OmniaScience

Journal of Technology and Science Education
JOTSE, 2023 – 13(2): 498-513 – Online ISSN: 2013-6374 – Print ISSN: 2014-5349
https://doi.org/10.3926/jotse.1744

FORMATIVE RESEARCH AND THE ACHIEVEMENT OF SKILLS BASED ON UNDERGRADUATE THESES IN UNIVERSITY HIGHER EDUCATION

Giovanna Enriquez[1], Edith Zevallos[2], Flaviano Zenteno[3], Daniel Pariona[4], Rommel López[5]

[1]Facultad de Ciencias de la Salud, Universidad Nacional Daniel Alcides Carrión (Peru)
[2]Facultad de Ciencias Agropecuarias, Universidad Nacional Daniel Alcides Carrión (Peru)
[3]Facultad de Ciencias de la Educación, Universidad Nacional Daniel Alcides Carrión (Peru)
[4]Facultad de Ciencias Económicas y Contables, Universidad Nacional Daniel Alcides Carrión (Peru)
[5]Facultad de Ingeniería Civil, Universidad Nacional Daniel Alcides Carrión (Peru)

genriquezg@undac.edu.pe, ezevallosa@undac.edu.pe, fzentenor@undac.edu.pe, dparionac@undac.edu.pe, rlopez@undac.edu.pe

Received May 2022
Accepted October 2022

Abstract

The aim of this research was to determinate the relationship between formative research and the achievement of skills based on undergraduate theses in university higher education, considering three dimensions: student perception in the investigative endeavor, the role of the instructor and the institutional support in the process of building research skills. The methodology corresponds to a quantitative approach, and a survey technique was applied. A 21-item questionnaire card was designed, with a Likert scale that ranged from 1 to 5 for the formative research variable, and 30-item card with a Likert scale from 0 to 4 for the attainment of skills based on the thesis review. The instrument was validated by expert opinion, reaching an average of 85%. The reliability of the questionnaires was 0.92 and 0.95, respectively, according to the Cronbach's alpha method. The population consisted of 1448 theses published in the institutional repository from 2016 to 2020, and the sample was made up of 110 theses from 11 colleges, with a 95% level of confidence. The results indicate that the perception of the achievement of research skills, instructor support during the research process and institutional support are "positive"; likewise, review of the theses reached a "successful" level. It is concluded that there is a direct relationship between formative research and the achievement of competences.

Keywords **–** Formative research, Achievement of research competences, Educational quality, Thesis evaluation, University higher education.

To cite this article:

Enriquez, G., Zevallos, E., Zenteno, F., Pariona, D., & López, R. (2023). Formative research and the achievement of skills based on undergraduate theses in university higher education. *Journal of Technology and Science Education,* 13(2), 498-513. https://doi.org/10.3926/jotse.1744

---

1. Introduction

In Latin America, university institutions are very prominent agents in the considerable scientific and technological knowledge that is produced, primarily financed by public funds (Albornoz, Barrere & Sokil,

2017). In many cases, the publication of findings is disseminated in scientific journals and institutional repositories, among others (Babini, 2019). The laws pertaining to higher education include research as one of the functions of education, and it is the obligation of the state to promote and strengthen its development, targeting social priorities and academic excellence.

The institutions of higher education train qualified, educated persons to ensure the sustainable development of a just and human society (UNESCO, 1998). Likewise, the policies that ensure their quality must make it possible to train citizens with great capacities for the competent exercise of their professional activity and the production of knowledge with high social value, where university-based higher education is a means of social inclusion and mobility for young people in the country (Alarcón, Flores & Alarcón, 2018). Quality education thus involves scientific research as it is referred to in Article 48 of the Ley universitaria 30220 (2014): "Research constitutes a function of the development of technologies in response to the needs of society".

Medina (2018) indicates that the processes of accreditation and licensing at the universities have a growing concern for strengthening their system of research, development and innovation. This is how expectations exist for instructors-researchers to strengthen formative research with their students.

Formative research can be defined as instruction by means of the research process, which uses methodologies in different stages (Miyahira, 2012), implemented from the earliest cycles at the university (Valero, 2021). It is a tool not only to acquire knowledge, but also those experiences that allow students to develop new competences (Guerra, 2017).

