Clinical Neuropsychological Assessment: a literature review
Avaliação Neuropsicológica Clínica: uma revisão da literatura

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ABSTRACT
This article aims to bring the vision of renowned authors in the area of neuropsychopedagogy to understand its nuances, its applications and interactions with the multidisciplinary team. They were used as search sources for books, articles, monographs, dissertations, theses. Searches were conducted in the Scientific Electronic Library Online (SciELO), Academic Journals (CAPES), Bireme (PAHO/WHO Specialized Center), Scirus, Scopus, Brazilian Digital Library of Theses and Dissertations (BDTD), in English and Portuguese, between 2016-2021. using the terms "neuropsychopedagogy", "tests", "applications", "multidisciplinary team "and the combination of these terms. Qualitative analyses were made narrating with the authors' words with their respective citations. It is concluded that neuropsychopedagogy is a science of its own, full of applications in different health contexts and at different ages.

Keywords: neuropsychopedagogy, evaluation, tests, multidisciplinary team.

RESUMO
O presente artigo visa trazer a visão de autores renomados na área da neuropsychopedagogy para compreender suas nuances, suas aplicações e interações com a equipe multidisciplinar. Foram utilizados como fontes de busca de livros, artigos, monografias, dissertações, teses. Foram realizadas buscas no Scientific Electronic Library Online (SciELO), Periódicos acadêmicos (CAPES), Bireme (Centro Especializado da
INTRODUCTION

Have you ever heard of neuropsychology? It is a branch of psychology that associates human behavior with brain functions and thus helps to discover and understand patterns of behavior. It was the year 1913 when William Oslert, in the United States, first used the term "neuropsychology". That is, although relatively recent, this is already a well studied and reliable science. We can conceptualise it by saying that neuropsychology is a way of relating the role of individual brain systems and the complex forms of mental activities (ARANGO et al., 2017).

In other words, neuropsychology part of the functioning of the brain to analyze and understand behaviors. Understanding how the complex human brain works has been one of science's great goals over the centuries. Nowadays, we already have a good knowledge on the subject, particularly when we think about the functions, specifications and characteristics of each part of the brain (CHAN et al., 2016).

However, there is still much to be discovered and the search for understanding of this powerful organ continues – including in psychology offices. The research problems raised here are: what are the theories and neuropsychopedagogical evaluations? What are your branches of activity in the different stages of life? How does the connection between the multidisciplinary team and neuropsychopedagogy occur? The hypotheses of the present study are that applications, tests and tests are varied in the different phases of life, providing the multidisciplinary team with the vision of brain performance and its obstacles (FERNANDEZ et al., 2016).

Neuropsychology studies the relationship between brain and behavior. Through Neuropsychological Assessment, it is possible to investigate which cognitive functions are preserved and which are compromised, such as attention, memory, perception, language, reasoning, learning, visuoconstruction, executive...
functions, information processing and affection, for example (GONÇALVES et al., 2020).

The neuropsychologist uses standardized instruments such as tests and scales to evaluate cognitions according to the complaint that the patient presents. The evaluation aims to collect loss data and explore intact functions in order to define the type of intervention required, since cognitive functions with low performance can impair daily activities, such as work, study and relationships (GOUNDEN et al., 2017).

Objectives of neuropsychology as we explained above, this branch of Psychology studies how brain organization interferes in human relationships and emotions, both in normal brain development and in cases of disease. The neuropsychologist correlates the observed changes in a patient's behavior with the possible areas of the brain involved, doing a clinical investigation based on tests and exercises. Neuropsychological evaluation is part of this process (HOKKANEN; NYBO, POUTIAINEN, 2016).

Who can perform the Neuropsychological Assessment? Children, adolescents, adults and the elderly who present cognitive complaints (inattention, learning problems, forgetfulness, among others). The most common complaints in children and adolescents involve behavior problems, learning problems (reading, writing or calculus) and suspected Attention Deficit Hyperactivity Disorder (ADHD), Intellectual Disability (DI), Dyslexia and its variations, autism disorder spectrum (ASD) (CFP, 2018).

Evaluation in adults and the elderly may also be indicated in cases of: Head trauma (accidents or falls); Stroke (stroke); Epilepsy; Depression; Dementia; Deficits associated with alcohol and drug use; Parkinson's disease. The importance of Neuropsychological Assessment Through the Neuropsychological Report, a rehabilitation program of impaired functions can be established, using cognitive training and establishing compensatory strategies so that the patient can readapt to daily life in the academic, professional and family environment (CRP, 2010).

