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Research skills and professional competencies: An instrumental relationship in university teaching

Habilidades investigativas y competencias profesionales. Una relación instrumental en la enseñanza universitaria

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ABSTRACT

From a committed vision, dialectical relationships are established between research skills and professional competencies in the university context. The present work addresses a topic of great interest for the scientific community; its objective was to identify publications on research skills and professional competencies in scientific journals. A systematic review of the literature was carried out in January 2024 in the SciELO, Web of Science and Scopus databases. Articles in English published between 2014 and 2023 were found. Three categories resulted: research skills as instrumentation for meaningful learning; professional competencies as the maximum expression of skills; systematized logic in the transition from a research skill to competencies of a professional nature in higher education. It is concluded that although there is a record in the literature of issues related to research skills and professional competences, it is necessary to expand the studies on this topic, still on the margins of scientific production in the field. There are records of research that aim to interpret the epistemological dynamics related to research skills and competencies in order to achieve significant advances in the students' processes.

Keywords: Significant learning; Competences; Professional competences; Skills; Research skills; College student.

RESUMEN

Desde una visión comprometida, se establecen relaciones dialécticas entre las habilidades investigativas y competencias profesionales en el contexto universitario. El presente trabajo aborda una temática de gran interés por la comunidad científica, su objetivo fue identificar las publicaciones sobre habilidades investigativas y competencias profesionales en revistas científicas. Se realizó una revisión sistemática de la literatura en enero 2024 en las bases SciELO, Web of Science y Scopus. Se encontraron artículos en inglés publicados entre 2014 y 2023. Resultaron tres categorías: las habilidades investigativas como instrumentación para el aprendizaje significativo; las competencias profesionales como máxima expresión de las habilidades; lógica sistematizada en el tránsito de una habilidad investigativa a las competencias de carácter profesional en la educación superior. Se concluye que si bien registran en la literatura cuestiones relacionadas con las habilidades investigativas y competencias profesionales, es necesario ampliar los estudios sobre este tema, todavía al margen de la producción científica en el campo. Hay registros de investigativas para lograr avances significativos en los procesos de los estudiantes.

Palabras clave: Aprendizaje significativo; Competencias; Competencias profesionales; Habilidades, Habilidades investigativas; Estudiante universitario

INTRODUCTION

Currently, one of the most studied areas from diverse theoretical and methodological perspectives is the development of research skills, considered fundamental competencies for the production of knowledge. This analysis encompasses modes of professional action related to reflective practice and the incorporation of the research approach into the university process. In this context, the acquisition of disciplinary knowledge and the development of critical thinking and metacognitive capacities essential for the comprehensive development of students are promoted. Fostering these skills is crucial for addressing professional and social challenges, enabling students to actively participate in solving relevant problems (López and García 2022).

According to Deroncele (2022), praxis becomes a fundamental articulator of theory, especially in terms of understanding the skills necessary for research. This is particularly relevant in the context of the complexities of a dynamic and changing reality, which poses epistemic challenges to scientific new reasoning every day. Furthermore, the epistemic diversity that characterizes the investigation of reality, within the framework construction of of the the so-called "knowledge society," demands increasingly developed research skills. Therefore, it is central that scientific knowledge become a

real lever for social change.

In this regard, Díaz and Cardoza (2021) affirm that the understanding of investigative as a consciously skills, systematization directed process and in a dynamic systematizing that transcends the different curricular levels in the university environment; they undoubtedly constitute an epistemological foundation for the development of professional competencies. The guiding principle for systematization must be to consider as its main axis how skills are conceived, operationalized, and applied in the scientific research process, from their essential formation in social subjects who are preparing to act professionally within a culture of scientific research.

In this sense, according to Ortiz (2012), the mastery of the most general theoreticalmethodological and procedural aspects of research in the university context, undoubtedly enriches the relationship between theory and practice in a holistic dialectic, taking as a basis the formative particularities of the university student in which the didactic requirements of the treatment of scientific-investigative content are involved in order to attend to the particularities acquired by their professional mode of action, insofar as they act as a social agent of modification of the subjective nature, in increasingly complex contexts; the above constituting valid proposals since they enrich the theory and practice of investigative skills.