In this context, the basic diagnosis of formative research stands out in our setting, and particularly those alternatives for improvement now and in the future as a cross-curricular activity that must take place starting in the first academic semester, with both novice and experienced instructors, according to existing protocols based on internal and external regulations of each university, with duly founded research incubators.

Scientific research requires spaces and settings of learning that facilitate comprehensive development (Barrientos, 2018) and allow people to continue to educate themselves throughout their entire lives (UNESCO, 2014). Likewise, Rojas and Aguirre (2014) indicate that throughout history, knowledge has been associated with cognitive, cultural, social relations, as well as pedagogical processes. Other authors (Bolívar, 2008), in turn, refer to the fact that the development of competences is transformed into learning achievement. Therefore, competences are a system of knowledge, skills, values and qualities of people's personality that are adopted according to individual and social needs, for integration in educational stages, professional activities and in their role as people (Espinoza, 2020). Therefore, for instructors and institutional systems, the competence focus facilitates the evaluation of students through indicators that integrate all three types of knowledge (conceptual, procedural and attitudinal (Rojas & Aguirre, 2014).

For Villalba and Gonzáles (2017), the research incubators constitute a strategy that allows both instructors and students to be integrated in the teaching-learning process of scientific research for the development of new focuses, mental maps and learning methods. In this case, the researcher, called the seed, the student, assistant or the instructor him/herself, learns how to learn, learns how to do research, and discovers knowledge. In other words, formative research, together with the research incubators, promotes autonomous and creative learning.

Scientific competence makes it possible to know the level of professional performance, promote the application of knowledge and generate high-impact results; likewise, it is crucial for successful professional performance and the visibility of researchers (Parra, Colunga & Carvajal, 2016). The achievement of research competences demonstrates student performance, based on respect and recognition of the vast diversity of theory-methodological approaches (Ortega, Veloso & Hansen, 2018).

Therefore, research is the basic pillar of universities, where creativity, innovation and knowledge, among other skills, are developed to meet the country's needs. Universities are subject to measurement parameters through the number of their various publications, performance comparisons and research competences based on the knowledge that allows them to differentiate themselves from others.

According to Barrientos (2018), the educative model of a University "is the educational philosophy of the institution, [...] which promotes the continuous improvement of people and their environment". The Educational Model of the Universidad Nacional Daniel Alcides Carrión (2014) has been structured focusing on training and competence development to train high-level professionals. It seeks to establish scenarios for formative research that permit optimizing learning, based on inquiry itself as part of the teaching-learning process, promoted by instructors in their pedagogic action implemented in various subjects of their educative-curricular projects. Likewise, the formative research process facilitates the necessary acquisition of skills for students, so that they may perform better as students, persons, and later as professionals (Universidad Nacional Daniel Alcides Carrión, 2019).

At Daniel Alcides Carrión National University, the thesis works are a product of formative research. They are not evaluated by means of a validated instrument that would allow us to know their research quality. The project protocol, research report and General Regulations on Academic Degrees and Professional Qualifications are the only documents oriented toward the investigative endeavors of the students. It is necessary to establish guidelines or manuals to overcome certain limitations and strengthen the existing rules and practices concerning formative research that lead to achieving the research competences with the final drafting of the thesis and the scientific article. Likewise, it is necessary to generate incentives to stimulate research development through financing, logistics and environments that are conducive to high-impact publications for both instructors and students (Guerra, 2017).

Taking into account the process manual for formative research at Daniel Alcides Carrión National University, the Vice-chancellor for Research, among other functions, "formulates and evaluates the regulatory framework for research in postgraduate and undergraduate studies" (Universidad Nacional Daniel Alcides Carrión, 2019: page 17), considering that the application of appropriate teaching methods and techniques facilitates the acquisition, construction and reconstruction of knowledge in the different scenarios that allow students to develop competences in the scientific method. In addition, the students' capacities are strengthened with regard to their research skills, including everything from improved research tools (adequate writing, better reading comprehension, search mechanisms and information management, etc.) to the research topics themselves (analysis and identification of the problem, definition of objectives, methodology, data analysis, etc.) (Universidad Nacional Daniel Alcides Carrión, 2019: page 14). The importance is stressed of forming research incubators to generate a research culture at the university, which permits students to participate in scenarios that invite them to conduct research. On the other hand, emphasis is placed on the end-of-degree project in order to obtain the academic degree or qualification as the result of their training process, oriented towards the established research lines and ethical principles.

