Research Competencies and Autonomous Learning of University Students

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The events that occur in education today have managed to make available to the students of the Faculty of Design a range of instruments and tools for the acquisition of new knowledge. However, the difficulty lies in the embedded traditional methodology of some teachers, who do not impart the execution of competencies in the students for their development in an environment that requires professionals capable of building solutions through research. These are induced by self-learning by students who need to carry out design projects aligned with current changes, and the requirements of a market by professionals capable of developing authentic projects that are developed on a scientific basis.

Keywords: research skills, autonomous learning, students, design

INTRODUCTION

Currently, the pandemic caused by covid-19 has left the entire world paralyzed and brought with it consequences in the labor, health, economic, social, and academic fields. The academic sector has been one of those affected by the little preparation that was had on virtual education[1]. Today, Latin America not only registers problems based on confinement in educational matters; but it is still afflicted by problems in the educational system unrelated to it, which have helped to place greater emphasis on various issues such as the existing socioeconomic gaps, one of the main causes within the educational system since it is directly linked to progress and well-being of the peoples. The economic commission focused on Latin America and the Caribbean indicates that the educational agenda that is followed in Latin America emphasizes the challenges of the new 21st century, linked to the achievement of a society that emphasizes knowledge and progress in technological issues that are being executed[2].

Nowadays, research competence is prioritized by higher educational institutions since it is a distinctive feature that is sought in its graduates due to social and labor demands and the characteristics of a society in constant search for knowledge[3]. It's one of the generic skills included in the Tuning Europe Project as well as in the Tuning Latin America Project since 2004; in both projects, it is referred to as research capacity. Latin America carried out a study on 16 countries; had the participation of 22,609 people, of which 4,558 were academics, 7,220 graduates, 9,162 students, and 1,669 employers, resulting in the research competence being among the ten most crucial due to this, it was incorporated into the educational model, in curricular plans and profiles of graduates[4].

On the other hand, university autonomy is one of the university conceptual foundations worked on since the Middle Ages that seeks to ensure, over time, for its members, independence from the power of the Church and for the future from the power of governments and interest. of money, directed towards the fulfillment of its institutional mission that is based on a free and disinterested relationship concerning the truth[5]. Traditional education has been based on the information provided by teachers, leaving aside the criticism and reflection of students in front of it. It is for this reason that today's educational institutions implement new teaching methods to develop the skills of the students towards autonomy over their learning, considering that this capacity can be a key to educational success in the field of higher education and reflected in the workplace[6].

RESEARCH COMPETENCIES

Competencies, within a broad concept of every person, constitute the formulation of knowledge, skills, values, and qualities; all this, based on their individual and social needs, subject to the professional motives and interests that allow satisfactory performance in professional execution. Research competence, in the professional field, allows generating significant learning in students in specialized knowledge and research skills that offer tools to be able to design and execute investigative projects, using the results to subsequently provide feedback on their exercise and professional and social conduct, helping to improve diagnostic criteria, intervention, promotion, prevention in social issues that will face in professional practice[7].

More specifically, the investigative skills seek the autonomy of the students to guide them towards self-realization as a path towards the realization of a vital project, which satisfies the needs of the community and the student. Students are idealized as objects and subjects of transformation. The research culture should not only be referred to as a labor issue, but also in a social context, there arises the need to promote training processes for future professionals on competent research bases that are motivated by reasons of a personal and social order[7].

Research skills are defined as a transversal professional component that provides guarantees about the ability to respond to the dynamics of constant changes and rapid advances with which society is characterized today, the ability to develop these skills helps in the process of autonomous learning, critical thinking, writing and reading skills, creativity, information management, the spirit of search and inquiry and study habits as the main tools to achieve professionals capable of learning from learning as a new lifestyle[8].

THEORY OF KNOWLEDGE

The theory of the Prussian philosopher and scientist Kant indicated that human reason has a kind of knowledge, questions that it cannot separate. They are natural proposals of reason itself, which cannot be answered because they exceed the limits of human reason. The elaboration of knowledge belongs to the work of reason, which leads to a safe march of science, and which could be judged by success. Knowledge has extensive preparations and arrangements, it stumbles at the end or at the moment to reach a result, it has to go back, again and again, to be able to embark on a new path and achieve a successful result during an investigation[9].