For his part, Montes de Oca (2009) points out that among the missions and functions recognized higher education for are: generating and disseminating promoting, knowledge through research and, as part of the services it must provide to the community, providing adequate technical preparation to contribute to the cultural, social and economic development of societies, promoting and scientific and technological developing research as well as research in the field of social sciences, humanities and creative arts.

The above confirms that, regardless of the specific characteristics of the various professional practices, there are common objectives and, therefore, common skills that are mandatory for all professionals. These include skills related to the use of information and communications technologies and the use of scientific research methods.

However, despite the fact that objectives related to scientific training are declared in the curricula and analytical programs of some subjects or matters and general guidelines are offered for the organization of the teachinglearning process that allow the professional's modes of action related to said training to be achieved, using various variants in the conception of the disciplines and/or subjects, specifically in the planning and execution of the process of most of them, the emphasis is placed on the system of knowledge that is necessarily the bearer of specific and/or professional skills, which leads to the stated purposes often remaining unsatisfied.

In the factual study of the problem under investigation, limitations are identified in the systematization of international and national scientific literature on the didactic approach to learning scientific-research content, the demands of the profession, and the contexts of university students' work. This lack of systematization is particularly relevant in an educational environment that seeks to develop research skills and professional competencies. In view of the above, this study focuses on identifying and analyzing publications on research skills and professional competencies in scientific journals and on the development of professional competencies in scientific literature.

METHOD

The research has a qualitative approach because it analyzes data such as the "description of the qualities of the fact or phenomenon" (Escudero and Cortez, 2018), which in our case is to describe the objectives, results, and conclusions of the relationship between visual memory and its relationship with academic performance. The method used will be a systematic review, which includes clear objectives, precise and reproducible methods, a rigorous search to obtain the studies, an internal evaluation of the findings, and a presentation of the results obtained (Clarke, 2011).

Likewise, Manterola et al. (2013, p. 150) refer to the existence of stages for the systematic review: the first stage, problem formulation; the second, location and selection of primary studies; the third, evaluation of methodological quality; the fourth, data extraction; and the fifth, analysis and presentation of results.

A qualitative systematic review was conducted in January 2024 to systematize what the national and international scientific literature has published in terms of discussions on research skills and professional competence, in addition to pointing out knowledge gaps that need to be explored in new studies in the context of higher education. To argue the rigor of the review, six (6) steps were followed:

1) Publication period

2) Choice of descriptors;

3) Selection of databases for searching;

4) Establishment of sample selection criteria;

5) General analysis of the research results;

6) Definition of the final sample.

The population of this bibliographic review study is made up of scientific articles different indexed journals, published in according to (Manterola et al., 2013). Regarding the analysis criteria used in the of study, scientific articles, the type objectives, designs, findings, limitations, results and conclusions of the relationship between research skills and professional considered. competence have been Furthermore, the same author states that for the third stage, the evaluation of

methodological quality is considered, which consists of evaluating the internal validity of the publications, as well as any bias that may exist.

The fourth stage involves data extraction, which is performed using templates; and the fifth stage involves the analysis and presentation of results, using Atlas software (version 22). The sixth stage involves the of results presentation through а systematization process. The publication period runs from 2014 to 2022.

In order to better define the field of research on the topic addressed, the following descriptors in Educational Sciences were used, in Portuguese, English, and Spanish: "skills," "research skills," and "professional competencies." These three descriptors were chosen because they were more comprehensive at the time of the research. The search was conducted in the following databases: SciELO, Scopus, and Web of Science. Multidisciplinary databases and those in the areas of education and higher education were also searched: ERIC and SPORTDiscus.

In the SciELO and Web of Science databases, the search strategy was used with the descriptors health and education, organized using the operators "and" and "or" to retrieve the qualified information.

Inclusion criteria for article selection were: full texts, freely accessible through the Capes Newspaper Portal, in Portuguese, English, and Spanish, that address the topic of research skills, professional competence, and their direct relationship to higher education. No criteria were established regarding the deadline for submission of articles.

