused on monitoring development from early childhood education onward. By integrating the principles of activity theory and Lurian neuropsychology (Solovieva & Quintanar, 2021a), the neuropsychologist can identify neuropsychological factors in formation, guide pedagogical strategies, and propose interventions aimed at fostering the development of higher psychological functions and their brain bases (Solovieva et al., 2019). This practice goes beyond diagnosis and rehabilitation, constituting a collaborative action between health and education aimed at promoting development and preventing learning difficulties.

This article presents a proposal for the neuropsychologist's role in early childhood education grounded in cultural-historical psychology and Lurian neuropsychology. The concepts of psychological age, leading activity, functional system, and neuropsychological factor are articulated, discussing their implications for assessment, intervention, and pedagogical organisation. It argues that early cultural development, guided by cultural-historical principles, supports the consolidation of basic neoformations and the balanced development of psychological functions, contributing to a truly formative educational process.

Methods

This theoretical-conceptual study is grounded in historical-dialectical materialism and cultural-historical psychology. Its aim is to systematise the main concepts and evidence supporting the neuropsychologist's role in early childhood education, considering both the Soviet tradition and its recent developments.

The research integrates classical works by Vygotsky, Luria, and Leontiev (1924–1998) with recent studies in neuropsychology and education (2010–2025). The bibliographic search was conducted between August and November 2025 in Scopus, Web of Science, PsycINFO, SciELO, PePSIC, and ERIC, and included texts in English, Spanish, and Portuguese.

Selection criteria included theoretical, empirical, and review studies on cultural-historical psychology or neuropsychology, research with children aged zero to seven, and publications addressing the interface between neuropsychology and education. Works grounded exclusively in biomedical or cognitivist frameworks with no reference to cultural mediatisation were excluded.

The analysis followed three vectors: (a) historical-conceptual reconstruction; (b) theoretical-methodological examination of contemporary authors; and (c) integrative synthesis of principles into a preventive action model. Triangulation between classical and recent sources and interpretative coherence was prioritised. As the study did not involve empirical data, ethical approval was not required under APA (7th edition) guidelines.

Results

1. *The Development of Higher Psychological Functions in Children*

Zaporozhets (1986), revisiting the foundations of historical materialism and Soviet psychology, emphasised that children's psychological development is essentially a social process. The child assimilates cultural forms of behaviour and thought, transforming them into properties of their own activity, which constitutes the core of the development of their abilities and personality.

The cultural-historical perspective conceives culture as a product of collective human life; therefore, the cultural development of behaviour is also a social development (Vygotsky, 1995). The social environment is not an external condition but the

very source of psychological development. The child actively participates in this process by interacting with symbolic tools — such as language, work, and art — mediated by adults (Zaporozhets, 1986).

Throughout development, social forms of behaviour are internalised and transformed into mechanisms of self-regulation. Initially, signs fulfill a communicative and other-directed control function; later, they become instruments of self-regulation, enabling the emergence of higher psychological functions (Vygotsky, 1995). This shift from external to internal control expresses the principle of the use of symbols and signs.

Vygotsky (1995) described three major stages of behaviour: the instinctive phase, based on innate reactions; the phase of conditioned reflexes, associated with learning; and the intellectual phase, in which conscious and mediated forms of adaptation are consolidated. The study of these transitions allows the identification of psychological maturation indicators that are relevant to educational practice.

Recent research reinforces these foundations, demonstrating that the quality of social interactions and cultural practices directly influences creativity, self-regulation, and executive functions (Ivanova et al., 2023). Other authors highlight the interfunctional nature of psychological functions and the qualitative character of development, understood as functional reorganisation rather than the mere accumulation of skills (Toomela, 2019).

Contemporary cultural-historical psychology has expanded the genetic-experimental method by analysing how different cultural contexts modulate symbolic mediatisation and the internalisation of experience (Gomes & Hedegaard, 2022). These advances reaffirm the relevance of cultural-historical principles for understanding and promoting a child's psychological development.

Thus, development proceeds through qualitative transitions that define specific periods of psychological life, each characterised by a particular form of relation to the environment, dominant activities, and central psychological formations. This view supports the principle of developmental periodisation into psychological ages, addressed in the following section.

