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Article

Impaired interaction between memory and neurocognitive functions in college students

Interacción deficiente entre memoria y funciones neurognitivas en estudiantes universitarios

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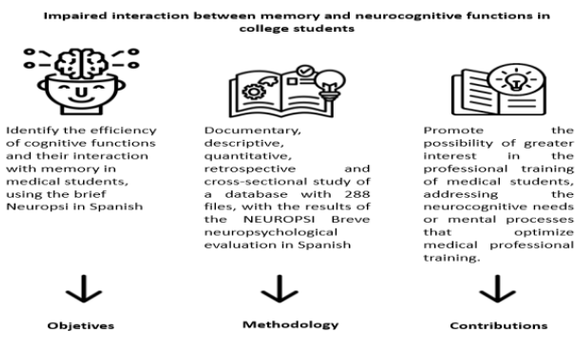
Abstract

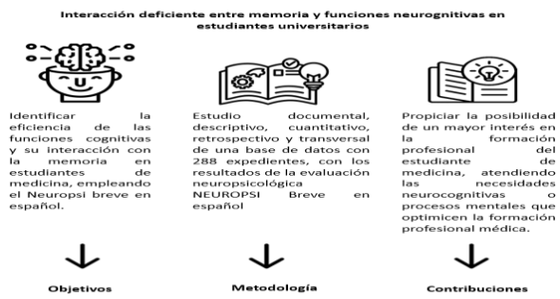
Introduction. Medical students require the ability to remember information, which allows them to forge their professional training. Aim. Identify the efficiency of cognitive functions and their interaction with memory in medical students. Methods. Documentary, descriptive, quantitative, retrospective and cross-sectional study of a database (288) with the results of the neuropsychological evaluation with NEUROPSI Breve in Spanish, applied to medical students. Results. Only 2 Neuropsi variables showed moderate correlation, which were Visuospatial Process Copy and Spontaneous Visuospatial Memory and the rest (20) of the variables showed weak or very weak correlation. Conclusion. The low interaction values between most of the neurocognitive variables and memory show an important area of opportunity to more efficiently improve the professional training of medical students.



Memory, Cognitive functions, University students

Resumen

Introducción. Los estudiantes de medicina requieren capacidad para recordar información, que permita forjar su formación profesional. Objetivo. Identificar la eficiencia de las funciones cognitivas y su interacción con la memoria en estudiantes de medicina. Métodos. Estudio documental, descriptivo, cuantitativo, retrospectivo y transversal de una base de datos (288) con los resultados de la evaluación neuropsicológica con NEUROPSI Breve en español, aplicada a estudiantes de medicina. Resultados. Solo 2 variables del Neuropsi mostraron correlación moderada las cuales fueron Proceso Visoespacial Copia y Memoria Visoespacial Espontanea y el resto (20) de las variables mostraron correlación débil o muy débil. Conclusión. Los bajos valores de interacción entre la mayoría de las variables neurocognitivas y la memoria evidencian una importante área de oportunidad para mejorar de manera más eficiente su formación profesional del estudiante de medicinas.



Memoria, Funciones congnitivas, Estudiantes universitarios

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Introduction

Cognitive processes are abilities that process information, in this way people acquire knowledge. Finally, cognition in relation to learning has to do with memory, reasoning and conflict resolution. To achieve a good cognitive process, good sensitive input is needed. One of the main cognitive processes is memory (Llanga et al, 2019). Therefore, memory is an important part of learning development.

Memory is formed through the process where the information received is converted into knowledge that will be used for life in the short, medium and long term. It is an intellectual function that structurally and functionally depends on the central nervous system, where the phenomenon of acquisition, storage and replacement of information, which enters through the sensory pathway, occurs (Solís, 2009). This ability to retain and subsequently evoke information through neurobiological processes is essential in learning and thinking (Etchepareborda, 2005).

Memory is integrated thanks to three events, the first of which is encoding in which the stimuli received are processed to be saved or stored. The second corresponds to the categorization of the stored information. And finally, the third is evocation that allows the recovery of information. The above is essential to identify possible failures in the memory process (Etchepareborda, 2005).

Memories are stored thanks to synaptic transmission between neurons due to nervous activity that gives rise to the formation of neuronal networks, which are the biological support of memory, which depending on the permanence of these networks, the classification is subject to its duration over time, thus short-term memory covers memories of a few seconds or minutes, medium-term memory can last for days, but later the information disappears and long-term memory, once stored, can be recovered for years more. late (Hall 2016).