The exclusion criteria were: studies with editorial research designs, theses and dissertations, evaluations of physical activity program protocols, and reviews. In addition, a reverse search was conducted based on the references of the articles found, that is, a search of the references used in the studies identified during the search.

In documentary analysis as a research technique, the individual analysis matrix was used for each document under review, specifying each document and being able to complete the information on the matrices was transferred to a group analysis matrix.

To validate these instruments, it was necessary to share them with professionals and experts in the subject under investigation in order to determine the feasibility (score of 95 out of 100) of the results in the documentary review.

Regarding the organization and structure of the data, they emerge from the two stages of documentary analysis with the intention of communicating the main findings in the search for relevant information on the researched topic and being able to provide a broad view of the temporal distribution of the studies found.

Research skills and professional competencies and their direct relationship with higher education are described.

To create the mind map, the thematic content analysis technique proposed by Bardin (2011) was used, with the following stages:

1) Pre-analysis, organization of the articles selected in the review;

2) Exploration of the material;

3) Treatment of results;

4) Inferences;

5) Interpretation of results based on the review of scientific articles.

For content analysis, Atlas.ti version 7 was used. The database search yielded 119 articles, distributed as follows: SciELO (28 articles); Scopus (20 articles); SPORTDiscus (54 articles); Web of Science (17 articles). Of the total number of articles retrieved, 12 were duplicates, leaving 107 articles.

Applying the exclusion criteria, 28 articles were eliminated by reading their titles, resulting in 79 studies. The abstracts were then analyzed, and 52 articles whose topics involved academic performance, intellectual abilities in students, and language skills not directly related to higher education were eliminated.

Thus, 27 studies advanced to the full reading stage. Of these, 9 addressed analysis of skill development programs as psychological development and specific competencies in the area of Sport and Physical Training, meaning they were not directly related to the topic of the present study. Thus, six articles were included after being fully read. Based on a reverse search of the references of the remaining 12 articles, six more articles were included in the review, totaling 18 articles. The results are shown in the following figure.

Figure 1. Flowchart for selecting eligible items



RESULTS

In the main results of the initial stage, and as part of the empirical verification of the process investigated in the different originals, the most significant results of the search for articles in the different databases selected by the intentional route, and in the collection of bibliographical references and citations of scientific publications (Scopus) are presented. A deeper look into the nature of the selected studies revealed that all were qualitative research. Regarding the data collection stage, some studies utilized a combination of structured, in-depth interviews, field diaries, and non-participant observation. The presence of theoretical essays and hermeneutic content treatment in the selected sample was also confirmed. In a second moment the thematic content was analyzed, declaring three basic categories that are representative in the Review topic: research skills as a tool for meaningful learning; professional competencies as the ultimate expression of skills in higher education. These categories are exemplified in Table 1.

Ta	bl	e 1	. (Categories	of ana	lysis	according to	o representative	questions j	for
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Categories	Representative contents						
Skills as an instrument for	Research attitudes in students; strategy for developing						
meaningful learning	research skills in students; meaningful learning						
Professional competencies	Conceptualization of professional competencies, competency						
as the highest expression	development approach, Formation of research competencies						
of skills							

Systematized logic in theResearch skills and professional competencies in highertransition from researcheducation; levels of scientific and professional systematizationskillstocompetenciesof university students.(professional character inhigher education)

Regarding the analysis categories according to representative questions for critical argumentation of the results, the categories resulting from the content analysis are analyzed.

The category "*research skills as an instrument for meaningful learning*" groups the findings in the articles by the authors: (Aldas, Ávila, & González, 2020); Calisto

(2020); Guerrero, (2017); (Fernández, Carcausto, & Quintana, 2022); (Machado, & Montes de Oca, 2019); Medina, (2020); (Díaz, & Cardoza, 2021). They refer to their conceptualization, typology and relationship of skills with meaningful learning.

Based on the articles identified, according to the review results, the authors (Machado & Montes de Oca, 2019) among their main

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findings are recognizing the formation and development of research skills as a key element in achieving the learning-to-learn processes, metacognition, and, consequently, autonomous learning in their own cognitive performance.