Neuropsychological Assessment also strongly contributes to the indication or follow-up of psychotherapy, in which the data collected can be used by the psychotherapist to support clinical intervention. The main objective of neuropsychological evaluation is to collect clinical data to help in understanding the extent of losses suffered by the brain in case of disease, for example, and how this may be influencing the individual's behavior. It seeks which areas are compromised and which
are preserved. The evaluation is made from instruments (tests, scales, test batteries) that compute data on cognitive functions, such as intelligence, attention, perception, memory, language, learning, speed of information processing, motor skills, affection etc. (FERNANDEZ et al., 2018).

From the neuropsychological evaluation we can establish what types of intervention or rehabilitation the individual – or groups of individuals – needs. Thus, the present article (in the form of a theoretical study conducted through a non-systematic review of the literature) has as its main objective to present the fundamental aspects of clinical neuropsychology, starting from its conceptual development to taxonomic models for the characterization of professional practice, through historical notes of expression, reports on legislation and normative regulation of class, challenges in the sociocultural and technological panorama, finally reaching a proposal of unified guideline, in favor of the social and scientific advancement of Brazilian Neuropsychology.

2 HISTORICAL ASPÉCTOS

Neuropsychology, as we currently understand it, concerns the discipline of theoretical basis and practical application – clinical and experimental – which results from the interface between neuroscience and cognitive psychology, having at its core the study of the relations between brain and behavior. Additionally, Neuropsychology describes the stages of acquisition and development of neurocognitive abilities during the critical phases of maturation and sometimes these explanatory models for such associations result from variations caused by lesions and/or pathologies, innately or acquired and of reversible course, sequela and/or progressive (GOUNDEN et al., 2017).

Neuropsychology, as an area of knowledge, dates back to the time of the ancient Egyptians (and, later, of Greeks and Romans). It is originally coined by Sir William Osler in the 20th century during a conference at the medical school of the renowned Johns Hopkins hospital. The term appeared again in The Organization of Behavior: A Neuropsychological Theory, by The Canadian Donald Olding Hebb, evidencing its application in the context of a physiological psychology that was able to answer questions about the neural foundations of human behavior (HOKKANEN; NYBO, POUTIAINEN, 2016).

In search of origins and tracing a historical route, it is observed in literature that papyri acquired by Edwin Smith in Luxor, dating from the sixteenth and seventeenth centuries to C., already documented the knowledge of these peoples about brain functions.
In the 2nd and 3rd centuries a.C., Galen, Herophilus and Hippocrates scribbled theories about the relationship of brain anatomy with affections, mind and cognitive processes, such as language. At the time, different thinkers admitted the brain as an organ of thought and sensations, the ventricles as places from which cognitive processes emerged and the brain mass responsible for the activities of the mind (JANZEN; GUGER, 2016).

After the barren era of the Middle Ages and already in the seventeenth and eighteenth centuries, thinkers decided to devote themselves to the anatomofunctional studies of the brain. After the famous mention of René Descartes in the mid-1700s, David Hartley (father of associationist psychology) proposes through his experiments that nerves, spinal cord and brain constitute the same essential structure. Then, in the 1800s, in parallel to the hypotheses of Charles Bell and Gustav Theodor Fechner on the differentiation between motor and sensory pathways, Jean Pierre Flourens and Marc Bouillard describe different brain centers for different cognitive domains, and their network functioning (KIM; CHEY., 2016).

A fruitful discussion about brain localization was inaugurated by Franz Joseph Gall, Paul Broca and Carl Wernicke by the anatomical observation of cranial protuberances and their relationship with personality traits, specific speech disorders and interhemispheric dominance, as well as conjecture about routes of association between different brain regions. In France and London, simultaneously, first steps were rehearsed by Alfred Binet and Francis Galton in the search for methods of intelligence assessment (CNPTC, 2016).

In contemporary history, they have been avant-garde of studies in Neuropsychology exponents such as Karl Spencer Lashley, responsible for the Theory of Equipotentiality, for which changes in behavior depended more on the amount of mass than on their location, Paul MacLean, father of the Trino brain theory, which deals with the brain divided into: reptilian, inferior and rational mammal, in addition to Hans Lukas Teuber, Lawrence Weiskrantz and Tim Shallice, responsible for the principle of dissociation between cognitive functions (KIM; CHEY, 2016).