The entry of information into memory is sensory and is integrated into the cortical regions of the brain (Barroso, et al, 2005); According to this modality of sensory access, a record is made that is divided into: auditory, visual, tactile, gustatory and olfactory (Fortoul Van et al 2005). Auditory memory analyzes stimuli to understand meanings such as words or sentences, (Matalinares et al. 2007) Marc D. Binder (2009) mentions that thanks to this process, verbal information can be recorded.

On the other hand, he also comments that visuospatial memory refers to the retention of information derived from the visual perception of spatial and temporal location (Binder 2009). Tactile memory recovers sensations that involve body movement, that is, kinesthesia (Sarmiento 2016). In taste memory there are memories of flavors such as salty, sweet, sour or bitter that are perceived thanks to the sense of taste (Perinat 2007).

In addition to the brain areas that make up memory, there are also some cognitive functions that interact with it, such as attention, which is responsible for inhibiting stimuli that are trivial for the task that needs to be performed (González and Ramos 2009). Therefore, the greater the attention to the information, the better the retention and evocation of it. (Fuenmayor and Yeriling 2008).

This interaction being fundamental to reflect on possible errors in memory, which are reflected in learning.

Another important process is reading because it is basic for learning, since different cognitive processes intervene in it, where different functions such as memory and attention are necessary for brain systems to identify different spellings (López 2019). Therefore, the interaction of memory and reading should have a strong interaction within the learning process.

Executive functions are also processes that constantly interact, since they associate simple ideas and combine them to achieve the resolution of very complex problems (Tirapu 2005). Therefore, the interest arises to know the

With respect to this interest in analyzing the interaction of cognitive functions, there are some previous studies, for example in 2019, research was carried out to find out how working memory (WM) is related to the academic performance of 270 medical students using the values of the NEUROPSI test, where they mentioned the importance of WM in the learning process because it is necessary to meet certain requirements such as following instructions, simultaneous processing demands and performing complex tasks (Varela et al, 2019).

Another study carried out in 2016 shows the importance of knowing the level of memory in new students at a higher level in order to meet the needs of this cognitive function and improve the neurocognitive results of these students (Nájera et al, 2016).

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Having a good memory is considered a positive effect for academic performance. This performance is reflected during the academic period through tests and evaluations that usually represent the level of memorization of different knowledge. For these academic processes, it is considered important that the capacities of memory, attention, analysis and synthesis favor the acts of self-reflection, criticism and creativity present in their area of study.

Box 1

Table 1

Population by gender

Genero	Frecuencia	Porcentaje
Masculino	126	43.8 %
Femenino	162	56.3%
Total	288	100.0

Consultation source: Own creation

With respect to this interest in knowing the efficiency of memory and knowing that memory is the cognitive function that allows encoding, storing and recovering information from the past and that it is a basic element for learning, for this project the analysis was carried out from the research database to medical students where the Brief NEUROPSI instrument was applied in Spanish, which evaluates the following areas: I. Orientation (level of consciousness and general state of activation) II. Attention and concentration (ability to focus and sustain attention) III. Memory IV. Language V. Visuo-spatial skills VI. Executive functions VII. Reading, writing and calculation (Ostrosky 1997).

These cognitive functions are represented by six complex variables which present different simple variables, being represented as follows: Complex variable Orientation which has three simple variables that are: time, place and person; then the complex variable Attention and Concentration with three simple variables that are: Digits in Regression, Visual Detection and 20 – 3; Then there is the complex variable Memory which is divided into two more complex variables: Coding with the simple variables Spontaneous Verbal Memory and Visuospatial Process Semi-complex Figure Copy and the complex variable Decoding with the simple variables Visuospatial Memory, Spontaneous Verbal Memory, Verbal Memory by Keys and Verbal Memory Recognition, continuing later with the complex variable Language that has the simple variables Naming, Repetition, Comprehension, Semantic Verbal Fluency, Phonological Fluency, continuing with the complex variable Reading and Writing that has the simple variables Dictation and Copying, Finally, there is the complex variable of Conceptual Executive Functions, simple variables of Similarities, Calculation, Sequencing and Motor Executive Functions, which has the simple variables, Right Hand, Left Hand, Alternating Movements and Opposite Reactions.

The article shows an approach to the study of cognitive functions, related to learning in university students of medical school.