Equally, Guerrero (2017),when addressing in his work the relationship between research skills and competencies at the university educational level, highlights the importance of facilitating, through the teacher's teaching action, learning situations where the student can appropriate the main concepts and relate them to other previous or already formed concepts, the reconstruction of semantic units, the use of strategies that problematize teaching, the use of the conceptual map, and the cumulative conception of learning (acquiring knowledge); the above; the author adds, reveals the predominance in the development of research skills.

There is interest from the scientific community in investigating meaningful teaching models for the development of research skills in the university context. Thus, (Machado & Montes de Oca, 2019), their main findings led to an innovative proposal for learning research skills focused on the stages of compulsory education. This proposal is based on meaningful learning, considering affective motivational activity that and cognitive-instrumental activity constitute the regulatory elements through which the subject interacts with the outside world and acquires,

among other learning, new capabilities. When this interaction is intentional, that is, it occurs, then cognitive processes originate that contribute to meaningful learning.

From this perspective, a first approach in the transfer towards a higher stage of investigative skills would be to make rethink When designing any competency-based learning program to ensure that these fulfill two purposes, they refer to their studies (Aldas, Ávila, & González, 2020); Calisto (2020).

At first, we must consider as the basis for this training process the accumulated experience or cultural matrix of the student identified through his learning diagnosis. And second, that the programming and timing of content should aim to construct new learning, and that these should be supported by or build upon previous learning; that is, the former should be transferred to the latter. Both goals are fully aligned with some of the major principles advocated by the current educational reform in higher education: meaningful and cooperative learning, etc.

Regarding knowing how the teacher can direct, from his or her methodological and didactic performance, the systematization of research skills which result would be to promote meaningful learning in the university student, (Díaz, & Cardoza, 2021), they carried out an investigation which result translates into basic principles for the instrumentation of meaningful learning based on research skills.

A first principle refers to assessing the meaningful nature of different learning

processes, a didactic and methodological aspect that will only be possible if teaching tasks and learning situations are designed with this intention, ensuring that the skills to be developed in students can meet the following two conditions: all selected content must constitute potential for the development of scientific skills, that is, it must be linked to the students' prior knowledge and be part of their research needs; it must foster a favorable research attitude on the part of the students, that is, they must be motivated and interested in learning.

The second principle refers to the need to dimension the personalized nature of learning by promoting significance in the construction of knowledge (using different levels of support and its transition to independence (meaningful learning in its own right), that is, stimulating the learning strategy: learning to learn. The instrumentation of this principle implies stimulating divergent and protagonist thinking in the student before the solution of each teaching task from the use of problembased methods by the teacher. The third principle highlights the need to modify teaching schemes towards the search for meaning in learning; seeing it from another perspective would be to pose a cognitive dissonance.

And finally, (Fernández, Carcausto, & Quintana, 2022) conducted a research that aimed to analyze learning methods to make didactic use of scientific and technical information with a productive nature of the

messages received, allowing access to meaningful learning for the student and redesigning self-training mechanisms based on invariants of knowledge and research skills. An analysis of the Teaching Strategies for Meaningful Learning was carried out, revealing a close relationship between information (organizer), knowledge representation (schemes building cognitive bridges), and research skills. They demonstrate through their results that these teaching strategies seek to develop research skills and knowledge specific to their profession.

The category *of professional competencies as the highest expression of skills* includes the results of the review of works by authors: Díaz-Barriga, (2014); (Ortiz, Vicedo, González & Recino, 2015); (Guzmán, I., & Marín, R., 2016); Pérez, (2018); (Chávez et al., 2022).

In an initial review of the works of these authors, studies were found on the relationship between research skills and the mastery of actions throughout the scientific research process. In this regard, Díaz-Barriga (2014) and Ortiz, Vicedo, González, & Recino, 2015 agree that research training is closely linked to academic and professional aspects.

It was found that in a group of research skills (to a certain extent it is combined with the narrow sense of the concept of research that must be taken into account at the level of any career, year, discipline, subject or matter: for the search for information in the native and foreign language, for the determination of the research problem and its solution, they found within the results that, for the elaboration of the research plan in its different stages, it is necessary to consider the design of the different instruments adjusted to research techniques, for the interpretation of the statistical processing and of the data derived from the research.

