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Article

Analysis of working memory in the learning of egb students in the framework of linkage with society

Análisis de la memoria de trabajo en el aprendizaje de estudiantes de egb en el marco de vinculación con la sociedad

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Abstract

The study focuses on the monitoring of structures that support information retention in learning processing. Working memory and some complex cognitive functions participate significantly in reasoning, planning or decision making of the learner. UNESCO indicates that 60% of the Ecuadorian student population has learning difficulties due to the conditions of virtual teaching during the COVID 19 pandemic. The objective of the work carried out within the framework of the linkage with society of the Faculty of Education of a University in Ecuador was to analyze the working memory of 871 children between 5 and 15 years of age, applying the Wechsler intelligence test (WISC V). This was the instrument used by 156 teachers in training. A descriptive and exploratory cross-sectional study was carried out. For the bibliographic research, texts and biomedical journals were examined. The scale considered the result of the working memory indexes with a confidence interval of 0.84 and an average qualitative score in 63% of the intervened children. The results obtained were communicated to the representatives by the teachers who applied the scale as a pedagogical contribution to strengthen the learning of the intervened group.

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Resumen

El estudio se enfoca en el monitoreo de las estructuras que admiten conservar la información en el procesamiento del aprendizaje. La memoria de trabajo y algunas funciones cognitivas complejas participan de forma significativa en el razonamiento, la planificación o la toma de decisiones del aprendiz. UNESCO indica que el 60% de la población estudiantil ecuatoriana presenta dificultades en el aprendizaje debido a las condiciones dadas en la enseñanza virtual durante la pandemia del COVID 19. La gestión realizada en el marco de vinculación con la sociedad de la Facultad de Educación de una Universidad en Ecuador tuvo el objetivo de analizar la memoria de trabajo de 871 menores entre 5 a 15 años, aplicando la prueba Wechsler de inteligencia (WISC V). Este fue el instrumento utilizado por 156 docentes en formación. Se realizó un estudio descriptivo y exploratorio, de corte transversal. Para la pesquisa bibliográfica se examinaron textos y revistas biomédicas. La escala consideró el resultado de los índices de memoria de trabajo con intervalo de confianza de 0.84 y una calificación cualitativa promedio en el 63% de los menores intervenidos. Los resultados obtenidos fueron comunicados a los representantes por los docentes aplicadores como aporte pedagógico para el fortalecimiento del aprendizaje del grupo intervenido.

Palabras clave: Investigación significativa, cualificación, competencia profesional.

Introduction

Throughout the history of educational systems in their development and implementation, there have been multiple interventions with students in general basic education. These have been carried out in order to develop each of their potentialities in the sphere of learning and in the exercise of skills not described so far in them and that could be cultivated individually and collectively to achieve their insertion in the daily environment (Dávila, 2016)

Educational institutions are undergoing a series of changes, adapting to the demands and needs of today's society; therefore, the academic level required of students will be increasingly higher in order to respond to these demands. Therefore, this study has the purpose of analyzing the cognitive abilities of GBS students, specifically, working memory with the application of the Weschler test (WISC V). This will be done within the framework of service-learning, generated from the subject of

educational psychology in the process of teacher training in basic education. The intervention will be carried out with a selected population of children between 5 and 15 years of age. Its purpose is to contribute to the learning of the children involved and to the professional training of university students.

Within these changes, the university student must have knowledge and adequate training to act in educational contexts, to meet the demands and contribute to the problems that arise in society. Many countries, including ours, encourage convergence, training and competencies within the framework of projects of linkage with society, through numerous initiatives that are promoting the optimization of student capabilities. This is, with the aim of ensuring the development of skills that allow them to fulfill the social object for which they are trained and subsequently continue their improvement in the professional field. (Manolov, 2016)

Among the great challenges of the 21st century is to create strategies that allow students to be the rector of their own teaching and learning process, through the use of different teaching methods and means. This, in promotion of self-directed study and to face the challenges presented by the context in which they develop and the society of which they are part and will later contribute to it. (Manolov, 2016)

In Ecuador there is a constant concern for the effectiveness of the pedagogical processes and the formative transcendence in favor of students and quality in the educational sector. However, as a primary effect, there are difficulties for the entry and development in the detection and counseling of gifted or talented students. Among the various purposes of pedagogical intervention, emphasis is placed on the application of instruments that allow to achieve early diagnosis of learning disorders and guide the interference in a rapid, timely and consistent manner to achieve their elimination. (Manolov, 2016)

There is concern for the personal development of each student. The apprentice must have high theoretical and practical knowledge and the fundamental basis for reaching these levels has been the repercussion of knowledge, skills, abilities and competencies. This is, from initial, middle, general education to give way to university education, which should be the link to achieve future professionalization. (Ministry of Education of Ecuador, 2016).

