Profile Of Investigative Capacities That Determine Factors To Investigate In The Universities Of Peru

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Abstract

The need to develop research in the Peruvian university context is urgently needed. That is why, in order to develop the research processes, it is required to have a profile of the research capacity of the students. For this reason, the purpose was to determine the profile of investigative capacities that derive from factors to investigate in universities. It corresponds to the quantitative approach, of a transversal type; a sample made up of 303 university students was used. Two instruments were used: investigative skills scale and the questionnaire of factors that influence investigative skills with construct validity by the KMO test (0.623 and 0.706, respectively). The results referring to the profiles showed that 32.3% of the respondents identified themselves with the reflective inquiry investigative capacity profile, followed by 26.7% with the generic conceptualization investigative capacity profile; while 27.7% were related to the specific cognitive investigative abilities profile and, finally, 13.2% of those evaluated were identified in the active cognitive construction investigative abilities profile. It is concluded that students have investigative skills at different progressive levels, with different characteristics depending on the influence of factors in the training process.

Keywords: Profile - investigative skills, investigative skills, reflective inquiry, active cognitive construction.

INTRODUCCIÓN

Lately, aspects related to research capabilities that help students acquire skills for problem solving and lifelong learning, the evaluation of scientific reasoning in science education, have gained considerable momentum (Kambeyo and Csapó , 2018). The work of most academics is of a dual nature, which involves research and teaching considered fundamental in university work. There is no doubt that professional advancement depends mainly on the level of performance in research (Cadez et al., 2017). Regarding this aspect, it is important to take into account the profile of investigative capacities inherent to academics, to know what is the ideal profile that a researcher should have.

Expectations for educational outcomes in the 21st century are increasingly focused on higher order thinking of synthesis, analysis and evaluation (Osborne, 2013). Zimmerman (2007) stated that research skills and content knowledge drive each other, creating a relationship that underlies the development of scientific thinking. A good model of scientific reasoning, scientific literacy and a body of knowledge will allow the development of these higher order cognitive skills (George and Salado, 2019). Scientific thinking requires a complex set of cognitive skills, the development of which requires much more practice and patience. Therefore, it is important for educators to understand that scientific reasoning ability is best developed through education based on scientific inquiry (Barbachán et al., 2021 and Raley et al., 2018).

A growing number of international reports document that universities, striving for research funding of some sort and a high ranking standard, have adopted a range of strategies including recruitment and reward systems that favor academics with the highest rankings. better publications or the potential to secure such publications (Douglas, 2013 and Parker, 2012).

On the other hand, the last four decades, ethical decision-making has received considerable attention from scholars and practitioners around the world (Casali & Perano, 2021). Educational researchers often draw on the philosophical traditions of consequentialism, deontology, or virtue ethics to frame their ethical decision-making (Suri, 2020).

INVESTIGATIVE CAPABILITIES

Research skills basically represent a set of domain general skills involved in research science that support experimentation, evaluation of evidence, inference, and argumentation leading to the formation and modification of concepts and theories about the world. natural and social (Kambeyo and Csapó , 2018). The development of investigative skills in students allows increasing knowledge in the technological area not only in their training (theoretical, practical), a fact that will

impact the exercise of their profession from now on (Pérez and Montaño, 2017). Inquiry skills comprise a set of basic reasoning skills that are thoroughly investigated and are necessary for students to successfully carry out scientific inquiry (Weiss & Barth, 2019). This includes exploring problems, formulating and testing hypotheses, manipulating and isolating variables, and observing and evaluating consequences.

Concrete cognitive investigative capacities (CICC) : are those that focus directly on the development of basic capacities in research, based on inquiry, research and, with it, communication on aspects derived from the immediate reality and that motivate the researcher to scrutiny, to collect and compile information aimed at corroborating hypotheses raised (Blanco, 2020). The individual reflects a clear tendency to learn based on experience and the generation of intuitive judgments, as well as deductive ones, allowing him to generate new concepts and references and, with this, the systematization of information. The positive attitude of the inexperienced researcher stimulates analysis and the generation of good ideas (Fuster and Santa María, 2020).

Generic conceptualization investigative capacities (CICG) : they refer to the set of capacities that the researcher acquires in praxis and for which he develops a marked tendency to privilege the analysis and conceptualization of the aspects or facts of investigation, where the development of logical thinking and rational evaluation. Logical thinking should be understood as the ability to reason logically, which is essential to develop due to the fact that it is an essential basic ability to weigh the facts and with it rational evaluation. Rational evaluation comprises cognitive aspects derived from logical thinking that, in the research field, allows developing a level of structuring and systematization of ideas and concepts that facilitate the researcher not only the ordering of the information obtained by the investigations, but also to be able to establish possible links that could occur and by default their hierarchy, it being clear that said capacity will be accentuated as their expertise evolves (Jaramillo and Puga, 2016).

