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Andragogic heterogeneity in cognitive competences for research

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Abstract--In the current context, the importance of having human capital capable of responding in a concrete and effective way to events that require a research profile has become evident, being essential to have the ability to materialize intellectual virtues in favor of general well-being. However, this is a difficult objective to carry out, provided that there is a lack of scientific training aimed at encouraging future professionals to be high-level researchers, explained by the significant differences between the transversal competences that they should have, in this case, in university higher education. Mainly, the cognitive instrumental competences, manifest the basic and essential characteristics, highly linked to the development of the scientific method. In this sense, the present work shows the diagnosis started in march 2019 and concluded in april 2020, regarding the existing heterogeneity in the cognitive competences for research that the participants should have (ideally), regarding what they manifest when they are in the process of preparing a thesis (actual status); as part of the research courses in the business sciences career and within the framework of the andragogic learning process.

Keywords--heterogeneity, andragogic learning, cognitive skills, researcher, higher education.

Introduction

The problem of investigative training

Authors such as Benarroch & Núñez (2015), point out that it is imperative to grant interest in developing scientific competencies at the university level of instruction, even more undergraduate, since there is a society that increasingly demands personal and professional qualities. In this way, the presence of competencies basic skills represents a key factor in andragogic training. However, Borja (2019), points out that among the main reasons for student dropout, there is the existence of cognitive, communication and interaction difficulties among university students. In this regard, the World Bank (WB, 2017) states that in Latin America, 42% drop out of higher education, with only 50% of students in Latin America and the Caribbean who enrolled in a career graduate "on time"*.

In this scenario, among the factors that reduce the interest in graduating there are the requirements to do it, mostly the preparation of an investigation. Indeed, once the study plan is finished, university students hardly manage to start a thesis (BM, 2017), being afraid to do it, since it represents a tedious, boring, even tortuous and discouraging process, taking many years to finish it, and never graduate (García, 2019). In Peru, according to the 2015 National University Census, 84.30% of university graduates (10,564) reach the bachelor's degree, while only 43.93% obtain the professional title; where 50.3% of graduates opt for the thesis preparation modality to obtain a degree (National Institute of Statistics and Informatics, INEI, 2015). Meanwhile, it can be inferred that in order to achieve a better academic position, the professional is subject to the complications that it presents in the development of its research, constituting the main limitation, despite having courses related to the subject in the last cycles of its specialty, as part of the curriculum.

In this regard, Aiquipa et al. (2018) allude to the lack of knowledge about research methodology, among other cognitive aspects, causing that, for the most part, students are not prepared to carry out research; being common to hear self-recognition of these weaknesses. Given this, Dávila (2017) specifies that teachers must focus on teaching or exercising critical analysis, comparison, discrimination of data, ordering them, conceptual preparation, argumentation, scientific writing, bibliographic references, etc. in the preparation of the thesis; being incorrect and insufficient to saturate with information that can even be found in different virtual platforms, not contributing to effective learning.

Despite the increase in the budget allocated to universities to promote research, the results are not at all encouraging, since worldwide the production of research reaches 0.03% for Peru, while at the level of Latin America 0.9% (10th place); having among the causes of this regrettable deficit, the absence of the use of the method to investigate and little interest in promoting these practices (Peralta, 2019). In the first, whose participation is attributed to the teacher, while, in the second, to the student, mainly. The urgency of innovation and changes in the way

* Understood as students who obtain the professional title between the ages of 25 and 30.

of teaching - learning to research is undeniable, before which the intervention of the cardinal actors is a first step to stimulate it, however, it is also indisputable, to consider the state of the students' skills .

In the local panorama and typical of the present study, it was observed as part of the experience in andragogic teaching practice in a public university, belonging to the faculty of business sciences, the presence of a significant heterogeneity in the manifestation of cognitive competences for research , by the learners. Undoubtedly external factors such as the quality of basic education received, cultural, economic and social aspects of the region, which refers to the Amazon, where it is known that it presents educational indicators at a disadvantage compared to other regions; added to access to basic services (including internet), aspiration to job opportunities and quality of life, among others;

Investigative learning presents deficiencies in key characteristics to effectively potentiate and achieve the academic product that synthesizes and demonstrates the existence of intellectual and attitudinal competencies of the individual after completing five years of higher studies, such as the thesis. Register the insufficiency in posing a question, linking and applying the lessons in reality, analysis and synthesis, critical thinking, creative thinking, decision-making and problem solving, knowledge of topics specific to their area and submit it for discussion, expression of their argumentative and objective ideas and exposition, correct spelling and writing, use of computer and search tools, among others; make it difficult and impossible for investigative learning to actually take place, Having stated the above, the objective is to diagnose andragogic heterogeneity in cognitive competences for research, in students enrolled in scientific research courses, whose final product of the course is the presentation of the thesis.