2. *The Internal Logic of Psychological Development: Psychological Ages*

Based on the cultural-historical perspective, Vygotsky (1996) conceived psychological age as a global and dynamic formation that qualitatively characterises each developmental period. Each age represents a specific systemic structure of personality, consciousness, and child activity, marked by internal reorganisations and the emergence of new psychological functions.

Vygotsky (1996) identified four fundamental psychological ages: the first year of life (0–1 year), early childhood (1–3 years), the preschool period (3–6 years), and the school period (6–12 years). In each of these, the child establishes a social situation of development, that is, a particular type of relation with the world and with others, which constitutes the dynamic core of the age and defines the conditions for the appearance of psychic neoformations (Gonzáles-Moreno & Solovieva, 2019).

Development in each period unfolds along two interdependent lines: the general (or central) line and the accessory (or subordinate) line, both derived from the neoformations of the stage (Vygotsky, 1996). The general line expresses the dominant aspect — affective-emotional or technical-operational — while the accessory line acts in a complementary way, preparing the transition to the next phase (Gonzáles-Moreno & Solovieva, 2022; Solovieva & Quintanar, 2016). When development is affective-emotional, the focus falls on human relations; when it is technical-operational, practical activity and the instrumental appropriation of culture become central.

Recent studies confirm the relevance of this conception. Veraksa (2024) reaffirms the usefulness of periodisation by allowing an understanding of the unity between cognition, emotion, and motivation within specific cultural contexts. From this perspective, psychological age is not a chronological stage, but a functional structure that is redefined according to cultural mediatisation and pedagogical orientation.

Veraksa et al. (2022) highlight the role of play as the leading activity in early development, showing that its contemporary forms — symbolic, cooperative, or digital — retain the formative value described by Vygotsky and Elkonin, provided they preserve the mediating and imaginative function that sustains the emergence of higher functions.

Methodologically, Veresov (2022) argues that contemporary cultural-historical research should maintain the genetic-experimental character of the Soviet tradition, integrating qualitative and contextual methods to reveal the genesis of new psychic formations in concrete learning situations. Carollo et al. (2025) add to this discussion by demonstrating that developmental patterns vary according to sociocultural context, proposing a flexible interpretation of Vygotskian periodisation adaptable to different educational realities.

Thus, each psychological age can be described by structural indicators — social situation of development, basic neoformations, general line, and corresponding leading activity — that express new psychological capacities and reorganise the child's system of relations with the world and with themselves (Solovieva & Quintanar, 2016, 2021b; Vygotsky et al, 1988). The main psychological ages and their structuring elements are summarised in Table 1.

From the cultural-historical perspective, a child's development results from qualitative advances that emerge in joint activity with adults and in communication with peers. Education and teaching, from the earliest years of life, act as essential mediators in the formation of new psychic structures and in the appropriation of cultural tools (Davídov, 1988).

Vygotsky (1996) reinforces this conception by proposing the Zone of Proximal Development (ZPD), understood as the distance between the child's actual level of development and the level that can be reached with the guided collaboration of an adult. What is initially carried out with assistance later becomes autonomous action, forming the Zone of Actual Development (Solovieva, 2022). This dynamic expresses the social and prospective nature of development, reaffirming the role of teaching as the driving force of psychological transformations.

Development may, however, be affected by internal and external conditions. Restricted or low-quality social interactions can generate maturational delays, while

Table 1

Psychological ages, social situation of development, leading activity, neoformations, and general developmental line at each stage of childhood according to the cultural-historical approach

Period	Social situation	Leading activity	Neoformations	General line
1st year (0–1 year)	We	Direct emotional communication with the adult	- Grasping as the basis of human object-related actions - Series of perceptual actions - Voluntary walking - Initial language	Affective-emotional
Early childhood (1–3 years)	Proto-self	Object manipulation play	- Verbal designation of objects - Generalised categorical perception of the world - Concrete action-based thinking - Emergence of the "self" as a central neoformation	Technical-operational
Preschool (3–6 years)	Reflective self	Role play	- Imagination - Symbolic function - Awareness of human relations - Hierarchy of motives - Rule-following - Initial abstract thinking	Affective-emotional

Source: Adapted from Solovieva & Quintanar (2016).

alterations in the organic basis of functional systems may result in neurological or electrophysiological deficits (Solovieva & Solovieva, 2022. In such cases, the concept of leading activity becomes a fundamental clinical and pedagogical resource for identifying the level of psychological development and guiding interventions that support the transition toward more complex forms of psychic organisation.