This educational action referring to formative research is ongoing during the degree program studies, by means of various courses related to research, such as University Working Methodology, Scientific Research Methodology, Statistics, Thesis Seminar I, II and III, progressively from the first until the last academic semester. In this manner, a research work (referred to as a thesis) is consolidated, evidencing the achievement of these competences as part of the graduate's profile.

Vallejos (2019) maintains that the research and information management competences are developed in relation to different areas, which include: context, agents, curriculum, course integration and extracurricular activities. On the other hand, the students' theses have deficiencies in terms of writing and the quality of the information. This situation is similar to what occurs at Daniel Alcides Carrión National University. Few studies have been published in indexed journals by our instructors and students; of these, the journal PRAXIS stands out, which is a means of disseminating research.

In the 2017 curriculum of different programs of study, competences were included in relation to research; in addition, as of 2019, the repository was implemented that allows open access to the degree theses. However, these skills remain to be implemented with the instructors, library staff and students in terms of searching for information and related topics. Furthermore, there is a need to foster attitudes in students that are favorable toward scientific research, with a foundation in a competence-based curriculum that is currently being implemented, with a generalization of courses such as university work study methodology, scientific research methodology, statistics and research. However, the levels of achievement of the research competences must be established, and their contents must be improved. Likewise, it is necessary to promote the dissemination of the results of the research conducted by students in the scientific sessions established each year for the instructors.

Mamani (2018) claims that "the thesis is the main input for student scientific production"; the instructor plays a determining role in order to motivate student in the different stages of generating new scientific knowledge, insofar as the graduate with a Bachelor's degree who is about to embark on the degree and qualification process, has the hope of having the formative research tools he or she needs, taught in the classroom, in order to undertake and consolidate the thesis work (Fajardo-Ramos, Henao-Castaño & Vergara-Escobar, 2015). Furthermore, Aldana, Babativa, Carballo and Rey (2020) state that "in order to achieve comprehensive and investigative training at the undergraduate level, it is necessary to adopt adequate strategies in order to consolidate a culture of research, which contributes to the training of researchers who have the proper investigative values". It is thus concluded that it is understandable that the competence processes are oriented toward skills management and promoting attitudes favoring the development of educational methods based on learning by doing; this is achieved with the continuous support of research instructors.

On the other hand, in our country, scientific production and dissemination is lacking, reflecting the weaknesses in the acquisition of the research competences at the undergraduate and graduate level (Mamani, 2018). This weakness in research works occurs for complex reasons and is associated with the inadequate support by instructors who have the training courses assigned to them and the very design of the university curriculum. In light of this, there is a need to insist on formative research processes that are capable of generating the new knowledge in an optimal and timely fashion.

In turn, Aiquipa, Ramos, Curay and Guizado (2017) highlight that a considerable number of graduates are focused on postponing or finding other ways to meet the thesis requirement; however, the objective should be to take advantage of the opportunities provided by the specialty courses, where the student identifies, describes and explains the knowledge to generate the research work.

Likewise, Aparicio,Ostos, Cortés and García (2019) allege that obtaining information from different sources helps students build knowledge from their own experiences in order to improve their arguments in a critical and rational manner. Similarly, communicative competences help explain the syllabus topics, as they contribute to the teaching-learning process. Minkévich (2005) states that in the different procedures involved in conducting the research, there is a connection between the research problem and the contextual and conceptual conditions; theories must also be explored for the data collection, comparing and analyzing them with regard to the methods applied; these must be flexible and adapted to the research purpose.

What stands out in the reality of the university situation is that with this research, an instrument is generated that will be used to assess studies, translated into research reports or theses produced by the graduates, with the advisement and evaluation of the instructors, which reveals the use of active methodologies that focus the achievement of research competences according to the lines of research, and which are in turn oriented toward the needs of the current national and international situation.