Reflective inquiry investigative capacity (CIIR): *it* usually occurs at various levels and can be related, at least theoretically, to the growth of the researcher from beginner to expert (Feixas and Zellweger , 2019). The CIIR reflects the tendency to learn impartially and reflectively. It is developed in individuals who opt for the expository classes, since in them they can function as impartial observers (Escobar and Jara, 2019). Another basic trait of individuals is a certain tendency to introversion. On the other hand, it is worth mentioning that the development of these investigative capacities shows a certain relationship to impartiality and is complicated by statistical skills (Escobar and Jara, 2019) .

Active Cognitive Construction Investigative Capacities (CICCA) : deriving from the combination of learning strategies, it allows the location of the individual in a quadrant, the same that will refer to a particular cognitive style, manifesting developed cognitive investigative competencies that allow the construction of knowledge and develop research instruments, this profile identifies the university student appropriating reality, constitutes inner satisfaction of handling information and domain knowledge of facts that investigates (Rivas, 2011). Cognitive construction allows being able to analyze, understand, understand, delve into and ponder a certain social or natural phenomenon with the aim of structuring a new perspective based on said reality with the particularity of being subject to specific conditions and a finite time. The investigative capacity of active cognitive construction, according to González et al. (2015), refers to the ability to reflect a tendency to learn through praxis; that is, carrying out specific works and in addition to experimenting with alternative mechanisms. Individuals who develop this ability tend to learn more when they are active participants in work, projects or discussion groups.

FACTORS THAT DEVELOP INVESTIGATIVE CAPACITIES

Research capabilities comprise a series of skills that, due to their level of generalization, enable the student to develop the potential supported by the application of the scientific method in the development of a certain learning activity (García et al., 2018, S. V. N. Sreenivasu . According to González et al. (2015),(S.V.N Sreenivasu, 2022, Mukesh Soni, 2022, Mehraj 2022, Abhishek Madduri 2021, Sharma D.K, 2023) these capacities comprise a series of protection actions against probable situations of harm, damage or threats to the development of investigative capacities, whether they are cognitive, procedural and/or attitudinal. These capabilities include the following:

(a) **Information search factor (FBI).** It consists of taking advantage, with a significant level of effectiveness and efficiency, of the possibilities offered by computer tools and databases to investigate, search, structure, collect, process information and obtain results (González et al., 2015).

(b) **Construction factor of the research methodology (FCMI).** It includes all the actions and procedures that are oriented to the search for solutions to a problem specific to research, which is why it is essential to achieve objective knowledge of reality. This factor empowers the ability to identify, interpret, explain and direct aspects of reality through the use of resources, procedures and techniques in order to achieve the proposed objectives (González et al., 2015).

(c) **Initial investigative training factor (FFII).** It is usually made up of a series of research teaching-learning mechanisms, typical of the preparation and training of a future researcher for the development of scientific-investigative skills and ethical-professional values related to the investigative action of a certain area of knowledge. , which will allow the power to interpret, substantiate, project and transform the immediate reality in relation to the

research problem and the solution or solutions that have been generated in this regard (Chirinos, 2012) .

(d) Psychological factor to investigate (FPSI). This factor comprises the set of components that are in constant interaction, which can be cognitive, affective, behavioral types inherent to the student who is being trained as a researcher. These components will play an organic role in the future, since they will tend to facilitate or hinder the continuation of any research work (Aiquipa et al., 2018).

(e) Research Methodology Teacher Orientation Factor (FODMI). This factor refers to the quality of the teacher in relation to research theory and praxis, which has proven to be a crucial factor closely related to a series of variables in education, such as student motivation, educational reform, teaching practice and the satisfaction and psychological well-being of teachers (Han & Yin, 2016).

(f) Adaptation factor of study plans to research (FAPEI). The factor of adaptation to the study plans inherent in research allows articulating curricular development and research (Weiss and Barth, 2019) . Those who design curricula must ensure that their work is scientifically based and subject to evaluation. Those studying under existing curricula will need to understand the ways in which they were developed and validated.