Andragogic heterogeneity and cognitive competences for research

According to the Royal Spanish Academy (RAE, 2019) heterogeneity refers to an adjective defined as the compound of parts of diverse nature, which, when engaging in the sphere of social sciences, such as education, there is a series of studies and postulates that orient heterogeneity to the presence of different behaviors, learning styles, cultural and social differences, and others, which undoubtedly condition the student. While others formulate it in the sense of differences in the educational background of the parents, in the educational quality received in the training in previous years, in the existence of specific qualities (disabilities for example), among others. In this way, the first perspective is oriented towards diversity, while the second towards inequality or gaps.

Within the understanding of this study, the concept of heterogeneity is chosen from the second perspective, focused on higher education students, and therefore corresponds to the characterization of educational training: andragogy. The term was coined in 1833 by the German-born primary school teacher, Alexander Kapp; Coming from the Greek root ανδρος (man) and ανδραγωγη (I drive), therefore, the word andragogy is understood as the art and science that grants accessibility to the adult learning process(Alonso, 2012). In this trend, Adam (1987, cited by Castillo, 2018) pointed out the arguments of the differentiation between pedagogy and andragogy, since, until then, education was developed around pedagogy

science, not discerning in the need to manifest a construct that involves training in youth and young adults, and no longer in children and adolescents:

Table 1. Differences between Pedagogy and Andragogy

Heading	Pedagogical model	Andragogic model
Relationship between components	Adult - child Vertical - dependent	Adult - adult Horizontal - participatory
Process center Control and direction	Teacher or professor	Participants)
Learning emphasis	On the essential program content	In the processes of learning and sources of information
Mental processes	Memory plays the central role in this process	Logical thinking, higher mental. Importance of imagination leading to creativity.
Approach, administration, assessment of learning	Pedagogue-led process	Shared process with the facilitator, where the focus is the participant
Process direction	Teaching - learning	Orientation - learning

Source and elaboration: Adam (1987, cited by Castillo, 2018).

On the other hand, according to Ausubel (1997), learning corresponds to the ordering and unification of information in the knowledgeable disposition, emphasizing the hierarchy of knowledge and the gathering of knowledge in the previous structures of the subject (cited by García, Fonseca & Concha, 2015). This can be integrated with the inquiry into the learning environment of students in university higher education, for which different models and theories have been exposed that seek to achieve this. In this sense, postulates such as that of Healey & Jenkins (2009) indicate the development of the research, considering if the circumstance in which learning occurs takes the learner as the central axis; as well as, if it is exposed in an area where the interest is for the research product or for the research process.

Along these lines, the integration of competencies in the university curriculum has shown significant interest on the part of those who participate in it, explained because these are the ones that allow the individual to effectively use vital socio-cultural instruments to "interact with knowledge , allow interaction in heterogeneous groups, promote autonomous action and understand the context "(García, 2011, p.4). With the above, the focus of competencies that has been given, exposes the imperative of giving a platform to social interactions, where these, in turn, request the personal commitment of the individual to solve the problem that needs to be faced. Rawal et. al (2021), Poongodi M et. al(2022), Poongodi M et. al (2021), Dhiman P et.al (2022), Sahoo S.K et.al (2022), K.A et. al(2022) , Dhanraj R.K et. al (2020), Yan Zhang et.al (2020), Md Hossain et. al (2021), Md Nazirul Islam Sarker et. al (2021) ,Y. Shi et. al (2020), Guobin Chen et. al (2020), Poongodi M et. al (2019), Poongodi M et. al (2020)

For Sanz (2010) they are:

Combination of capacities (abilities), knowledge, attitudes and conducts directed to the correct execution of a task in a defined context; or as a way of acting in which people use their potential to solve problems or do something in a specific situation. It is a measure of what a person can do adequately as a result of mobilizing their resources and planning their actions after completing a learning process (p.9). This is how the competence construct links the demand for an education that responds to the needs of the world (quality), with the aim that this is achieved by all university students (equity) (Sanz, 2010).