2. Methodology

To conduct the research, a correlational and longitudinal quantitative focus was used.

To evaluate the formative research variable, the survey technique was applied (Ñaupas, Majía, Novoa & Villagómez,, 2014), using a 21-question survey card with a 1-5 Likert scale (1 = never, 2 = almost never, 3 = sometimes, 4 = almost always and 5 = always). Three dimensions were considered: Development of scientific research, considering the perceptions of students with regard to the investigative endeavor and the achievement of competences; instructor performance, investigating the role of the instructor in the process of building research competences in students; and institutional support, recording the perceptions with regard to the role of the institution in the process of building research competences. The sample consisted of 314 students in their last year of studies in the 27 professional degree programs. The instrument reached a reliability coefficient (Cronbach's alpha) of 0.92.

In order to evaluate the achievement of research competences based on the review of degree theses, a 30-item survey card was designed, with a scale of 0, 1, 2, 3, 4 (0 = not present, 1 = initial phase, 2 = in progress, 3 = achieved, 4 = fully achieved), which had a Cronbach's alpha reliability coefficient of 0.95. The study population consisted of 1448 theses published in the institutional repository between 2016 and 2020; the sample was made up of 110 theses from 11 colleges, with a confidence level of 95%. The construction of the instrument took into consideration the structure of the diagram of the proposed theses in the General Regulations for Academic Degrees and Professional Qualifications at the UNDAC. The following dimensions were considered: general aspects, problem, theoretical framework, methodology and results and discussion. The quality of the thesis was categorized according to the score obtained by applying the measurement scale to the different theses: Not achieved: 0 – 30 points; in progress: 31 – 60 points; achieved: 61 – 90 points; and fully achieved: 91 – 120 points. For the validation of the instruments, the expert opinion method was used, attaining 85.3%, in which six university higher education instructors participated.

3. Results

No	Courses focused on research	Programs of study																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Study methodology applied to university work	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
2	Statistics/General statistics/Statistics and Biostatistics	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
3	Inferential statistics/Statistics applied to research/Experimental designs/Statistics applied to educational research/Statistical methods							x			x	x	x		x	x	x	x	
4	Research methodology	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x
5	Scientific methodology II			x															
6	Research I/Scientific research in nursing I/Seminar on Scientific research I/Educational research I: Research project/ Thesis I/Thesis seminar	x	x	x	x	x	x	x	x	x		x	x		x		x	x	x
7	Research II/Scientific research in nursing II/Seminar on Scientific research II/Educational research II: Instruments and information processing/Thesis II/Thesis seminar II/Thesis writing	x	x	x	x	x	x	x	x	x		x	x		x		x	x	x
8	Research III/Scientific research in nursing III/Seminar on Scientific research III/Educational research III: Research report/Thesis/Thesis writing	x	x		x					x	x	x	x		x		x	x	x

Table 1. Courses focused on scientific research by program of study

18 programs of study have been selected out of a total of 27: (1) Obstetrics, (2) Nursing, (3) Human medicine, (4) Dentistry, (5) Mining engineering, (6) Civil engineering, (7) Environmental engineering, (8) Geology, (9) Food industries, (10) Metallurgical engineering, (11) Agronomy, (12) Animal science, (13) Communication sciences, (14) Administration, (15) Economics, (16) Accounting, (17) Education, (18) Law. Each program analyzed has different courses in its study plan as part of its research training; this is implemented in five to seven courses, from the first until the tenth semester. By analyzing the study plans of 18 programs, homogeneity was found in the implementation of the University Work Methodology (UWM) and Scientific Research Methodology (SRM) courses, which were taught in the early semesters. At UWM, the aim is to manage autonomous learning and continuous preparation in order to build their capacities with regard to contents in order to strengthen their learning methods, study techniques and monographic research. On the other hand, in SRM, the purpose is to effectively and efficiently analyze and explain the value and limits of science, the scientific method and research. Covered are the topics of general aspects, the scientific method, types and levels of research, elements of research and the research process.