Many tests and diagnostic procedures are used to achieve the means of student training and among them is the Wisc-V. This instrument allows a diagnosis in the health and pedagogical areas to determine alterations

in both spheres. With the immediate objective of strengthening the missing sector and potentiate elements of learning, including work capacity and fixation and working memory, cognitive and affective skills among others. (Huarca, 2016,)

In this sense, it should be noted that those students who adequately develop working memory, if not assertively integrated into learning, may be excluded. Therefore, one way to establish exclusion is to force them to study subjects that they are already aware of and master, which creates restlessness, as well as disruptive directives that can discourage serious study. It is necessary to propitiate in this type of learners the circumstances of integration to the appropriate teachings, relevant, to their reality, thus achieving to focus on meaningful learning. (Huarca, 2016,)

Consequently, an education with a complex vision is required to serve all students from an inclusive and quality perspective. It is necessary to promote systemic thinking to organize interaction between teachers and students in order to generate an inclusive approach to learning. Although they are described, it is imminent to strengthen the student-centered learning approach. This will allow that, through research and inquiry, the same acquires knowledge due to their demands and perspectives, with the possibility of growing in line with the multiple global challenges. (Huarca, 2016,)

That is why the working memory is determinant since through it the cognitive processes in the learning of the child can be strengthened, through the accumulation of experiences they will be able to form their own criteria of some events that usually take place in society on a daily basis.

Authors have tried to determine the existence of a relationship between working memory and some complex cognitive functions, concluding that it is significantly involved in reasoning, planning and decision making (Funahashi, 2006). (Funahashi, 2006). Working memory is determined as a component of human learning, which is related to mental processes in charge of storage, manipulation of temporal information, and the manipulation of information (Baddeley A. D., 2006). (Baddeley A. D., 1986) and long-term memory. These are related through a number of relationships that allow the human being to retrieve and process the information already stored. Working memory is the key element in the area of knowledge and cognitive processing.

Currently, the classification of types of working memory is related to language, thought and communication with the environment.

Specifically, many authors claim that within working memory, two types could be distinguished: verbal working memory and visual working memory. (Redolar Ripoll, 2014). The one in charge of understanding and producing language. According to the model proposed by (Baddeley A. , 2012), it is related to the phonological process, linked to the left temporal cortex. Wernicke's and Broca's area is called verbal working memory, while the relationship between spatial information processing, (Baddeley A. , 2012) was named visuospatial agenda, closely linked to the dorsal prefrontal cortex and is related to visual working memory (Redolar Ripoll, 2014).

The working memory that is developed in the processing of the learner's information shows the individual variation in academic performance and is widely known in the educational institution and in the social environment to which the individual is related. All this is part of the fact that, related to general basic education students, the different skills related to academic achievement may vary from one person to another, as an effect of the society in which he/she lives. (Jenkins, 2003)

This study is based on the importance of working memory in EBG students. The purpose of this study is to evaluate the cognitive abilities of the children involved. In the execution of the project of linkage with society, teachers in training were asked to apply the Wisc-V test to 871 children in order to contribute with the results to the pedagogical intervention and, therefore, to improve learning with the application of the Wisc test. Therefore, it should be emphasized in this research that the first intelligence scale was Weschsler's scale for children in 1949. Wechsler defined intelligence as the total capacity of a person to act and relate to his or her environment. In addition to thinking rationally, he proposed the presence of two factors, giving rise to verbal and execution tasks. The results obtained were related to verbal, execution and total intelligence (Marín, Angeli and Porto, 2016).