Additionally, we have: Arthur Lester Benton, researcher of aphasic syndromes and creator of several neuropsychological tests; Brenda Milner, dedicated to the study of epileptic patients, undergoing temporal lobe surgery; Ronald Myers and Roger Sperry, studying patients and animals submitted to callosotomy; Norman Geschwind, proponent of the term disconnected syndrome; and Theodor Meynert,
exploring the hemispheric and interhemispheric association fibers, as well as several other renowned collaborators (KREMEN; PANIZZON; CANNON, 2016).

In view of a growing interest in the study of Soviet aphasic conditions, neurology and psychology not only contributed to describe their central symptoms, but also provided significant contributions to explain the physiological basis of language disorders. Later and although still influenced by the physiological heritage of Sechenov and Ivan P. Pavlov, Lev Vygotsky sought to replace the localist and globalist doctrines (VYGOTSKY, 1991). Vygotsky, in this way, proposed three main instances for what he understood as "Superior Cortical Functions": (a) association between changing functional systems - plasticity; (b) dynamic functions resulting from convergence between basic functions; and (c) real understanding and perception of our psyche (VYGOTSKY; LURIA; LEONTIEV, 1994; OLABARRIETA-LANDA et al., 2016).

Alexander Romanovich Luria's studies, based on Vygotsky's work with Russian neurological patients from the 1920s onto, represent a historical milestone for Neuropsychology. Luria advocated a discipline that offered, simultaneously, parallelism between physiological and neurological aspects, without emerging from them a purely causal relationship and, moreover, never giving up a "humanized" understanding of the most diverse clinical presentations investigated. Nevertheless, Luria also contributes to the technical-methodological advance made through clinical examination: managements once considered elementary, but now based on the triple concept of "Superior Cortical Functions", now lead to observational praxis of the neuropsychological onslaught (OSTROSKY; VelEZ, 2016).

There are three basic units, or functional systems, which would include: (I) An adolunit, or regulation of tone and wakefulness that involves layers of the cortex and the activating reticular system; (II) A coding unit to obtain, process and store information arriving from the outside world (and from the devices of its own body) located in the occipital, temporal and parietal lobes and (III) A planning unit to program, regulate and verify mental activity. This third block (or unit), located basically in the dorsolateral and ventromedial parts of the frontal lobes, would be the one who elaborates behavior programs, ensures and regulates their realization and participates in the control of their compliance (PONSFORD, 2016; WAJMAN, 2018).

Neuropsychology represents a science dedicated to studying the behavioral expression of brain dysfunctions and its praxis is based on a series of fundamental principles about cognition. It can therefore be segmented into at least four major modules:
(1) receptive functions: which involve the ability to perceive, select, classify and integrate information; (2) memory and learning: which refer to data storage and retrieval; (3) thought processing: with regard to the permanent organization and reorganization of information within a feeding and feedback system and (4) expressive functions: means by which information can be accessed, retrieved and communicated (TRUTER et al., 2017).

3 PROFESSIONAL REGULATION AND MULTIDISCIPLINARITY

According to the Federal Council of Psychology (CFP, 2007), the title of specialist in neuropsychology is granted exclusively to psychologists who have verified and declared professional experience in the following ways: (a) through the time of professional performance (two years), (b) by verification of experience; recognized specialization course and/or (c) proof-competition for granting a title. In addition, all of them must be duly accredited by the class council and/or Ministry of Education and Culture. The CFP resolution, number 013/2007, grants the title of specialist in Neuropsychology to the psychology professional with recognized competence with the processes intrinsic to the practice of the specialty: evaluate, monitor, treat and develop research focusing on the relationship between psychic aspects and neurobiological foundations, strumming for an evidence-based science (TRUTER et al., 2017).

Recognized as one of the most important stages of the neuropsychological process, neuropsychological evaluation is – in the same way – restricted to the neuropsychologist and should provide results (partial and/or global, preliminary and/or definitive) in the form of an opinion, report or report of the evaluator. Nevertheless, this document has its importance not only in the quantitative-qualitative description of psychometric findings, but also suggestions for follow-up and prospective-longitudinal follow-up (WAJMAN, 2021).

In view of the very origins of Neuropsychology, they reassemble the foundations of a comprehensive science about the functioning of the brain and the modulation of behavior, we look forward, as ideal professional formatting, to a multidisciplinary and integrated Neuropsychology with the most diverse areas of activity that also make up the neurosciences: Neurology, Psychiatry, Speech Therapy, Pedagogy, Physiotherapy, Social Assistance, Occupational Therapy, Physical Education and Nutrition, among others (RABIN; PAOLILLO; BARR, 2016).
For a long time this theme seems to raise several doubts about the role of health and education professionals who work with themes in Neuropsychology: to those professionals with undergraduate courses other than psychology, they are not given the title of neuropsychologist. In situations where these professionals (non-psychologists) have completed and graduated in specialization courses in Neuropsychology, duly recognized by the CFP, their certification is in the sense that they are able to work in partnership with professionals and/or certified institutions, once accompanied and/or supervised by a neuropsychologist duly registered as such with their local council. These non-psychologist professionals, in turn, receive the title, granted by the MEC, of cognitive rehabilitation, and their performance is restricted to rehabilitation (REIS, 2019).