3. *Leading Activity and the Role of Play in Child Development*

The periodisation of development proposed by Vygotsky was expanded by Elkonin, who related psychological ages to the stages of play. In *Psychology of Play* (1978/2009), Elkonin describes play as a human activity that synthesises social experience and psychological development. For Vygotsky et al. (1988) and Elkonin (2009), play is an object-oriented activity through which the child appropriates the human world and its meanings, becoming the leading activity when mastery of reality requires symbolic representation.

Vygotsky (1998) conceived play as a privileged context for the Zone of Proximal Development (ZPD), where children act "ahead of their habitual behaviour." Bayley (2024) corroborates this perspective, demonstrating that *guided play* — intentionally mediated play — promotes greater cognitive flexibility, creativity, and self-regulation than free play, thus reaffirming inclusion in cultural activities as essential for the emergence of new psychic formations.

For Elkonin (2009), play is simultaneously a social practice and an instrument of moral and collective formation. By reproducing phenomena of adult life, the child learns to act according to implicit rules and constructs an ethical awareness of human relations. This educational and symbolic function grants play a central role in the development of the child's personality, recognised as the leading activity of both "Early Childhood" and "Preschool" periods (Solovieva & Quintanar, 2016).

Elkonin (2009) describes five stages of play from the first year of life through school age. Nonspecific manipulative play, characteristic of the first year, appears around six months and is linked to sensorimotor mastery (Solovieva & Quintanar, 2021b). These operations are nonspecific, aimed at exploration and emotional communication with the adult (Lazaretti, 2013).

In early childhood, object play emerges, with manipulation according to social use. Through mediatisation, in different activities, the child internalises social norms of cooperation (Elkonin, 2009; Solovieva & Quintanar, 2016), breaking with immediate perception and preparing voluntary action (Vygotsky, 2007).

From around two years of age, symbolic play develops, with actions representing imaginary situations (Solovieva & Quintanar, 2016; Gonzáles-Moreno & Solovieva, 2022). The child progresses from similarity-based substitutions to arbitrary ones, revealing abstraction and imagination (Elkonin, 2009), which form the basis of symbolic thinking, self-regulation, and executive functions (Vygotsky, 1998). Nhase et al. (2025) observed that intentional use of objects in dynamic contexts fosters language, cooperation, and autonomy, confirming the social and mediated nature of play.

In the preschool period, role play becomes the dominant activity, expressing the social meaning of activities and human relations (Elkonin, 2009). The child is oriented toward the adult as a model and, through the imaginary situation, overcomes the contradiction between the desire to act like an adult and their real limitations of experience (Vygotsky, 1998). In this type of play, the human–human relation replaces the human–object relation, and the child begins to act according to implicit rules, assessing their own behaviour in an incipient way (Elkonin, 2009). Contemporary research on free play, especially in "loose parts play" contexts, shows that three indicators — pleasure, free choice, and a sense of wonder — characterise high-quality play because they correspond respectively to positive affective involvement, the child's own initiative, and exploratory curiosity that drives imagination (Houser et al., 2016; Spencer et al., 2019; Askar, 2023). These indicators correspond functionally to the neoformations described by Vygotsky for the preschool period: pleasure relates to the social motivation to assume the adult's role; free choice reflects the development of intentional regulation of conduct; and wonder manifests the expansion of voluntary imagination. Thus, role play becomes the privileged space for the emergence and consolidation of these new psychological formations.

Elkonin (2009) distinguishes two stages in role play: ages 3–5 (object-related actions and practical logic) and 5–7 (emphasis on social relations). The transition depends on motivational reorganisation and symbolic expansion, not on chronological age. Cross-cultural studies confirm this flexibility: Carollo et al. (2025) and Andiema (2024) show that play development adapts to diverse contexts while preserving its mediating and creative character.