This intelligence scale was formed by twelve tests that were derived from the Wechsler-Bellevue scale (Wechsler, 1939), the same that has been prototypical and under different forms and successive adaptations, which have endured for decades as a measurement option for intellectual abilities. The use of the Wechsler tests has been extended to most countries, and versions have been made for different age levels (adults, school age and preschoolers). Nevertheless, and due to the different conditions that have arisen in the framework of intelligence studies, successive modifications of the Wechsler scales have been registered, being effective to incorporate knowledge about intelligence, cognitive development and neurobiological processes.

In the light of the above, it has also brought with it advances in psychometric methods, especially in structural models of intelligence. This has allowed the updating or versions of the scale as an adequate and suitable instrument to evaluate intelligence, especially in children and adolescents. It is focused on some characteristics such as high intellectual capacity, intellectual disability, learning disabilities, attention disorders, etc.

Likewise for Osuna (2017) the Wechsler Intelligence Scale is one of the most widely used tools to measure the intellectual capacity of children and adolescents who are of school age. It is better known as the WISC test. This test for students has been standardized with exceptional attention over a period of many years of experimental testing, field testing and statistical analysis.

Meanwhile, intelligence tests can be divided into two categories: aptitude tests also known as ability (predict the ability to learn a new skill or task). The achievement tests known as achievement (they evaluate how much a person knows about a specific subject), the latter are usually used for educational and/or employment purposes, there are also those who argue that today achievement tests and IQ tests differ only by the degree of instruction required to be able to perform them (Posada, 2016)

Currently, one of the most widely recognized tests for the assessment of intelligence are the Wechsler scales, which were developed by Wechsler, a clinical psychologist at Bellevue Hospital. His initial test, the Wechsler-Bellevue Intelligence Scale, was published in 1939 and was designed to measure the intellectual performance of adults. This test is composed of fifteen tests, of which ten are the most relevant: stopping digits, clues, concepts with pictures, vocabulary, similarities, matrices, symbol search, cubes, sequence of numbers and letters, comprehension. The five added tests are: information, arithmetic, clues, records and incomplete figures.

For its part, the Wisc-V test, due to its reliability, has become the most widely applied by psychology professionals, whose results are used to establish whether the person has a learning disability. If so, apply methods that contribute to improve the quality of life of the individual. (Schonhaut, 2017).

The WISC-V is preferably used in clinical, health and educational contexts, with the following aspects as characteristic processes in both the health and educational sectors. With respect to the educational setting, the following aspects are taken into account:

Establish the diagnosis of cognitive aptitudes in cases with special educational needs: learning problems or disorders, attention disorders, giftedness, intellectual disability, etc.

- To assess the cognitive abilities and difficulties of these people in order to design intervention plans.
- Evaluate the results of the intervention plans.
- Predicting academic performance.

In this sense, the intelligence test process begins with the application of the Cubes test, alternating with the application of the verbal comprehension, visuospatial, fluid reasoning, working memory and processing speed tests. This makes the administration of the scale varied and enjoyable and minimizes the effects of fatigue. Therefore, the strengths of these students are summarized in their potentialities with respect to the promotion of their professional vocation related to their learning style. Participants with left limbic (LI) predominance, according to Ned Herrmann, are characterized by being planners and organizers. In general, they do not develop activities without these being planned and under their supervision. (EcuRed, 2020)

We highlight the contributions of (Oliver M, Fonseca C, 2017)who developed a study related to reading comprehension in the Ecuadorian Amazon, where they carried out the identification of the level that will reflect the alterations of this in high school, based on the reform of the technological high school. In this case, once the reading comprehension levels were identified through the application of a survey to the students, the object of the study, an improvement plan for these levels was elaborated and obtained satisfactory results. (EcuRed, 2020)

The first argument on which working memory researchers maintain some differences is who should be considered gifted. They all agree that giftedness is a general intellectual capacity or several cognitive capacities far above what we observe and understand that a child in reference to his age should have. This alone is not enough in educational practice, since we can ask ourselves: what is a high degree of capacity? by means of what instruments can we know their capacities? how can we know the intellectual or creative potentials in children with low cultural possibilities? The very terminology that has been used and is used is different, and often confuses families and teachers. (Oliver M, Fonseca C, 2017)

The present research approaches working memory from the globalized approach of general basic education. Education has a transcendental importance in society, provoking an understanding and interpretation of the social reality that each student lives through the cognitive processes

from different positions and that influences the processing of the information they receive and, therefore, in learning.