Including figures and tables-Editab

Box 2

Table 2

Population by age

Edades	Frecuencia	Porcentaje
18	3	1.0
19	28	9.7
20	62	21.5
21	56	19.4
22	60	20.8
23	35	12.2
24	21	7.3
25	12	4.2
26	6	2.1
27	1	.3
28	1	.3
29	1	.3
34	1	.3
43	1	.3
Total	288	100.0

Box 3

Table 3

Population by school grade

Grado	Frecuencia	Porcentaje
1	6	2.1
2	25	8.7
3	44	15.3
4	19	6.6
5	67	23.3
6	27	9.4
7	25	8.7
8	10	3.5
9	37	12.8
10	28	9.7
Total	288	100.0

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Box 4

Table 4

Correlation of simple variables

	Memoria					
	Codificación		Evocación			
Variables simples	Mem VerEspon	Proc Viso Copia	FEV - Mem Viso Esp	FEV – Mem VerbEspon	FEV - MemVerbXClaves	FEV – MemVerbXReconoc
Ac-DigReg	.143** p .015	-.043 p.467	-.009 P .873	.143** P .015	.123* P .037	-.033 P .572
Ac-DetVis	.104 p .078	-.015 P .804	.050 P 394	.093 P .115	.033 P .575	.005 P .932
Ac 20-3	.152** p.010	.101 P .086	.124* P .035	.066 P .267	.033 P .577	-.099 P .095
C-MemVerEsp		.159** P .007		.193** P .001		-.100 P .091
C-ProcVisoEspCopiaFig			.468** p .000			.113 P .056
FEV - MemViso Espon	.108 P .067			.189* P .001	.125* P .034	
FEV-MemVerEspon		.060 P .307			.671** P .000	
FEV – MemVerbXClaves	.148* p .012	.158** P .007				.235** P .000
FEV-MemVerbXReconoc			-.015 .798	.223** P .000	.265** P .000	
L-Denomin	-.021 p .718	.092 P .120	.066 P .263	.072 P .226	.136* .021	-.035 P .556
L- Repet	-.063 p .287	-.057 P .333	-.026 P .657	-.053 P .372	-.068 P .253	-.063 P .286
L-Compren	.004 p .947	.102 P .086	.096 P .105	.068 P .252	.098 P .096	.027 P .644
FluidVSem	.132* p .018	-.019 .749	.058 P .326	.081 P .169	-.046 P .441	-.105 P .076
FluidFon	.191** p .001	.017 P .771	.082 P .163	.080 P .177	.054 P .365	-.025 P .668
Lectura	.008 p .890	-.020 P .729	.023 P .697	.170** P .004	.106 P .074	.103 P .082
Escritura	0.000 p 1.0	0.000 P 1.0	.063 P .285	-.088 P .138	-.110 P .062	.083 P .161
FEConSemej	.014 p .815	.045 P .444	.035 P .550	.057 P .335	.017 P .770	.050 P .401
FEConCalc	.144* p .015	-.025 P .672	.071 P .232	.126* P .033	.007 P .912	-.142* P .016
FEConcSecuen	.098 p .095	.032 P .587	.112 P .057	.064 P .280	.096 P .104	.055 P .349
FEFunMotCamPosMano	.049 p .404	.046 P 435	.034 P .565	.104 P .079	.105 P .076	-.096 P .104
FEFunMotMovAlt2Manos	-.036 p .548	.011 P .848	.048 P .412	.019 P .754	.018 P .767	.114 P .054
FEFMotReacOpuestas	.083 p .158	.059 P .322	-.010 P .861	.032 P .586	.098 P .095	.020 P .730

*. The correlation is significant at the 0.05 level (two-sided)

**.The correlation is significant at the 0.01 level (two-sided)

Consultation source: Own creation

Methodology

The research is documentary analytical, descriptive, correlational and transversal. According to the brief neuropsi in Spanish, the variables are described as follows:

Attention and concentration digits in regression

The px's ability to repeat series of numbers inversely to the model provided to it, progressively greater. It is graded according to the number of digits it manages to emit in reverse.

Attention and concentration visual detection

Patient's ability to identify the requested figures on a sheet with similar shapes, in 60 seconds. It is graded according to the number of correct answers and errors made.

Attention and concentration 20-3

Ability of the patient to carry out subtraction progressively starting from 20 in 3 at a time until obtaining the minimum requested amount. 1 is scored for each correct answer and 0 for each error.

Spontaneous verbal memory encoding

Patient's ability to verbally reproduce 6 words during 3 trials. It is scored by adding the number of words uttered in each essay.