(g) Autonomous or individual work factor in the construction of research (FTAICI). Said factor corresponds to those intrinsic motivation skills that the individual manifests, among which the principle of self-determination usually stands out (related to the relevance that the individual usually categorically imprints on research), the desire to continuously learn and improve (referred to the assessment as a professional that contributes to continuous improvement processes), as well as their capacity for self-regulation (it has to do with the administration of time and activities in relation to research), which are inherent to the individual (Zhou et al., 2016,).

(h) Ethical factor in research (FEI). The ethical factor, due to its nature, is oriented to the adoption of various processes such as identifying an appropriate epistemological orientation, having an appropriate end or purpose, evaluating, interpreting and elucidating the suitability of the processes to be carried out, respect and consideration of the copyright and communication of results (Suri, 2020). Ethically acceptable research in education requires a broader understanding of the nature of research ethics, including professional duties and codes of research practice, the ability to identify hard-to-anticipate consequences of research actions and the development of an ethical judgment to choose the most suitable research (Butterwick et al., 2020).

METHODOLOGY

The research was carried out under the quantitative approach, being of the basic type, applying the hypothetical-deductive method to contrast the hypotheses by means of test statistics so that said results reflect the objective reality of the study. Simple random probabilistic sampling was used to calculate the study sample made up of 303 university students who were taking subjects related to the research. The survey was used. The investigative skills scale instrument was applied to identify the profiles of investigative skills. After the evaluation of the characteristics, it was possible to discriminate four groups or styles to investigate. The second instrument was the questionnaire of factors that influence research skills. These instruments were subjected to reliability analysis for the theta coefficient ($\theta = 0.790$) and omega coefficient ($\omega = 0.778$). In both instruments, the reliability was acceptable. The content validity was executed by expert judgment, whose opinion was applicable. Likewise, for the abilities instrument, the construct validity was carried out through the exploratory analysis of the items, with the Kaiser-Meyer- Olkin Measure of sampling adequacy (0.623), Bartlett's sphericity test (Approx. Chi-square = 400.056; df = 36; Sig. < 0.0001) and the total explained variance (66.788%). Regarding the instrument factors that influence investigative competences, the Kaiser-Meyer- Olkin Measure of sampling adequacy (0.706), the Bartlett sphericity test (Approx. Chi-square = 957.242; df = 21; Sig. < 0.0001) and the total explained variance (82.951%).

RESULTS

Figure 1 Average score of the models of investigative capacities linked to factors that determine investigative competencies by university students
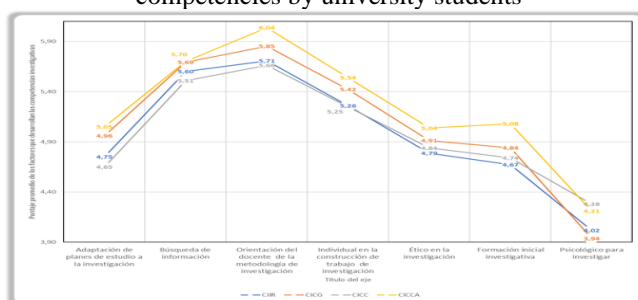
Note: Questionnaire applied to university students

As shown in figure 1, it was observed that the students with the model of active cognitive construction investigative capacities (CICCA) considered that the adaptation of the study plans, search for information, orientation to the teacher of research methodology, the construction individual research work, ethics in research and the initial training of students; tends to strengthen and consolidate the investigative skills of university students. However, they expressed that the psychological factor is not important to be able to investigate; while the students identified with the model of concrete cognitive investigative abilities *(CICC)* They believed that ethics, initial training and the psychological aspect are relevant to strengthen investigative skills and rule out that the adaptation of planning activities linked to research, information search and orientation of the methodology teacher tend to contribute to the development of the work. research.

The students, who develop the reflective inquiry investigative capacity model (CIIR) , noted that aspects such as ethics, individual development of research work, initial training and psychological aspects; they lack relevance in investigative competences. In addition, they highlighted aspects such as the adaptation of the study plan, the search for information and the orientation of the methodology teacher, since they are fundamental elements in the consolidation of investigative capacities. Finally, the students identified with the model of generic conceptualization investigative capacities (CICG), pointed out that the search for information and the orientation of the methodology teacher are relevant for the development of research capacities. They also showed that the psychological aspect and initial training do not usually reinforce research training.