Today's society is more complex and, in addition to this, technological advances represent new challenges. Educational and social institutions must be articulated since both play a more active role in the transformation of the main problems affecting humanity. The evolution of society and General Basic Education Institutions are not outside the new social rules, and must adapt from their organization with new structures that respond to these needs.

Materials and methods

The methodology is a transcendental aspect of all research; as well as the relationships established between the stages or phases that are presented reveal how the research was carried out to obtain the data obtained and the revealing demonstrations achieved in relation to the difficulty under study. In relation to the new knowledge it is probable to locate in the contexts of reliability, impartiality and internal effectiveness. For this, it is intended to demarcate the processes of the methodical order through which it will be tried to give answers to the questions of the object of study.

Therefore, in the methodological path of the present study, which alludes to the techno-operational moment present in every research process, it is necessary to set out in detail the set of methods, techniques and instrumental protocols that will be used in the data collection process required in the proposed research. It is necessary to set out in detail the set of methods, techniques and instrumental protocols that will be used in the data collection process required in the proposed research. The characterizing elements of the same were established and presented in a pedagogical manner in order to be easily understood. Taking into account the type and purpose of the research, it was based on the descriptive-exploratory paradigm of quantitative-qualitative type.

This type of study turns out to be useful, since, through observation after the application of the instrument, an initial diagnosis of the cognitive conditions of the students can be made, and after applying the WISC V test, the results that will reflect the level of working memory of the intervened children are obtained. The management of the 156 applicators in the execution phase of the project within the framework of the linkage with society was the route that made possible the intervention with the children selected for the study.

The study was conducted during the second semester of 2021 with 156 undergraduate students in Education in online modality, from the Universidad Del Pacífico with the role of applicators in the management of the project of linkage with society. The WISC V test was applied to 871 students of General Basic Education, 78.8% of whom belonged to public institutions and 21.1% to private entities in six provinces of the highlands and two of the Ecuadorian coast region. The gender of the participants corresponds to 49.7% male students and 50.3% female students, between 5 and 16 years of age, with an average age of 11.32 years and a standard deviation of 2.883. The legal representatives of the participants were asked to sign the informed consent form.

The sample size was calculated using the following formula:

$n = N * Z2 * p * q\ (N\text{- } 1) * e2 + Z2 * p * q$

Where:

N: Population size

n: Sample size

Z: Confidence level 95% = 1.96

p: Probability of success = 0.5

q: Probability of failure = 1-p

e: Estimation error = 5%.

Substituting the values in the formula, the following result was obtained:

$n = 30 * (1{,}96)2 * 0{,}5 * 0{,}5\ (30\text{- } 1) * (0{,}05)2 + (1{,}96)2 * 0{,}5 * 0{,}5 = 18$

n=18

Students who met the following inclusion and exclusion criteria were selected by simple random sampling.

Inclusion criteria

Be a student of basic general education

To have participated in the project of linkage with society.

Show readiness for the application of the WISC V test.

Exclusion criteria.

Non-student of general basic education

Not having participated in the project of linkage with the society.

Results

After processing and tabulating the information, the following results were obtained and are shown in the following tables and graphs:

Table 1 shows the distribution and analysis of the results where the frequency distribution in relation to the biological gender of the interviewees can be seen, where the highest percentage is represented by male students with 49.7% in relation to the female gender, which has a representation of 50.3% in relation to the sample.

Table 2. *Distribution between Educational Level and Type of Educational Center*

Educational Level	Public	Private	Total
1EGB	86	6	15
2EGB	88	10	38
3EGB	112	12	45
4EGB	84	13	53
5EGB	58	8	66
6EGB	17	15	72
7EGB	42	10	52
8EGB	59	5	64
9EGB	41	7	48
10EGB	56	12	68
1BGU	46	2	48
2BGU	17	0	17

3BGU	65	0	65
Total	771	100	871

Note: basic education grades

Table 2 shows the distribution in relation to the educational level and type of educational center, where the sample of the public institution is represented by 475 students and 158 correspond to the private educational system.