There is interest from the scientific community in investigating the competencybased approach to developing research skills. Thus, (Guzmán, I., & Marín, R., 2016) a study that concluded by conducted delimiting the epistemological boundaries competency between and teaching competencies, as well as specifying the expeditious pathways through which, from a didactic and systemic perspective, their development is possible within the conditions of higher education as a mode of professional performance beyond research as a specific activity.

Similarly, Pérez (2018), in a theoretical review of the competency-based approach and its application, investigated that investigative skills are a product of the systematization of actions in conditions that allow their constant development, where the inducer and the executor are enhanced in them, then these actions are directly related to a conscious objective or end and the conditions, paths, methods with procedures, which their execution is carried out will be related to the operations, which the subject faces in order to achieve the objective, and have their maximum expression in professional

competencies.

Regarding the development of research competencies in university students (Chávez et al., 2022), they conducted a study in which they delved into the higher levels of development of professional competencies such as harmony and the integrity of the subject's feelings, thoughts, and actions in professional performance. The aforementioned authors justified, through the main findings of their study, that a professional is competent not only because they display behaviors that express the existence of knowledge and skills allow them adequately that to solve professional problems; but also because they feel the need and the commitment to act in accordance with their knowledge, skills, abilities, motives, and values with ethics, flexibility, dedication, and perseverance in solving the problems demanded by their professional practice.

The third category analyzes the systematized logic in the transition from a research skill to professional competencies in higher education, based on the following studies: (Martínez-Miguel, et al., 2018); (Yangali, et al., 2020); Ballesteros, (2020); Vega, (2023).

To understand the transition from a research skill to professional competencies in higher education, it is initially necessary to conceptualize the term "systematization" as the establishment of a system or order that aims to obtain the best possible results according to the goal to be achieved. In their studies, they add that it constitutes an articulation as a systematization of scientific experiences, in the circuit of permanent theory-practice dialogue, and they also refer to it as a method in scientific knowledge or as a process inherent to the epistemic construction of science (Martínez-Miguel, et al., 2018).

Based on the identified articles, in this category, the results are highlighted (Yangali, et., al, 2020), the authors assert in their work "Research culture and research competencies of university professors in southern Lima", that scientific - professional training is manifested in the university student through competencies during the performance of research tasks and within the framework of the teaching _ learning process for professional training, in this context their intentional construction of research skills and capacities is also located.

From this perspective, professional competencies constitute the integration of core or invariant knowledge, invariant skills and generalized abilities, and professional and social values. However, knowledge and skills, together with values, constitute inseparable aspects of a whole that is configured in the dynamics of the process itself and comes to constitute a higher-order configuration, due to their intrinsic nature.

It is worth highlighting that, among the articles analyzed to this point, there are points of agreement regarding the strategic nature of the subject's functioning in their training process. Considering that the functionality of professional competencies corresponds to the subject's functions, it is possible to develop research skills and capabilities through the learning of strategies appropriate to research and its generic processes. These aspects, as part of the review's results, converge from:

a) Recognize that systematization is a permanent and cumulative process of knowledge production based on intervention practices in social reality;

b) It is based on planned and therefore intentional action, but it is not exhausted in it, because it transcends it, it takes it as an object of knowledge to treat it, analyze it, understand it and rework it on a qualitatively different level than a simple description;

c) It allows the location of experiences in a system of abstraction called theory, which expresses the explicit conception or that underlies all practice.

In a more up-to-date context, there are the studies by Vega (2023), who, through his work "Digital Competence and Research Skills", recognizes that research skills, in their systematization, are considered an activity with intellectual characteristics particular and requirements: therefore, its execution requires the development of specific capacities that, essentially, find their support in the quality of thought and its processes, as well as in its logic, which is essentially metacognitive: this means that it is oriented, together with the production of knowledge, to the development of awareness of how it can be constructed and produced.

This author highlights, among the main characteristics of systematization, the critical confrontation and interpretation of experience, which leads to an ordering and reconstruction of the lived process and its logic, conceptualization, and practical application. His considerations serve as the basis for the analysis presented in this chapter on the systematization of research skills, from a perspective that relates them to inquiry, systematic doubt as a cognitive platform, and the epistemology of science.