Figure 2 Profile of investigative capacities that determine factors that develop investigative competencies
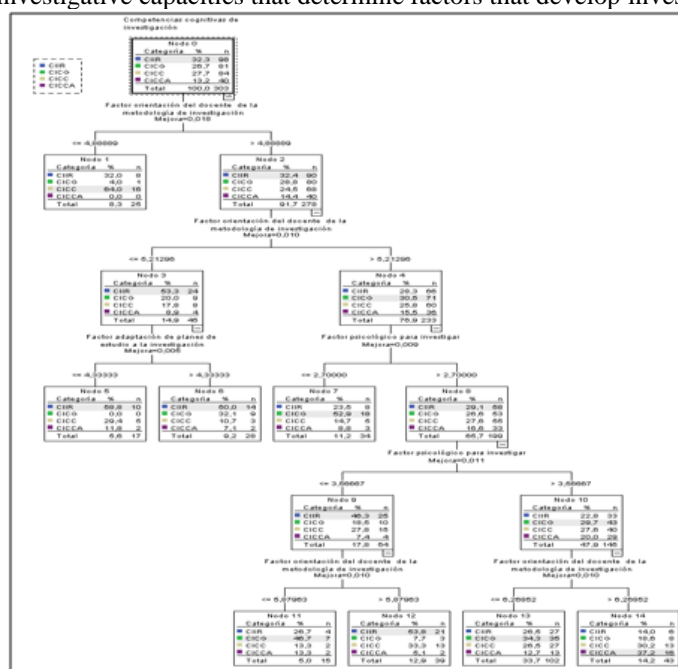
Note: Classification Tree, CRT Growth Method. Correct classification prediction 45.2%.

The scores established according to the instruments used that measure the profile of investigative abilities of university students ranged between values of 1 to 7 with minimum, intermediate and maximum values, which allowed explaining the results of each one of them. This score corresponds to the Osgood semantic scale (Gorenc et al., 2016).

Profile 1: Reflective inquiry investigative capacity (CIIR). In this profile, individuals usually opt for expository classes because they usually function as observers in them, facilitating step-by-step reflection processes. Said profile is identified or discriminated when the research methodology teacher's orientation is subject to the use of a highly technical language, reaching a value less than 5.2 and greater than 5.8. Likewise, when the adaptation of study plans focused on hours assigned to research courses, sequentiality in research courses and the strengthening of formative research are approached with the value of 4.33. On the other hand, the students were grouped by the presence of psychological aspects such as distrust to investigate, fear in the use of correct theories and leaving their comfort zone. The frustration that was referred to not being able to advance with the assigned work was also taken into account, where the latter obtained values lower than 3.56. In this profile we identify 32.3% of the students evaluated.

Profile 2: Generic conceptualization investigative capacities (CICG). The individuals, who present these capacities, focused on the analysis and conceptualization of the aspects or facts of the investigation, where the development of logical thinking and rational evaluation were highlighted . The CICG profile was discriminated against or identified by the presence of psychological elements such as fear in choosing the theoretical foundations of the research topics and frustration at not understanding methodological elements of the research work with values less than 2.70 and when the orientation methodology teacher presents diversity of methodological criteria of teachers with mastery in quantitative and qualitative data analysis. In addition to having accredited training with values greater than 5.8 in this profile, 26.7% of students evaluated were found.

Profile 3: Concrete cognitive investigative capacities (CICC). The subjects, with this profile, usually focus directly on the development of basic capacities in research based on research and, with it, communication on aspects derived from the immediate reality. The mechanisms of The individual's inquiry reflects a clear tendency to learn, based on experience and the generation of intuitive judgments. Said profile obeys or discriminates due to the presence of the teaching orientation of research methodology regarding availability and predisposition to consultancies. When the criteria are unified or the difference between problem, objective and hypothesis of the study is highlighted; the optimal cut-off point is established with a value less than 4.88. In this group, 27.7% of students evaluated were identified. Rawal et. al (2021), Poongodi M et. al(2022), Poongodi M et. al (2021), Dhiman P et.al (2022), Sahoo SK et.al (2022), KA et. al(2022), Dhanraj RK 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. to (2020)

Profile 4: Research capacities of active cognitive construction (CICCA). This profile refers to cognitive construction mechanisms of a concrete type such as analyzing, understanding, understanding, deepening and pondering a certain social or natural phenomenon based on the objective of structuring a new perspective derived from said reality. This profile is enhanced or discriminated by the orientation of the research methodology teacher in the theoretical and methodological domain and analysis of the results of various methodologies as well as qualified and accredited teachers in research teaching when they reach values greater than 6, 27. In the study, 13.2% of university students were located in this profile.