These findings reaffirm leading activity as the structuring axis of child development. Play, in its various modalities, continues to be the primary field for the formation of higher psychological functions — imagination, abstract thinking, self-regulation, and motivation — and a space of cultural mediatisation that prepares the child for systematic learning and new forms of consciousness.

4. *Cultural-Historical Neuropsychology and Education: Interfaces Between Development, Assessment, and Intervention*

According to Glozman (2013), developmental or paediatric neuropsychology studies the interaction between a child's social functioning and brain maturation under both typical and atypical conditions. It is based on the principle that psychological development is historical and mediated, resulting from the integration of culture, cognition, and the nervous system.

Cultural-historical neuropsychology emerged in the Soviet Union during World War II with Alexander Luria, building on Vygotsky's cultural-historical psychology (Quintanar & Solovieva, 2008). This tradition understands higher psychological functions as complex functional systems — social in origin, mediated in structure, and voluntary in nature — whose organisation is dynamic and historically conditioned (Solovieva et al., 2021; Solovieva & Quintanar, 2020; Xomskaya, 2002).

For Luria, the mind constitutes an open system of cooperation among specialised brain zones. Each higher function depends on the integration of these sectors, forming complex functional systems composed of neuropsychological factors (Glozman, 2007). Dysfunction in a factor gives rise to a specific syndrome, with typical errors and predictable patterns of impairment (Glozman, 2007; Solovieva et al., 2022; Solovieva et al., 2021, 2022).

Recent research expands this classical view. Zakharova (2023) demonstrated that the development of executive functions is heterochronic and depends on the structure of mediated activities, confirming the plasticity and dynamic localisation proposed by Luria. Koutsoklenis et al. (2025) showed that the diagnosis of ADHD must consider the interaction between regulatory factors and the activity context, reinforcing the value of qualitative analysis. In the field of intervention, Bonilla-Sánchez et al. (2024) reported that programmes based on mediated tasks and guided collaboration promote functional reorganisation in children with learning difficulties, confirming the compensatory role of social collaboration in cultural activities.

These findings reinforce that cerebral functional systems are dynamic structures that vary according to age, context, and degree of automatisation (Quintanar & Solovieva, 2008). The same function may be localised differently in a child and an adult, requiring individualised qualitative assessment. The neuropsychological factor, understood as a functional and structural unit, reflects both brain functioning and an essential psychological component of the functional system (Table 2). Its alteration affects multiple domains of activity, guiding intervention plans centered on systems rather than isolated deficits (Glozman, 2007; Solovieva & Quintanar, 2017; Quintanar & Solovieva, 2025).

Table 2

Neuropsychological factors, their functions, and participation in the functional systems of reading and writing

Factor	Function of the factor	Reading	Writing
Regulation and control	Execution of tasks according to goals, instructions, or rules	Application of orthographic and syntactic rules; comprehension of meaning	Thematic and lexical selection; organisation of ideas and grammatical rules
Motor sequential organisation	Fluid transition between movements; inhibition of previous action	Fluency between letters, words, and sentences	Sequential coordination of strokes and graphic elements
Phonematic integration	Differentiation of verbal sounds according to phonemic oppositions	Grapheme–phoneme decoding	Phoneme–grapheme encoding
Kinesthetic analysis and synthesis	Tactile sensitivity and articulatory precision	Differentiation of phonemes	Fine, precise handwriting; auditory–motor discrimination
Audio-verbal retention	Stability of auditory mnemonic traces	Word memory and text comprehension	Maintenance of verbal sequence and textual cohesion
Visual retention	Stability of visual mnemonic traces	Recognition of words and letters	Accurate orthographic reproduction
Analytical perceptual	Perception of features and spatial relations	Analysis of the spatial structure of letters	Adequate spatial distribution in text
Global perceptual	Perception of overall form and proportions	Spatial coherence of the textual whole	Graphic organisation and formatting
Nonspecific activation background	Maintenance of wakefulness and alertness	Sustained attention	Level of alertness and postural control
Nonspecific emotional background	Emotional stability	Motivation and engagement	Interest and involvement in the task
Sequential unfolding of new actions	Planning and ordered execution of novel motor sequences; flexibility to incorporate new actions into previously learned motor programs	Organisation of new decoding and verbal anticipation strategies	Creation of new grapho-motor and orthographic combinations; automatisation of new motor programs

Source: Adapted from Quintanar Rojas et al. (2023).