The objective of Kant's theory was to discover the basic conditions for knowledge to start from there toward validity or speculation; his philosophy is exposed, mainly, in his critical work on pure reason. In this theory, the axis of the discussion slides towards the opposition between theory and its practice, where theory is synonymous with passive contemplation and practice with a transforming activity. In addition, Kant makes a union between the subjective and the objective, between the phenomenon and the noumenon, with the questioning of whether there are modes of knowledge and what they are; for Kant they were the following: 1) sensitivity, 2) discursive understanding and 3) reason[10].

THEORY OF SCIENTIFIC KNOWLEDGE

The German philosopher Schopenhauer affirms that scientific research has as its main characteristic the exploration and discovery of new knowledge, something that can be reached by intuition, but that should not be understood as a type of scientific knowledge, since it does not it is justified. In the Historical Dictionary of Schopenhauer's Philosophy, two instances of the constitution of scientific knowledge are distinguished: 1) the discovery of information (discovery) and 2) the justification of the knowledge discovered by being systematized (technical use). According to the author, reason has an important function and is to convert the knowledge obtained, since it is not cumulative, but moldable. For this reason, it relates the systematization of knowledge through concepts with the ability to calculate and foresee[11].

EPISTEMOLOGICAL KNOWLEDGE

Knowledge is a progressive and gradual process, which is developed by man to apprehend and understand himself as an individual, and species and understand his world. For science, it is an epistemological study defined as "the theory of knowledge" and, etymologically, it comes from the Greek episteme, critical of the development, results, and methods of science, also defined as the field of knowledge that deals with the study of human knowledge from a scientific look. Epistemology derives from the Greek gnosis, the study of knowledge from a general perspective and not exclusively from a scientific point of view. In practice, it is a way of understanding knowledge from man and his individual, personal, and even daily sphere, establishing relationships with things, phenomena, and other men. Both proposals develop currents and systems of parallel thoughts with different visions of knowing the world. However, for the present project, it was necessary to delve into epistemology to know scientific knowledge, which is linked to educational learning. Therefore, knowledge raises three major questions: 1) the possibility of knowing, 2) the nature of knowledge and 3) the means to obtain knowledge. Likewise, it must be taken into account that knowledge has characteristics that are: a) empirical knowledge, b) philosophical knowledge and c) scientific knowledge[12].

UNIVERSITY RESEARCH

University research is understood as a process of constant search for new knowledge, a process made up of the creation of an act, the innovation of ideas, the acquisition of rigorous methods used, and the validation of critical peer judgment[13]. Likewise, research on university students seeks to generate content that involves not only a theoretical understanding but an understanding of man and his environment itself, as well as their interrelationship. In addition, students, through it, are initiated into an investigative, ideologically critical, and autonomous cultural development that allows for advances in the knowledge that can be imparted in the classroom[14].

CONCEPT OF RESEARCH SKILLS IN UNIVERSITY STUDENTS

The research skills focused on university students, have the purpose of instructing the student in the ability to identify, pose, formulate problems, design objectives, manage sources of information, develop theoretical frameworks, define types and designs of research, design instruments that allow analyze and interpret results through written reports in a detailed research paper. For this reason, it can be summarized that the research competencies are the methods and mean to be able to produce new and valid knowledge through scientific research, which allows the training of competent researchers who can face the dizzying changes that the constant changes that occur require nowadays. In addition, it should be considered that research skills must go hand in hand with other skills, such as digital skills, which will allow students to use information management tools[15].

DIMENSIONS OF THE INSTRUMENTS ON RESEARCH SKILLS IN EDUCATION

The proposed dimensions were 36 items and are grouped as follows: 1) problem statement and theoretical basis, 2) materials and methods, 3) tools and means, 4) necessary skills for research, and 5) evidence or results of research study[4].