Table 3. *Correlation between descriptive elements*

	Media	Deviation Deviation	N
Type of Educational Center	1.25	.433	871
Educational Level	6.96	3.003	871
Age	11.32	2.883	871
Direct Digit Test Scores	26.70	8.134	871
Digit Test Scalar Score	10.61	3.808	871
Drawing Span Test Direct Scoring	27.50	8.626	871
Span Drawing Span Test Scalar Score	9.85	3.702	871
Sum of Working Memory Scalar Scores	20.31	6.290	871
Working Memory Index	99.36	18.551	871
Percentile Rank	51.463	32.4117	871

Note: descriptive elements of the correlational study.

Table 3 shows the correlation between the descriptive Elements, where the mean of the sample of 871 students the type of educational Center equals 1.23 with a standard deviation of .433, while the mean of the educational level is 6.96 with a standard deviation, where it is evident

that the mean by the memory index equals 99.36 with a standard deviation of 18.551 for the sample of 871 students.

Discussion

Numerous are the studies that relate the application of psychometric tests of multiple intelligence in pedagogical studies related to intervention with students at different levels. As for the relationship of their learning with direct interaction with society. However, it should be noted that the cognitive functioning of schoolchildren shows a configuration of skills similar to the hierarchical structure proposed by the model. This means that the more specific skills (10 primary subtests) are organized around five broader skills (main indexes or first-order factors), which together account for an intelligence construct or second-order factor (Brenlla, 2013; Kaufman et al., 2016; Scheiber, 2016).

National and international evidence has shown that the most diminished performance is reflected in children from rural or socioeconomically vulnerable sectors. This deficiency is detected in tasks that require problem solving skills. Through the use of language and the level of verbal abstraction, they are involved in the corresponding study to achieve adequate performance. (Oliver M, Fonseca C, 2017)..

Regarding discriminant validity, the technical and interpretation manual presents data on the sensitivity of the WISC-V scores. In its American and Spanish adaptation, to discriminate between children belonging to special groups: children with high intellectual ability, with intellectual disability, specific learning disorders in reading, written expression and mathematics, attention deficit hyperactivity disorder, disruptive behavior, cranioencephalic trauma or autism spectrum disorders (Oliver M, Fonseca C, 2017)

Scheiber (2016) examined the factorial invariance of WISC-V across ethnicity and gender in a sample of 2637 African American, Hispanic, and Caucasian children in the United States. Results demonstrated configural, metric, and scalar invariance for the 6 groups in which it was explored. This author implies that the factor structure is consistent across groups, both by ethnicity and gender, and thus the inferences drawn from the scores are equally significant for Hispanic, African-American and Caucasian boys and girls. The author concludes that, at the level of clinical implications, this study provides additional empirical evidence for the use of the WISC-V in the groups of children belonging to the ethnicities studied.

The contributions of Reynolds and Keith (2017) posit in a study of factorial invariance across age ranges with an American standardization sample of WISC-V where evidence of strict invariance was obtained, which allows determining the presence of the same factorial structure and the same underlying constructs, regardless of the age of the participants.

Similarly, the contributions of Van de Vijver et al., (2019) allowed examining the invariance of the five-factor model in different countries where the scale had been adapted (Australia, New Zealand, France, Germany, United Kingdom, United States, among others). For this analysis they used the standardized scores of the 10 primary subtests. Their results show support for the level of configural and metric invariance and, more weakly, for scalar invariance. According to these authors, these results would support the existence of shared psychological meanings for the WISC-V subtests in the countries studied, supporting the global applicability of the hierarchical factorial structure of the scale.

For Pauls et al., (2019) the analysis of measurement invariance across gender, in the German version of WISC-V. Their results support the equivalence of 11 of the 15 subtests, supporting the possibility of interpreting test scores in the same way for males and females, considering the level of partial scalar invariance achieved. The authors of this study warn about the difficulties observed in relation to the factor loading of the "Reasoning Matrices" subtest on the "Fluent Reasoning" index, and the cross-loading of the Arithmetic subtest present in the model proposed by Wechsler (2014). The items corresponding to working memory indicate a medium level, marking a medium-low range reflected in the mean scores obtained by the intervened children.

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