In this category, the majority of the topics highlighted are favorable aspects or those deemed potentially positive for the systematization of research skills, in order to achieve their maximum expression as professional competencies. The structure of professional competencies is general in nature, but their content is specific depending on the specific activity in which the individual works.

The cognitive component integrates, in addition to the specifics of the activity of all processes, cognitive the conceptual, theoretical, and empirical knowledge base related to scientific production and psychological research as a research activity. The metacognitive component, for its part, guarantees the regulation and control of the process, and its conscious mastery through reflection and metacognitive knowledge. This is justified through the stages of activity development: guidance, planning, control, evaluation, and feedback to correct the

strategies deployed at each stage of scientific knowledge construction.

The gaps in this aspect in the international literature identified in this review are highlighted, such as: the integrative, contextual and current nature of professional competencies; the development and execution of research strategies that enable, through the use of the scientific method, the organic and progressive nature of existing knowledge based on constant regulation and adjustment of the research process itself; and the training process in the university context as a platform epistemic for the valid analysis and construction of knowledge of science as a social process and product.

DISCUSSION

Based on the criteria of the cited authors and the transit through the different research variables attending to the causal relationship between research skills and professional competencies of higher education, the results identified a positioning of an integrative and systematized logic for the development of research competencies in this context, and assumes an important role in the formative process of the university student, since it intends from its integrative, contextual and current core of professional competencies, its functions, the investigative projection of the subject before the investigative reality.

As a reflection, it is distinctive to highlight as a significant element of this study, the leading role of investigative skills in their transition to the formation and development of professional competencies (Vera, Chirino, Ferrer, Blanco, Amechazurra, Machado and Moreno, 2021).

It is worth noting that, in the first category, the profession category and the contextualization of the different modes of student action in the process of directing the university learning at are overemphasized, an aspect that demands a restructuring in its formative approach that allows a significant appropriation of the academic, scientific-investigative and labor content to promote the development of scientific thinking that dynamizes the performance and modes of behavior of students in a significant way from the point of investigative view with а transformative sense (Castrillón, 2012).

The second category addresses a competency development approach based on the training and development of skills in the context being studied; however, the results are directed toward deepening awareness of the more general theoretical-methodological and procedural aspects of research without taking into consideration the different particularities of the subject of the future profession; they do not delve into the didactic-methodological aspects related to the potential of the scientific-research content reflected in each discipline and subject, which would allow for a differentiated approach and contextualized those particularities that are educated in the modes of professional action, as it acts as a

socially significant educational agent in the modification of subjective nature, and in increasingly complex contexts (De Faría and Prieto de Alizo, 2006).

In the third category, it was possible to verify and corroborate the need to pay attention to the systematization of the skill formation process and the transition to its professional maximum expression: this systematization process competence; implies the formation of a system of actions and operations of a structural nature, reaching a high degree of perfection in research skills in certain teaching situations, the object of the profession and educational contexts, which is accompanied by a process of abstraction and generalization, which leads to the formation of qualitatively superior skills according to their generality. The above requires the contribution to every conceptual-methodological object and a process of logical argumentation that requires the construction of professional competence (Zarraga and Cerpa, 2023).

CONCLUSIONS

The level of intentionality on the part of the scientific community to investigate this issue of research skills and professional competencies in higher education was confirmed, demonstrating the need to study the relationship between the logic of the university profession and the subjective elements of the research process from academic. an professional, and investigative perspective. These aspects are expressed in the different

levels of student performance through research skills and competencies.

Similarly, the following gaps found are considered: studies related to the relationship: research ability - capabilities - professional competencies, the research identity in the university student and the formative procedure from an epistemic approach, an validates the aspect that process of constructing knowledge of science as a sociocultural process.

Similarly, there is research on scientific and professional development in university students through Digital Competence and research skills. On the other hand, there are records of research that aim to interpret this epistemological dynamic regarding research skills and competencies to achieve research identity in university students in the context of the Medical Sciences.

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