INSTRUMENTS TO MEASURE AND EVALUATE RESEARCH SKILLS IN UNIVERSITY STUDENTS

The instrument applied to be able to evaluate the research competencies were the questionnaires since they allow us to measure the necessary dimensions to be able to validate the collection of the required information. This questionnaire had a reliability of 0.96 through Cronbach's alpha coefficient and validation through principal component analysis using a Kaiser - Meyer - Olkin (KMO) sampling adequacy, which contrasts the partial correlations between the respective variables, the KMO is 0.94. Therefore, it could be indicated that the instrument was valid for said measurement process[4].

Dimensions of the Instruments on Research Skills in Education

The proposed dimensions were a total of 36 items that were grouped as follows: 1) problem statement and theoretical basis, 2) materials and methods, 3) tools and means, 4) necessary skills for research, and 5) evidence or study results[4].

Problem Statement and Theoretical Basis

The statement of the problem and the theoretical bases indicated that the students have a perception or know the beginning of an investigation and the elaboration of a theoretical framework of study[4].

Materials and Methods

The use and knowledge about the materials and methods allowed us to know the use of the validation and reliability of the research instruments, likewise, the application of the statistical methods[4].

Tools and Means

The tools and means that students use the most to carry out the formative research process were related to the processing and application of information to convert it into knowledge. In addition, it allowed knowing the use of APA standards and the analytical reading of the sources consulted[4].

Research Skills

This dimension allowed us to know the development of investigative skills such as the exposition of a problem, the formation of questions, the elaboration of comments, proposals, conclusions, and the evaluation of studies already carried out[4].

Research Evidence

The research evidence on the students allowed us to know the performance that is had when the students emphasize the formation of investigative competence through the collection of data on their own experiences on a scientific investigation. The student also needed to demonstrate knowledge about research plans, design, and application of instruments in a study, partial reports, and reports on completed theses, among others[4].

Autonomous Learning

Autonomous learning is a process of acquiring a set of linguistic knowledge, as well as cognitive strategies necessary to interpret and reproduce works that are used in an educational context. Knowledge is acquired through literate knowledge, produced by discourses that communicate the knowledge of each discipline indistinctly and from a frequently written culture[16].

In the same sense, the autonomous learning process is understood as the ability to ensure that the student has the conditions established to achieve self-regulated learning. Virtual teaching has managed to strengthen the autonomous learning of students, especially with the support of digital tools that allow the scientific evidence on the autonomy of university students to be systematized, with the help of databases such as Scopus, Scielo, Erick, and Ebsco Host[17].

Likewise, autonomous learning is directly related to the governance of student learning, and decision-making about the learning process, in the company of entertainment and development of their cognitive, affective, interactive, and metacognitive skills or abilities. Likewise, it is related to the goal – the ability to be able to exercise control over their learning pace, and their habits when doing so[18].

Metacognitive Theory

On the one hand, the metacognitive theory indicates that metacognition is an evolutionary trend that develops in humans during adolescence[19]; on the other hand, metacognition develops in the adulthood stage, when the subject is already older, and these can be given through the lived experience of each person in particular. Metacognition arises through the cognitive growth of a person; this is a characteristic of the ontogenetic development of mental abilities. In other words, the metacognitive process is born and develops with the person, but this process begins when a subject is already right about their own acquired learning [20].

Theory of Mind

Likewise, when human beings acquire an object with a mind, which we call learning, it comes from a physical and natural world, which does not occur once, but is a slow evolutionary process and occurs differently each time. Person[21]. Piaget (1981) was the first one of the pioneers in developing studies on knowledge in children, in his proposal, he maintains that children do not have their knowledge, since they confuse the objective with the subjective so that they see internal events as phenomena, external (realism) and external phenomena that are interpreted as subjective elements (animism)[22].