DISCUSSION OF RESULTS

The development of investigative skills will allow students to more optimally handle novel situations and design original investigations aimed at solving scientific, social, and engineering problems in the real world (Osborne, 2013).

The students, who manifested investigative capacities of active cognitive construction (CICCA), are in the capacity to analyze, understand and understand the social environment; They consider that the adaptation of study plans, search for information, orientation to the teacher of research methodology, individual construction of the research work, ethics in research and initial training of students tend to strengthen and consolidate what concerns investigative competencies.

In the case of active thinking in students, it must be developed in its higher stages, for which it is necessary that they possess the capacity for analysis, synthesis, comparison, abstraction and generalization, since they will allow them to consolidate logical thinking and lateral thinking the same ones that are of capital importance for investigative capacities (Assman , 2002). The manifested elements must form a structural part of the graduation profiles, curricular meshes and subject programs from the initial formation. The importance of focusing on suitable teaching methods and strategies for the teaching and learning process of research should contribute by generating trust, responsibility, equality and self-regulation in order to develop research competence (Calisto-Alegría, 2021).

On the other hand, the students identified with the active cognitive construction (CICCA) considered that aspects of the emotional order such as fear, frustration, distrust and leaving the state of comfort, are not estimated in a relevant way when the development of the investigation is necessary, since the psychological aspects tend to be progressively overcome. This data is in contrast to what was stated in the study by Aiquipa et al. (2018) who in this regard stated that traits related to personality, apathy (tendency to avoid activities of a cognitive nature) and tendency to immediacy (desire to obtain or achieve goals immediately); it tends to alter the student's perception of difficulty with respect to investigating a fact that would condition the decision to carry out the research work. That is why the psychological aspect of the university student is essential when it comes to conducting research; Therefore, it is urgent that in their initial training all those academic actions that lead to progressively overcoming those pitfalls of an emotional nature must be carried out. From the above, the psychological aspect is not a determining factor to develop investigative skills.

The students, who developed the model of reflective inquiry investigative capacity (CIIR), tend to show an affinity for the expository classes, since they consider them adequate to develop as observers and, in addition, to be able to link in the theoretical aspect; with which they begin their reflections, they denote the ethical aspects, the individual development of research work; while psychological aspects are not relevant in investigative skills. This reference is consistent with what was stated by Vidal et al. (2021) about the university curriculum linked to research subjects, where a permanent process is not established in which theory-practice are articulated to strengthen training in and for research. Similarly, didactic-pedagogical processes that allow the student to explore inquiry strategies, identify problems, analyze contexts and propose possible solutions are not confirmed.

On the other hand, it is considered that, although the ethical aspects for research, such as the objective aspect, do not favor investigative competences because it is not a procedurally or methodologically established process; however, it is usually present subjectively in the daily fact of investigating. In research processes, skills related to information access and management can be trained, as well as ethical aspects such as respect for sources and intellectual property. The communication of the results of the investigations implies actions such as choosing the appropriate medium and knowing how to use the conventions of the chosen medium. This activity includes other skills such as coherent structuring of ideas, selection of relevant data, adequate presentation of data verbally, graphically or statistically (Rosa et al., 2021 and Castro et al., 2021).

The students, with a model of concrete cognitive investigative skills *(CICC)* , focused directly on developing basic skills in research, based on research and interaction with immediate reality. That is why the presence of research methodology teaching orientation tends to promote the progressive development of research skills. Then it can be affirmed that the students have not yet consolidated the investigative competencies, that they still present weaknesses in methodological and didactic knowledge and other factors, since the fundamental element or subject is the research methodology teacher (Castro-Sánchez, 2021).

The interest of the universities of the Latin American region has followed the path of improving the research skills of teachers, who have shown certain weaknesses regarding research skills. This is evidenced by González et al. (2022), who identified university professors with a doctorate degree who do not carry out research, some fact that directly affects good research practices, highlighting relevant aspects such as the training gap on research skills, interest in research in addition to management skills in the digital field and new technologies. In this regard, they stated that the teachers evaluated showed deficiencies in the recognition of social problems. Such a situation tends to worsen if the aforementioned teachers are in charge of the investigative training of the students, since they will exhibit deficient investigative skills. For these reasons, one of the main actors in strengthening investigative skills is the research methodology teacher. That is why the university, as a training institution, must carry out constant processes of updating, preparing and strengthening the investigative capacities of teachers in order to have an ideal plan to attend to the training of future researchers involved in solving problems in their environment.

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