Contemporary cultural-historical neuropsychology integrates qualitative and quantitative methods while preserving Luria's syndromic approach (Korneev et al., 2021). This integration has supported the development of digital protocols for assessing executive functions and language, combining automated recordings with qualitative error analysis. Culturally informed assessments have also advanced, considering linguistic, social, and economic influences on neuropsychological performance (Costello et al., 2025), increasing ecological validity and reinforcing that psychological functions are constituted within the concrete conditions of life.

An early critic of purely psychometric assessment, Luria had already warned of its limitations in capturing real brain functioning (Santana, 1999). Qualitative assessment, in turn, focuses on the execution process, types of errors, and the need for constant collaboration between adult and child (Solovieva et al., 2024), complemented by Akhutina's (2012) observational diagnosis, which considers children's behaviour in diverse contexts and the structure of the leading activity.

The central objectives of child neuropsychological evaluation are to identify developmental and personality characteristics; characterise the status of neuropsychological factors; determine the functional systems corresponding to each age; and design individualised interventions (Solovieva et al., 2024).

Recent studies reaffirm the relevance of this approach (Veraksa, 2024). By articulating functional analysis, use of symbols, and sociocultural situations with clear goals, cultural-historical neuropsychology remains a robust reference for education and rehabilitation, uniting theoretical tradition with contemporary evidence.

5. *Theoretical and methodological foundations for the neuropsychologist's role in child development*

Cultural-Historical Neuropsychology understands teaching as the driving force of development, where socially mediated learning reorganises children's psychological functioning (González-Moreno et al., 2012). Recent studies confirm that the quality of social interactions and cultural directed activities directly influences creativity, self-regulation, and executive functions (Ivanova et al., 2023), reinforcing the conception of development as a qualitative process of systemic reorganisation (Toomela, 2019).

This perspective values the school as the primary context of development, where a dialectical relationship is established between education and the formation of psychological neoformations. It also provides practical criteria for neuropsychological planning, guiding essential questions regarding priority development and correction, individual objectives, appropriate mediatisation, and developmental transitions.

In the preschool period, role play as the leading activity makes it possible to identify the child's developmental level. For example, the transition from mere manipulation to the appropriate use of objects with adult orientation and regulation indicates progress in symbolic control. An assessment instrument based on the theory of the leading activity, such as the Protocol for the Assessment of the Development of Play Activity (Borges & Morais, 2019), evaluates five stages of play development, allowing the planning of transitional activities that stimulate new psychological formations.

Identifying the predominant leading activity makes it possible to stimulate specific neuropsychological factors. For instance, verbal spatial orientations during play in the stage of object play stimulate the perceptual-analytic factor. Qualitative observation of children's activities (Akhutina, 2012) complements the diagnosis by capturing functional indicators in ecological situations.

The maturation of neuropsychological factors integrates complex functional systems that support formal learning. The methods for proper psychological development integrated into daily school routines promote this functional integration, ensuring conditions for advancement within psychological ages. *Table 3* synthesises these relationships, articulating development, neuropsychology, and education.

Table 3

Neuropsychological factors, manifestations of functional weakness, and suggestions for the methods of correction and development in early childhood education.

Neuropsychological factor	Manifestations of functional weakness	Correction suggestions
Programming and control of conscious activity	Difficulty following rules during play; impulsivity in rule-based games or sequencing activities; difficulty maintaining directed attention or being regulated by the adult's speech.	Regulative control and games with rules ('red light, green light'; 'statue'; 'follow the leader'; 'follow conflicting instructions'); language-mediated activities involving progressively complex rules.
Sequential organisation of movements and actions (kinetic melody)	Difficulty learning motor sequences; movement perseveration; blocking during transitions between consecutive actions (e.g., 'Escravos de Jó').	Rhythmic and choreographed games ('Head, shoulders, knees and toes'; body sequences using instruments or alternating claps.
Sequential unfolding of new actions	Difficulty creating, adapting, or learning new motor sequences; tendency toward stereotyped repetition; rigidity in performing new tasks.	Imitation games with progressive variation; creation of new choreographies; motor games requiring flexibility and innovation ('invent a new step'; 'complete your partner's movement'); group motor planning tasks.
Phonematic integration (phonemic hearing)	Difficulty understanding or differentiating speech sounds (e.g., confusion between 'faca' and 'vaca'); phonemic substitutions in words and rhymes.	Games with rhymes and alliterations; exploration of initial and final sounds; activities involving phoneme substitution and combination; songs emphasising articulation.
Kinesthetic analysis and synthesis (tactile-kinesthetic integration)	Immature fine motor coordination; shaky lines in drawings; difficulty reproducing shapes and gestures.	Body games with eyes closed; texture exploration; motor imitation games; guided graphic activities ('Simon says' with fine-motor gestures).
Auditory-verbal retention	Difficulty recalling verbal instructions, song lyrics, or short lists; rapid forgetting of spoken information.	Cumulative songs ('The green grass grows all around'); verbal sequencing games ('Simon says' with increasing commands); retelling of short stories.