Adolescent Cognitive Development Theory

Along the same lines, the concept of man and his mind was explained, linking them with the science that rationally addresses different aspects. Specifically, it focuses on seven trends: 1) increased capacity in the information process, 2) increased knowledge in specific domains, 3) presence of some features typical of concrete and formal operations, 4) quantitative predisposition oriented towards measure, 5) sense of the mental game to an ability to judge at a correction level, 6) metacognitive development and 7) ability to improve existing competencies, not yet completed. The author pointed out that human knowledge is procedural and declarative, it grows as the years go by, it is a slow process, and it is automatically activated before various situations[23].

Strategic Knowledge Theory

Finally, the theory of strategic knowledge refers to knowledge about the differential value, which each person has about their cognitive and metacognitive strategies to meet their proposed objectives. Knowledge requires activation, these are not always present and need a strategic motivation to be able to act. All cognitive and metacognitive action starts from the subject and his instance on his motivation; in other words, it depends on the interest to reach the goal and how much you are willing to work for it[24].

Concept of Autonomous Learning in University Students

Autonomous learning, from an educational context, refers to the self-directed process that the student carries out in their learning processes, taking the initiative in this process without the need for collaborative help from the teacher. Likewise, the student in his autonomous learning process can determine his needs in the learning process and the management of his strategies; Self-directed learning readiness (SDLR) also helps to understand and examine attitudes, abilities, and characteristics through the self-directed process[25].

Instruments to Measure and Evaluate Autonomous Learning in University Students

The instrument to measure and evaluate autonomous learning was through exploratory factor analysis, the scale to measure is through a 5-point Likert scale, and the validity of the proposed instrument obtained a reliable result of Cronbach's Alpha of 90[26].

Dimensions of the Instruments on Autonomous Learning in University Students

Regarding the dimensions of an instrument to measure autonomous learning in university students, it was pointed out that the following points should be considered: 1) learning process, 2) motivation, 3) communication, and 4) learning interaction[26].

Learning Process

The first dimension is related to student learning autonomously, evaluating their performance and strategies used in the student's learning process.

Motivation

The second dimension allows knowing the motivation of the students in the face of the adversities that can arise in their self-learning process, measuring their connection as a student and mediators of their learning.

Communication

The third dimension helps to know the student's difficulty in oral and written communication, considering the type of expression that the student executes.

Learning Interaction

The fourth dimension focused on the student's interaction in their learning process allows us to know if the student also includes cooperative help with their peers in this process.

METHODOLOGY

For the development of the following investigative project, the method was the hypothetical deductive one, which is a quantitative design, based on pre-established hypotheses, measuring variables that must be applied to the design conceived in advance. In developing it, the researcher should focus on the validity, rigor, and situational control of the research. Likewise, statistical analysis is essential to obtain knowledge objectives. The research approach was quantitative, which offers the possibility of repetition, and the focus on specific points depending on the phenomena to be studied. Furthermore, this type of research facilitates comparison between similar studies[27].

The type of research was basic, applied, that is, pragmatic or utilitarian, it takes advantage of previous knowledge through basic or theoretical research for the knowledge and solution of the problem addressed. In addition, it seeks new knowledge without a practical and immediate purpose, it focuses on scientific principles and laws to organize a scientific theory. The research design was non-experimental, cross-sectional, or correlational. This design was made without deliberately manipulating its variables[27-28].

In addition, the research was cross-sectional or transactional, since data information applied to the instruments in undergraduate design students will be collected at a set time[29]. Likewise, it was correlational since it seeks to determine the statistical relationship of the variables: investigative skills and autonomous learning in times of covid-19. The population is defined as the set of all cases that match a series of specifications, which needs a description deep enough or consider the sample automatically. The present study was made up of undergraduate students from the Faculty of Design of a private university during the 2022 period, approximately 300 students from the last three academic cycles. A sample is a subgroup of the population or universe of interest that helps to collect relevant data through two data collection instruments, which will be selected probabilistically. For the research, 150 university students from the Faculty of Design[27-29] participated.