The Tuning project was the one that contributed to the development of competences in university education, succinctly organizing generic competencies into four groups: cognitive, socio-affective (relationship with others), technological (search and management of information) and metacognitive (awareness of cognitive processes); Before which, attention will be paid to the first group, since it converges with the purpose of the study. In this regard, Sanz (2010) mentions: The cognitive competencies suggested by the European Union are part of the mental architecture of the human being, made up of the processes whose main purpose is to understand, evaluate and generate information, make decisions and solve problems. These processes, of different levels of complexity and idealization, cannot be observed directly but are inferred from behaviors, from what individuals say and do (p.15).

There are different levels of functioning of the cognitive system: low, medium and high; each with its own performance characteristics. The low level (they carry information), in order to capture, register and give meaning to the information (sensory, perceptual and attentional processes); medium level (stores, encodes, retains and shares information) that includes learning, memory and oral and written communication; and the high level (deduces, evaluates, discovers, creates and coordinates information), being the most abstract, with processes such as reasoning, creativity, taking solutions and problem solving (Sanz, 2010). In this sense, cognitive competencies are classified into five groups, where each of these has, in turn, specific competencies and abilities, adapted from the work carried out by Swartz and Parks (1994), being: comprehensive thinking, critical thinking, creative thinking, decision making and problem solving; added to cognitive resources such as self-regulation and metacognition.

Research methodology and results

The study corresponded to a quantitative type, descriptive level, and with a non-experimental cross-sectional design; Taking as a sample the students of the Faculty of Business Sciences of the last cycles: IX and X, with a total of 65 students, selected by non-probabilistic sampling, where the inclusion and exclusion criteria were:

Inclusion criteria

- Students enrolled in research course / seminars or called thesis I and II.
- Students with less than 10% of absences registered during the development of the course.

- Students with registered grades in each of the aspects evaluated during the development of the course.

Exclusion criteria

- Students enrolled in a research / seminar course or called thesis I and II but who dropped out during the first unit of the course.
- Students with more than 10% of absences registered during the development of the course.
- Students with grades not registered in at least one aspect evaluated during the development of the course.

Regarding the data collection instruments, the following instruments were used: observation guide, so the resources used were directly the products per academic unit presented by each student, and, therefore, submitted to evaluation by the course teacher; having what was observed was:

- The sessions themselves, where the student interacts with the teacher and classmates.
- Active and consistent participation during the development of each of the classes of the course.
- Presentation of each of the activities and / or assigned tasks, complying with the guidelines given for their preparation.
- Compliance in the delivery of each of the activities and / or assigned tasks, within the stipulated time.
- Periodic presentation of the progress of your investigation according to the established schedule.
- Individual presentation of each student for the partial and total support of their study, under the products of the unit to be presented of the course.
- Performance and evolution of the student regarding the grades obtained during the written and oral evaluations during the development of the course.
- Individual sessions in which the student meets with the teacher, who guides him in the development of his research.
- Other communications that the student has with the teacher, remotely, through different means of communication.
- Behavior regarding the status of the process of presentation and approval of the student's research, as part of the academic requirement to obtain the degree.

The analysis was carried out by calculating relative frequencies in percentages and figures for their better interpretation, starting with the tabulation of the 38 statements that made up the observation guide, whose evaluation was "low", "medium" and "high"; where these in turn made up the 19 indicators for the total dimensions that responded to the five cognitive competencies, aligned to the learning of the research within the andragogic process (Table 2).

Table 2. Indicators evaluated according to cognitive competence

Variable	Dimensions	Indicators
Andragogic heterogeneity in cognitive competences for research	Comprehensive thinking	Compare
		Sort out
		Analyze and synthesize
		Sequence
		Discover reasons
	Critical thinking	Source reliability
		Discover causes
		Predict effects
		Reason analogously
Variable	Dimensions	Indicators
Andragogic heterogeneity in cognitive competences for research	Creative thinking	Generate ideas
		Establish relations
		Create apps
		Undertake goals
		Determine object to decide
	Decision making	Consider options
		Predicting consequences
		Choose option
	Problem solving	Check the solution
		Evaluate results

It was obtained, mainly, that the problem solving competence has the highest percentage of students with a "low" level, with 87.69%; while in the Decision-making competition it was manifested at a "medium" level with 72.30% of participants. Likewise, the only competition where the students showed that they had the highest desired level, "high", was in Comprehensive Thinking with 20.00%.