Neuropsychological factor	Manifestations of functional weakness	Correction suggestions
Visual retention	Forgetting images, positions, or letter shapes; difficulty recalling written words or symbols; errors in visual recognition.	Memory games; matching activities ('what is missing?'); reconstruction of figures and letters; guided drawing.
Analytical perception	Inattention to details; difficulty distinguishing right from left; drawings lacking differential features.	Spot-the-difference games; completing figures; spatial correspondence tasks ('Where's Waldo?'); tangram; comparing figures in different orientations.
Global perception	Loss of overall structure in drawings or constructions; difficulty understanding broader spatial relations; disorganisation in construction tasks.	Building models; treasure hunts; assembling figures with blocks; integrating geometric shapes to create new objects.
General nonspecific activation (cortical tone)	Hyperactivity, slowness, easy fatigue, frequent distractibility; performance decline due to unstable arousal.	Routine organisation (sleep, nutrition, physical activity); alternation between active and passive tasks; outdoor activities; stretching.
Nonspecific emotional background	Demotivation, apathy, resistance to tasks, or low affective involvement.	Incorporating the child's interests into activities; use of characters and narratives; valuing achievements; emotional co-regulation strategies.

Source: Adapted from Quintanar Rojas et al. (2023).

The isolated stimulation of neuropsychological factors, although necessary, is not sufficient to promote comprehensive development. It is essential that these factors be integrated into complex functional systems, which constitute the psychological and cerebral basis of higher mental functions (Luria, 1979; Glozman, 2007; Solovieva et al., 2019). Cultural-Historical Neuropsychology offers conceptual and methodological tools for monitoring child development in the school context, combining qualitative observation with assessment methods adaptable to different sociocultural realities (Akhutina, 2012; Korneev et al., 2021).

This approach makes it possible to understand what to observe — the functioning of factors and systems, the leading activity, the social situation of development, and the neoformations - and how to intervene, that is, by selecting activities and orientation that correspond to each child's maturational needs. The Zone of Proximal Development (ZPD) becomes, in this context, the fundamental criterion for determining the utility and scope of each intervention: a task is truly developmental only when it operates within the ZPD, meaning that the child cannot yet perform it independently but is capable of completing it with guided assistance (Vygotsky, 1996; Veresov, 2022).

The role of the adult — teacher or neuropsychologist — is to introduce mediating signs, symbolic instruments that regulate behaviour and lead to the internalisation of action control (Vygotsky, 1998). Orientation, in this sense, is the core of the educational and therapeutic process: what the child does with another today will be

done independently tomorrow. Thus, an activity retains its developmental value only while it requires collaboration; as the child gains autonomy and enters the Zone of Real Development (ZRD), the task must be replaced by another of greater complexity. This principle constitutes the foundation of the promotion of autonomy, in which the mediator acts as an agent of reorganisation of psychological functions and behaviour (Bonilla-Sánchez et al., 2024).

A complementary and indispensable concept is that of uneven development of psychological functions, formulated by Akhutina & Pylaeva (2012). Every child - whether in typical or atypical development - presents distinct rhythms of functional maturation, determined by cerebral heterochrony and sociocultural experience (Zakharova, 2023). Development, therefore, is intrinsically non-linear and qualitative, and must be analysed in its interfunctional and dynamic structure. This means that, although the group may serve as a general reference, the learning process must respect each student's unique maturational profile.