RESULTS

TABLE 1
SPEARMAN CORRELATION BETWEEN VARIABLES

			Research competences	Autonomous learning
Spearman Rho	**Research competences**	**Correlation coefficient**	1,000	,366**
		Sig. (bilateral)		,000
		N	133	133
	Autonomous Learning	**Correlation coefficient**	,366**	1,000
		Sig. (bilateral)	,000	
		N	133	133

Table 1 shows the Rho Spearman correlation = 0.366**, considering a moderate positive correlation between the autonomous learning variables and the autonomous learning variable. Likewise, the value of p=0.000 (p < 0.05) so the null hypothesis is rejected. Therefore, there was a significant relationship between the variables of research skills and autonomous learning.

TABLE 2
SPEARMAN'S CORRELATION BETWEEN THE PROBLEM STATEMENT DIMENSION AND THEORETICAL BASE AND AUTONOMOUS LEARNING VARIABLE

			Statement of the problem and theoretical basis	Autonomous learning
Spearman Rho	**Statement of the problem and theoretical basis**	**Correlation coefficient**	1,000	,299**
		Sig. (bilateral)		,000
		N	133	133
	Autonomous learning	**Correlation coefficient**	,299**	1,000
		Sig. (bilateral)	,000	
		N	133	133

In Table 2, the Rho Spearman correlation = 0.366** was presented, considering a moderate positive correlation between the autonomous learning variables and the autonomous learning variable. Likewise, the value of p=0.000 (p < 0.05) so the null hypothesis is rejected. Therefore, there was a significant relationship between the problem statement dimensions and theoretical basis and autonomous learning variable.

TABLE 3
SPEARMAN'S CORRELATION BETWEEN THE MATERIALS AND METHODS DIMENSION AND THE AUTONOMOUS LEARNING VARIABLE

			Materials and methods	Autonomous learning
Spearman Rho	**Materials and methods**	**Correlation coefficient**	1,000	,383**
		Sig. (bilateral)		,001
		N	133	133
	Autonomous learning	**Correlation coefficient**	,287**	1,000
		Sig. (bilateral)	,000	
		N	133	133

In table 3, the Rho Spearman correlation = 0.366** was presented, considering a moderate positive correlation between the autonomous learning variables and the autonomous learning variable. Likewise, the value of p=0.001 ($p < 0.05$) so the null hypothesis is rejected. Therefore, there was a significant relationship between the dimensions of materials and methods with autonomous learning.

TABLE 4
SPEARMAN'S CORRELATION BETWEEN THE DIMENSION TOOLS AND MEANS FOR RESEARCH AND AUTONOMOUS LEARNING

			Research tools and means	Autonomous learning
Spearman Rho	**Research tools and means**	**Correlation coefficient**	1,000	,383**
		Sig. (bilateral)		,001
		N	133	133
	Autonomous learning	**Correlation coefficient**	,383**	1,000
		Sig. (bilateral)	,000	
		N	133	133

In Table 4, the Rho Spearman correlation = 0.366** was presented, considering a moderate positive correlation between the autonomous learning variables and the autonomous learning variable. Likewise, the value of p=0.001 ($p < 0.05$) so the null hypothesis is rejected. Therefore, there was a significant relationship between the dimension's tools, and means for research and autonomous learning.

DISCUSSION OF THE RESULTS

Based on the results collected on the first variable, research competencies in design students, a high frequency was indicated at the basic level of said competence, which reflects on Kant's theory based on knowledge, since the said process is gradual. It is constantly changing in students and human beings in general[12]. Students in the process of vocational training at the secondary level have an inadequate selection of investigative components, they show that they tend professionalization, limiting themselves to the acquisition of new knowledge in a certain area. In addition, it was found that students have an insufficient research component, theoretical studies, a broad vision of social reality, and lack of objectivity, which causes insufficient proposals and implementation of new social transformation projects[30].

Regarding the first dimension, problem statement and theoretical basis, with a high frequency at the basic level, it was commented that students in the issues of the problem statement, information gathering, location, and analysis usually apply it based on their represented knowledge. The works presented in the courses they take, create a seed of growth in the research activities, this is verified with the research evidence, where it was observed that 85% of the students enrolled in the accounting course carried out a written work applying the corresponding scientific regulations[28].