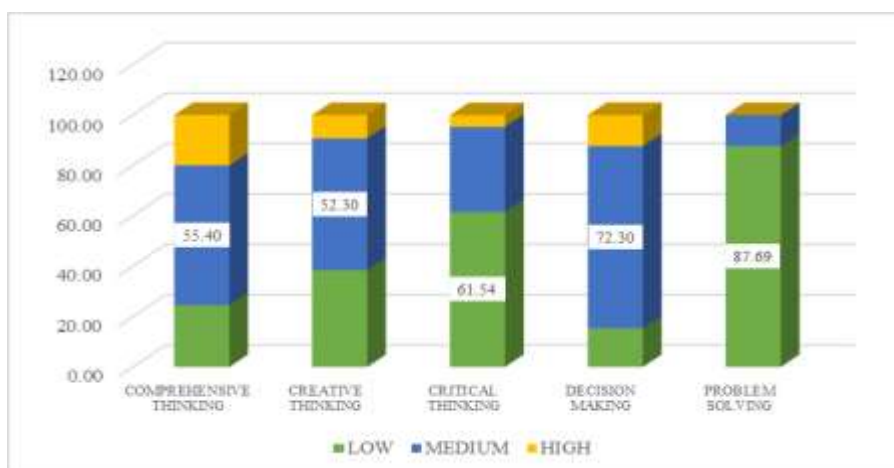


Figure 1. Level of cognitive skills in university students

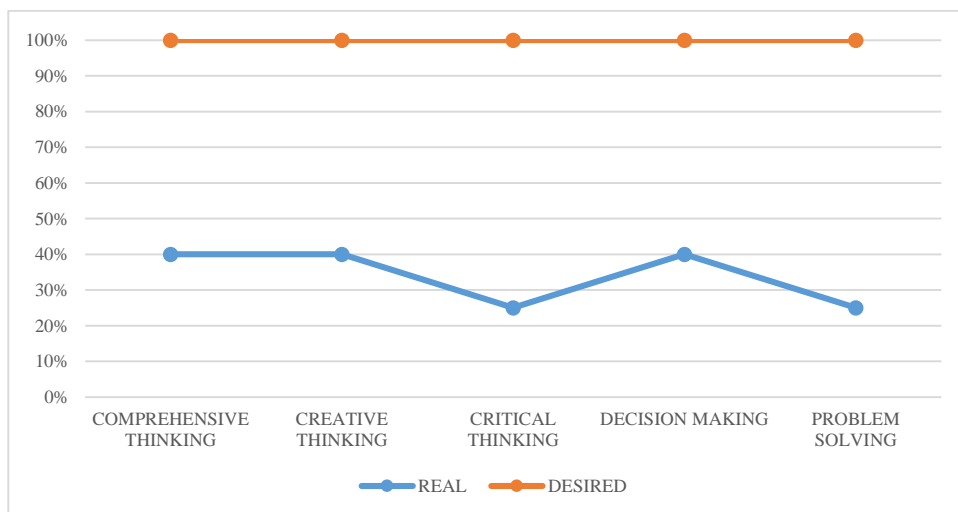


Figure 2. Heterogeneity (actual - desired) existing at the level of cognitive competences

Discussion and Conclusions

It is important to point out that there is a lack of research addressing the problem raised, since, although there is an analysis of transversal competences, none is oriented to materialize it within what it requires to learn to investigate, and even less considering the characteristics of an andragogic process. In this sense, the Comprehensive Thinking competence was the only one that obtained the highest desired level ("high": 20%), unlike the other four; This is explained because in this, the participant is devoted to the processing and interpretation of the information, responding to concepts and definitions of the scientific methodology. Meanwhile, in the Critical Thinking competence, there is the highest level of heterogeneity, explained by difficulties in the discernment of selection and identification of what and how? This is what he intends to investigate; being this pillar, key to start any study, and even more to materialize it successfully. Consequently, it is understandable that the following competencies present values below what is desired, since, by "not knowing what to do", it is difficult to show interest and openness to investigate (creative thinking), decide what alternatives you have (decision making), and choose one that is optimal for your problem (troubleshooting).

Cognitive competencies represent a process in themselves, so it is imperative to reinforce its foundations (comprehensive and critical thinking) to be able to achieve optimal results, especially when it comes to teaching and doing research. The participants in the andragogic process present their own interests that motivate them to study a career, and therefore, to choose what and how they want to develop a task. It is there, where the role of the university, and of course, the teachers, is fundamental, to provide them, not only with tools that allow them to do research, but also that allows them to understand what the impact of it is, through a dynamic and realistic methodology, beyond the classroom lectures on scientific method.

Finally, it should be pointed out that the study has limitations in terms of the characteristics of the sample taken, which is why it is important to take it to a larger scale that allows reaching conclusions that contribute to promoting and motivating human capital interested in conducting quality research; even more so in LAC countries, where innovation is the key factor for economic development, mainly in education.

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