By-product of the CFP, the Psychological Test Assessment System (SATEPSI; CFP, 2018) is a system developed by the CFP itself to disseminate information about psychological tests to professionals in the area and to the community. Information can be obtained on psychological tests with favorable and unfavorable opinion, verifying the possibility of using the test in psychological/neuropsychological evaluation, as well as the identification of private and non-exclusive instruments of the psychologist. In conclusion, as recommended, the access and use of neuropsychological tests should occur exclusively and in accordance with the resolution set out in Article 13 of Law No. 4,119/62, which restricts to the psychologist the use of psychological techniques and methods, considering criminal misdemeanor the illegal exercise of the profession by professionals not included in this resolution (SPERLING et al., 2017).

According to The SATEPSI (CFP, 2018), the figure of the psychology professional must correspond to that of an expert with an insight into the magnitude of the biological, human and social sciences; who performed a technical and notorious quality work; based mainly on ethical foundations; focused on teamwork, and fit to use their training for the production and dissemination of their understanding in the most varied contexts that need their participation in situations that require psychosocial incentive to human dignity and the collectivity as a whole. Thus, this professional is required to attend and respect CFP Resolution No. 002/2003, in order to complete the perception that psychological assessment instruments can only be employed in our environment once they obtain the favorable opinion of the CFP, without disregarding the use of unfavorable measures, in research condition (SANTOS; SILVA, 2021).
Thus, the CFP comprises that there are at least one pair of modalities of courses on Psychological Assessment: those who introduce professionals into the environment of scientific research and those who develop the psychological tools themselves. Regarding the dissemination of tests once deemed unfavorable, the CFP recommends the suspension of the course in favor of maintaining the professional technical-scientific quality. For research centers, once properly oriented, professionals can use these tools using the principle that scientific research is inexorable to the professional development of psychology (VAKIL; HOOFIEN, 2016).

Regarding the profile of the Brazilian psychologist regarding the specialty of Neuropsychology and its contact with evaluation instruments, the distribution, through responsible advice, points out that there are no updated data on the number of psychologists working in each area, or in the public and private sectors. However, according to the IBOPE/MQI survey conducted in 2004 (IBOPE Opinião, 2004), through 2000 telephone interviews, of the total of 994 psychologists duly enrolled in the CFP, 71% reported knowing the psychological test evaluation system, with no statistically significant differences in their sociodemographic characteristics and/or time since graduation (PONSFORD, 2016).

When asked about the importance of the main actions practiced through cfp commissions, approximately 38% pointed to the psychological test evaluation system as an initiative relevant to the exercise of their profession. As an additional data, of the total amount, half underwent some specialization, while less than 10% entered master's or doctoral programs (RABIN; PAOLILLO; BARR, 2016).

In summary, neuropsychological methods comprise not only tests, but also procedures that have, as a product, the analysis of behavior and, more specifically, cognitive functions and their correlations with functions and brain areas. According to the health descriptors of the Virtual Health Library in the area of Psychology (Latin American and Caribbean Center for Information on Health Sciences, n.d.), neuropsychological tests are "tests designed for the evaluation of neurological function associated with certain behaviors. They are used in the diagnosis of brain dysfunction or damage and central nervous system disorders or lesions." Following this premise, it can be said that the success of Neuropsychology in Brazil is directly related to the capacity, dedication and efficiency of professionals in the area that, although regulated a few years ago, has been developing and sedimenting increasingly fertile ground (SANTOS, 2021).
In 2017, 14 centers/courses/nuclei for training and certification of the specialist in Neuropsychology were included in the electronic directory of the CFP. Of these, seven are in the capital or in the interior of São Paulo (SP), two in Rio Grande do Sul (RS), two in Pernambuco (PE), one in Brasília (DF) and another in the state of Rio de Janeiro (RJ). Today it is spread in several other federated entities (SAKAMOTO, 2016).