The second dimension, materials and methods, showed a low frequency; one of the methods of inducing students into research is with the introduction to digital skills since they are the ones that will be able to highlight the role of students in the search for new and current information and even more understanding that in areas of study as design, the physical material is scarce. Therefore, digital literacy skills, digital skills, digital skills, and e-skills are needed for students with greater use of digital tools, and with it, greater learning opportunities and learning opportunity[31].

The third dimension, tools, and means for research, obtained a basic frequency according to four aspects: the promulgation of learning objectives, time management, memory and support management, and finally navigation, concluded that students fundamentally need the support of self-management skills that can improve their autonomous learning, leading us to an improvement in research and management of their means to reach the knowledge of new and scientific information that allows managing a new experience in the student and can take advantage of the opportunities offered by the virtual world in its majority[32].

The fourth dimension, investigative skills, presented a high frequency at the basic level, it is commented that greater development of the investigative competence of the students through thesis and research projects, improvement of the results in terms of academic subjects in the subjects related to the investigative competence and the positive perception of the students about the didactic strategies, the evaluation, and the results of the investigative competence[33]. Research competence comprises a series of knowledge such as knowledge, skills, values, and attitudes for solving problems in a specific context. According to the complexity that the work requires, the researcher needs training in skills such as teamwork, ICT proficiency, critical thinking, communication, and discipline, among others.

The fifth dimension, research evidence, presented a high frequency at a low level. The investigative skills are based on a series of evidence collected by the students, an activity carried out in everyday life throughout their lives intuitively and spontaneously; however, academically this process is through the scientific method, which has a series of ordered and linked steps. The process to carry out scientific research requires necessary knowledge in various aspects, as well as skills and attitudes for its preparation, which make up the concept of investigative competence[34].

Regarding the inferential results, the general hypothesis had a significant relationship between the variables of investigative skills and autonomous learning. University research is based on the constant search for new knowledge induced by the same student through various factors that encourage him to do it[13]. Likewise, investigative skills are essential for progress and problem-solving, which may be subject to individual and social issues that allow self-directed learning to be undertaken, so the products or work obtained from an investigation must be relevant in terms of the community setting at local, regional, national, and international levels[35]. Academic training in terms of research is more demanding and rigorous, where students need training oriented towards the current reality, thus the idea of enhancing the skills of students to train critical professionals, capable of applying what they have learned. and put into practice new contexts that need capable professionals in the development of problem-solving.

The first specific hypothesis test indicated a significant relationship between the problem statement and theoretical basis dimension and the autonomous learning variable. The research competencies have the objective of awakening in the student the need to investigate to obtain an improvement at the academic and professional level, the competencies must not only be given by institutional aspects directed by the teachers, but by the articulation with the student's scenarios. The importance of research development is interdisciplinary since it provides relevant importance in research due to how productive and transcendent it can be in the academic subject[36].

The second specific hypothesis test indicated a significant relationship between the materials and methods dimension and the autonomous learning variable, which refers to a theory of knowledge that

indicates that it refers to the idea that an individual has about the nature of the task to be performed perform is related to the type of information that is found and must be dealt with in any cognitive task. So, the process of knowing when memorizing a telephone number, when remembering a shopping list with 20 or more items will take a different way of processing the information. The process of remembering certain things more than others is anchored to physical injuries, the telephone number will be easier to remember because it has a link to do so, while purchases are subject to textual knowledge, which occurs more frequently in schools[37].

The third specific hypothesis test indicated a significant relationship between the tools and media dimension and the autonomous learning variable. The autonomous learning process is understood as the ability to ensure that the student has the conditions established to achieve self-regulated learning. Virtual teaching has managed to strengthen the autonomous learning of students, especially with the support of digital tools that allow the scientific evidence on the autonomy of university students to be systematized, with the help of databases such as Scopus, Scielo, Erick, and Ebsco Host. This helps to determine, that the tools and means in a research process are widely subject to autonomous learning since both are directed towards the same process[17].

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