Based on these principles, school neuropsychological follow-up should prioritise ecological observation and intra-subject comparison: progress is not defined by the group average, but by the individual's movement within their development zones. When a child is able to perform independently a task that previously required assistance, a qualitative leap in development has occurred. This approach makes it possible to evaluate progress not only quantitatively but structurally — through the reorganisation of functional factors and systems (Toomela, 2019; Korneev et al., 2021).

A pedagogical example may illustrate this process. Imagine a teacher observing a child's difficulty assembling a puzzle. The child does not display impulsivity or disorganisation, which rules out weaknesses in regulation and control factors. However, she confuses central and border pieces, revealing problems in spatial perception. Based on this observation, the teacher forms the hypothesis of immaturity in the analytical and global perceptual factors. When observing the child in other activities, she notices that the child gets lost in motor circuits, confirming the hypothesis.

The teacher then proposes a shadow-matching game in which the child must identify the corresponding figure. The student is able to carry out the task with help, placing her within her ZPD. Later, in symbolic activities, she demonstrates the ability to organise roles and contexts - a characteristic of the advanced stage of role play (Elkonin, 2009; Solovieva & Quintanar, 2012). The teacher then creates a structured play activity, such as "driving the children to school by following a map," which integrates symbolic, spatial, and regulatory functions, stimulating multiple functional systems. Gradually, she introduces rule-based games, such as hopscotch and elastic jump, which promote the development of self-regulation and awareness of social norms.

These mediated and contextualised strategies exemplify developmental intervention: rather than correcting isolated functions, it reorganises functional systems and supports the transition to new forms of activity, according to psychological age and dysfunctional neuropsychological factor (Solovieva et al., 2024). The same reasoning can guide group-based pedagogical programmes that use neuropsychological parameters as the basis for preventive orientation in school learning (Bonilla-Sánchez et al., 2024).

The central objective is to promote the integration of the systems that support the basic neoformations of the preschool age - voluntary activity, graphic activity, reflection, and imagination (García, 2008). Children with lower development in these domains tend to present later difficulties in reading, writing, and mathematics, reinforcing the importance of early developmental programmes integrated into daily school routines.

Thus, the neuropsychologist's role in early childhood education goes beyond diagnostic evaluation: they act as guide and educator of teachers, collaborating in the construction of pedagogical environments that promote the development of all students. This practice integrates Lurian functional analysis, activity theory, and cultural-historical pedagogy, transforming the school into a space for rehabilitation and prevention — not of deficits, but of emerging potentialities (Glozman, 2013; Veraksa, 2024).

Conclusion

This study reinforces the importance of a neuropsychological practice in early childhood education that is oriented toward development rather than deficit. The neuropsychologist's work, grounded in the cultural-historical perspective, should transcend corrective diagnosis, acting preventively and developmentally alongside educators and families in the construction of pedagogical contexts that stimulate the higher psychological functions in formation.

Early neuropsychological correction, based on the concepts of leading activity, neuropsychological factors, and functional systems, makes it possible to monitor the development of basic neoformations and prevent learning difficulties. This approach values the school as a space for functional reorganisation, where play, language, and symbolic mediatisation are central instruments of development.

The legacy of Luria, Vygotsky, and Leontiev provides a solid foundation for rethinking the role of the neuropsychologist in education: not as a clinical specialist, but as a mediator between brain functioning and the social practices that structure thought and consciousness. Promoting this integration constitutes, therefore, a scientific and ethical act — aimed at forming subjects capable of acting consciously upon the world and transforming their own activity.

Ethics Statement

As the study did not involve empirical data, ethical approval was not required under APA (7th edition) guidelines.

Author Contributions

All authors contributed substantially to the conception, development, and finalisation of the study. C. Morais was responsible for the theoretical design, literature review, and formulation of the cultural-historical framework applied to neuropsychological praxis in early childhood education. C. Borges and Yulia Solovieva contributed to the methodological articulation, development of examples, and refinement of the

pedagogical implications. All authors reviewed and approved the final version of the manuscript and are jointly accountable for all aspects of the work.

Conflict of Interest

The authors declare no conflict of interest.

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