Coding visuospatial process copy of semi-complex figure

Ability of the patient to accurately reproduce a model observed for 5 minutes. To qualify, the size, shape and location are considered, where qualitative scores of 0, .5 and 1 will be obtained depending on the efficiency of the reproduction of the figure presented.

Executive functions visuospatial memory evocation

The patient's ability to evoke the illustration of the figure presented, at the end of the evaluation. To qualify, the size, shape and location are considered, where qualitative scores of 0, .5 and 1 will be obtained depending on the efficiency of the reproduction of the figure presented.

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Executive functions evocation spontaneous verbal memory

Ability of the patient to verbally evoke the greatest number of words previously presented, at the end of the evaluation. To qualify, 1 point will be given for each word correctly remembered.

Executive functions evocation spontaneous verbal memory by cues

Ability of the patient to verbally evoke the greatest number of words for 3 semantic fields, fruits, animals and parts of the body. To qualify, 1 point will be given for each word correctly remembered.

Executive functions verbal memory evocation by recognition

The patient's ability to auditorily identify the words that were previously memorized. To qualify, 1 point will be given for each word correctly remembered.

Naming language

Patient's ability to recognize a series of 8 figures and name them correctly. To qualify, one point is provided for each figure correctly recognized.

Repetition language

Patient's ability to repeat a series of 2 words and 2 sentences after hearing them. It is scored by giving one point for each word uttered correctly.

Language understanding

Patient's ability to correctly point to the indicated figure of 4 figures shown. It is scored by giving one point if the action is correct.

Semantic verbal fluency

The patient's ability to mention all the names of animals he remembers for one minute. It is scored by adding the number of words you can mention.

Phonological verbal fluency

The patient's ability to utter words that begin with the phoneme m for one minute. It is scored by adding the number of words you can mention.

Reading

The patient's ability to understand a short text and then answer 3 questions about it. It is scored by giving one point for each correct answer.

Writing

Patient's ability to write a sentence from dictation.

Executive functions conceptual similarities

The patient's ability to mention the semantic field to which a series of even words belong.

Executive functions conceptual calculation

Patient's ability to mentally solve 3 arithmetic problems of subtraction and addition. It is scored by giving one point for each correct answer.

Conceptual executive functions sequencing

Patient's ability to order figures shown progressively. A point is scored if the action is correct.

Executive functions motor functions change of hand position

Patient's ability to imitate a series of 3 presented hand movements. It is graded qualitatively with scores of zero points, one point and two points.

Executive functions motor functions alternating movements of the 2 hands

Patient's ability to execute alternating and simultaneous manual movements with both hands. It is graded qualitatively with scores of zero points, one point and two points.

Executive functions motor functions opposite reactions

Patient's ability to execute movements contrary to those requested. It is graded qualitatively with scores of zero points, one point and two points.

Results

In the studied sample of FAMEN UJED medical students, a larger female population is shown (see table 1).

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Regarding the distribution by age, a greater number of students are 20 years old (see table 2). Regarding the school grade of the population studied, a greater number of students were observed in the 5th grade (see table 3). Regarding the correlation results, low and very low levels were found between the variables studied, nine of them being observed without any correlation (see table 4).

Conclusions

It can be concluded that in the 22 simple variables analyzed from the Brief Neuropsi in Spanish, the correlations obtained were constantly low, this being contrary to what would theoretically be expected because memory is part of the cognitive processes that store information to convert it into learning. (Llanga 2019). However, only 2 correlations obtained a moderate result, which were Visuospatial Copy Process and Spontaneous Visuospatial Memory¬; 11 presented a correlation between weak and very weak and nine presented no correlation. The highest correlation was .671 with a p of .000 between Spontaneous Verbal Memory and Cued Verbal Memory. The lowest correlation was .123 with a p of .037 between Digits in Regression and Verbal Memory by Cues. These results demonstrate the need to optimize the interaction of cognitive functions with memory, because, from the first days as medical students, they must recognize a large amount of information to acquire knowledge and skills for their profession (Collipal 2004).

Declarations

Conflict of interest

The authors declare no interest conflict. They have no known competing financial interests or personal relationships that could have appeared to influence the article reported in this article.

Author contribution

Teresita-del Rayo, Isais Najera: Scientific foundation, Database analysis, statistical analysis

Rios-Valles, Jose Alejandro: Responsible for the idea of the research project, Conclusions and contributions

Salas-Name. Sagrario: Participation in documentary and statistical analysis

Herrera-Vargas, Isela Vanessa: Document analysis

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