Item	Development of scientific research	Never (a)	Almost never (b)	Sometimes (c)	Almost always (d)	Always (e)	Summary of the results		
		%	%	%	%	%	a+b	c	d+e
1	I am taught the scientific research process in the different courses.	0	9.1	34.5	39.1	17.3	9.1	34.5	56.4
2	The different courses in the degree program have allowed me to develop research competences.	0	5.5	37.2	37.3	20	5.5	37.2	57.3
3	I feel satisfied with the academic and scientific level of my programs of study.	3.6	5.5	30	37.3	23.6	9.1	30	60.9
4	Conducting scientific research strengthens my professional training.	0.9	3.6	12.7	34.5	48.3	4.5	12.7	82.8
5	Conducting research makes my thinking more flexible and strengthens my creativity.	0.9	6.4	14.5	34.5	43.7	7.3	14.5	78.2
6	I have achieved the necessary competences in order to do research work.	0	5.5	29.1	41.8	23.6	5.5	29.1	65.4
7	I participate in groups or research incubators within and outside of my program of studies.	5.5	17.3	36.4	29.1	11.7	22.8	36.4	40.8
8	I work on a team to conduct research.	3.6	10	32.7	35.5	18.2	13.6	32.7	53.7
9	I interact with instructors and students who engage in scientific research at my university with regard to my research proposal.	1.8	16.4	36.4	32.7	12.7	18.2	36.4	45.4
10	I actively participate in events where the results of scientific research are disseminated.	2.7	14.5	36.4	30	16.4	17.2	36.4	46.4
	$\bar{X}$ %						11.28	29.99	58.73

Table 2. Student perception of the research endeavor

Likewise, the courses that are intended for developing the project, thesis and writing the final report have different names in the different programs of study. The statistics courses also have different titles and are complementary in order to achieve the competences according to the profile of the graduate.

The perception is favorable with regard to the set of items proposed for this dimension of the implementation of formative research, with 59 % for the scales almost always and always; 30 % for sometimes and 11 % between never and almost never. Likewise, students are enthusiastic (always) with regard to those aspects directly related to research (items 4 and 5), because they consider that research strengthens their professional training, makes their thinking more flexible and builds their creativity; the percentages for these items were 48% and 43%, respectively; the responses regarding the achievement of competences were also favorably highlighted (almost always) with regard to research: 41.8 % (item 6). The levels were between 12.7% and 37.2% for the different actors who show attitudes that are less than well established (sometimes). With regard to the somewhat unfavorable responses and the low percentage of responses between never and almost never, these are unfavorable situations that characterize some study programs that do not contribute to research training of students as a result of them not finding spaces in which to participate in groups, forming part of research incubators or interacting with instructors within or outside their programs of study in relation to their proposals.

Item	Instructor performance	Never (a)	Almost never (b)	Sometimes (c)	Almost always (d)	Always (e)	Summary of the results		
		%	%	%	%	%	a+b	c	d+e
1	The professors express confidence in the capacities of students to engage in scientific research.	0.9	11.8	28.2	36.4	22.7	12.7	28.2	59.1
2	The professors promote and support the conducting of scientific research from their departments.	0.9	11.8	33.6	32.7	21	12.7	33.6	53.7
3	The professors use scientific articles as teaching resources as part of their classes.	1.8	9.1	25.5	40	23.6	10.9	25.5	63.6
4	The professors present their own scientific research works in class.	7.3	22.7	21.8	31.8	16.4	30	21.8	48.2
5	The professors promote the use of APA or Vancouver rules in their courses.	0	8.2	27.2	38.2	26.4	8.2	27.2	64.6
6	The professors grade written work (monographs, articles, essays, etc.) taking into account the requirements of APA or Vancouver rules.	0	6.4	21.7	45.5	26.4	6.4	21.7	71.9
	$\bar{X}$ %						13.5	26.3	60.2

Table 3. Perceptions of instructor performance

With regard to the analysis of instructor performance related to the support the students receive to strengthen their research competences during the formative process, altogether, they receive a favorable evaluation, with 60% of the respondents selecting the scales of always and almost always, 27% reporting sometimes and 13% between never and almost never. Likewise, with regard to the student evaluation of the instructors with percentages between 31.8% and 45.5% (almost always), they indicate the highest values for the items "inclusion of requirements to write according to APA rules"; on the contrary, with regard to those stating never, almost never and sometimes, they reflect characteristics or peculiarities of

some programs with regard to instructor competences toward the students, since they do not share (37%) or use their research in their classes (52%).