4 APPLICATIONS OF NEUROPSYCHOPEDAGOGY: WHEN TO DO THE TESTS

Neuropsychological evaluation can be done in adults, children and the elderly. In the case of children, it is usually performed in patients with behavioral changes and learning difficulties, such as attention deficit, coordination problems, lack of memory and inability to read and make calculations. In adults and the elderly, it is done in cases of trauma, depression, schizophrenia, developmental disorder, stroke, deficit associated with alcohol or drug use, among others. No matter what the case, the doctor will try to understand how changes in the individual’s behavior relate to their traumas and how to help them overcome the problem from brain functioning (SPERLING et al., 2017).

Neuropsychology is where classical science – the one in which we imagine scientists in white coats and test tubes – meets psychology to figure out how to help people who go through several different problems. How do I know I need a neuropsychological evaluation? As mentioned above, children, for example, need these assessments because they usually have learning difficulties. However, it is more common to observe this demand within the school environment, where teachers notice the student's difficulty and inform their parents. In this case, when the person responsible seeks the help of a psychologist, the professional will evaluate the complaint to understand whether it is necessary to undergo a Neuropsychological Evaluation or if only the common therapeutic process will be sufficient (TRUTER et al., 2017).

In other cases, children with follow-up with pediatricians may also be observed by the doctor and referred for this evaluation. In the case of adults, the adult can seek psychotherapy and, throughout the process, the professional understands that the evaluation is necessary, this will be referred, as well as those patients who also have some medical follow-up, and the doctor notes that it is the case of an evaluation. Remembering that, in cases of the patient who seeks only psychotherapy and the professional observes that an evaluation will be necessary, it will be pre-established and combined, with the consensus of the patient (VAKIL; HOOFIEN, 2016).
5 FINAL CONSIDERATIONS

Neuropsychology is, in essence, an applied science and, like several other disciplines, Neuropsychology has witnessed the effects of a vertiginous technological evolution, provoking the need for updates and reformulations in relation to its conceptual roots, offering foundation to academics, support to professionals and streaming for the well-being of people who benefit. Likewise, Neuropsychology is faced with the challenges that accompany the inexorable sociocultural transformations observed in our society, including, among others, the need to adjust to the cognitive and behavioral profile of our heterogeneous population, which includes "new" strata such as shortened childhood, stretched adolescence and overcome longevity.

Paradoxically, the more Neuropsychology was, of course, if (re)approaching the biological and medical sciences, the more noticeable has been the effect of the environmental pressure to which it is exposed. Basic foundations of knowledge about the organism caused the psychologist specialized in Neuropsychology to broaden his understanding adapting to new social and scientific contingencies, in search of an evidence-based psychology. Thus, it constitutes the know-how of this specialist, basic and/or advanced foundations on complementary topics, such as: introduction to Neuropsychology (history), Neuroanatomy, Neurophysiology, Neuropathology (neurological syndromes), Psychopharmacology, Neuroimaging (subsidiary techniques), cognitive systems, neuropsychological development, semiology in clinical neuropsychiatry, Methodology Scientific, statistical models, neuropsychology contexts (areas of activity), psychometrics (neuropsychological evaluation), neuropsychological reports/reports and rehabilitation techniques.

Recently conducted and previously cited studies have demonstrated a tendency and preemience in characterizing the activity of the neuropsychologist in the most diverse places in which it is taught, practiced and disseminated. Also, in Brazil, it is necessary a taxonomy about the profession of the professional specialist in Neuropsychology, whether in relation to his/her training or professional performance. Such curricular exercise would meet not only a particular need of Neuropsychology, but also the agenda of the psychologist's profession, since other subareas could favor the matter questioned here, aiming at the progress of Brazilian psychology as a whole.

Recording and transferring landmark events provides intellectual support so that people, throughout their generations, are able to learn from past experiences and overcome current challenges through the continuous recycling of knowledge. The history
of Neuropsychology must, then, live up to its present role of guiding for a future time, not only presenting a sum of isolated events, but above all serving as a retroactive parameter for a movement of the scientific and social dynamics itself in which it is currently part. Once formidable assumptions were overcome by new theories and it was precisely the description of the methods used at the time that allowed contemporary experimentalists an original thesis, which would overcome the challenges of the time and contribute a new perspective.

The present article aimed to present the historical development of Neuropsychology, especially in Brazil, highlighting essential theoretical and methodological foundations, its current regulatory conjuncture and future perspectives in the creation of guidelines for professional training. Although this study is limited to a theoretical discussion about the topics addressed, students and professionals can benefit from the content presented, in search of the development and execution of controlled studies that address the issues of Neuropsychology as a specialty and promote its advancement through dissemination and understanding among colleagues in the profession and also in related areas.
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