Item	Institutional support	Never (a)	Almost never (b)	Sometimes (c)	Almost always (d)	Always (e)	Summary of the results		
		%	%	%	%	%	a+b	c	d+e
1	The university promotes open calls to form part of research projects.	1.8	10	36.4	33.6	18.2	11.8	36.4	51.8
2	My college promotes events related to scientific research.	5.5	14.5	30	28.2	21.8	20	30	50
3	My college has a specialized infrastructure for scientific research.	10.9	15.5	33.6	26.4	13.6	26.4	33.6	40
4	My college or program of study has ties to other institutions that conduct scientific research.	9.1	18.2	28.2	27.3	17.2	27.3	28.2	44.5
	$\bar{X}$ %						21	32	47

Table 4. Perceptions of institutional support

This dimension refers to the institutional support represented by the research authorities, such as the Vice Chancellor, Dean or Director as part of the support for management, strategies or mechanisms for the development of scientific research. Regularly acceptable ratings can be seen in a general context (between always and almost always), with values of 40% to 52%, sometimes between 28% and 36%, and never and almost never of 28 %.

A considerable percentage is apparent that does not provide support in terms of opportunities for participation through open calls, events promoting skill building, specialized infrastructure for the development of research and the establishing of corporate ties with other institutions.

Level of achievement of research competences	Frequency	Percentage
Initial phase	2	1.8
In progress	36	32.7
Achieved	58	52.7
Fully achieved	14	12.7
Total	110	100.0

Table 5. Achievement of research competences by UNDAC graduates

As seen in Table 5, most of the theses evaluated (65%) with the applied instrument show the achievement of the research competences by the graduates. Similarly, 33% are in progress, because there is heterogeneity of criteria used in the drafting and presentation of the theses. This indicates that it is necessary to establish a document that considers the protocol of each of the components, of both the project and the thesis report, and it is also necessary to disseminate the APA or VANCOUVER writing style for their generalized use within the institution.

The general aspects that correspond to items 1 to 6 show favorable evaluations with regard to the organization, according to the institution's internal protocols and APA or VANCOUVER rules (item 2) and the writing of the introduction with the minimum required contents, with 66.7% and 63.6% reporting this has been fully achieved, respectively. This is attributed to the fact that before uploading the work to

the repository, it must meet certain standards that are gradually being implemented; however, it is evident with regard to the formulation of the title that the proper competences are not being reached, as values of 3.6% for initial phase; 30% for in progress; 32.7% for achieved and 33.7% for fully achieved were found. With regard to the abstract, the evaluations failed to reach levels of 50% for achieved or fully achieved; these evaluations are between 21.8% and 35.5%, indicating that favorable scores were not obtained.

Items	General aspects and approach to the problem	Not present	Initial phase	In progress	Achieved	Fully achieved
		%	%	%	%	%
1	States the title of the study with 2 or more variables, up to 20 words.	0	3.6	30	32.7	33.7
2	The content is organized according to the institution's internal protocols and APA or VANCOUVER rules.	0	0.9	0.9	31.8	66.4
3	Takes into account the preliminary pages in the draft (title page, committee approval, dedication, acknowledgments, abstract, introduction, contents).	0	20	23.6	30	26.4
4	The abstract contains no more than 250 words, and with the following structure: introduction, objective, methodology, results and conclusions.	0	10.9	31.8	21.8	35.5
5	The introduction is written containing basically the importance-approach to the problem, research limitations, objectives, hypothesis, conclusions and organization of the contents of the report.	0	5.5	10.9	20	63.6
6	Presents the automatic index of the content, the tables and the figures of the thesis.	2.7	5.5	25.5	52.7	13.6
7	Describes the identification and determination of the problem, taking into account the statistical data of the study population.	3.6	9.1	23.7	29.1	34.5
8	Delimits the research according to the real context of the problem.	2.7	1.8	4.5	25.5	65.5
9	Formulates the general and specific problems in coherence with the proposed title.	0	1.8	4.5	47.3	46.4
10	Formulates the general and specific objectives in coherence with the research problem.	2.7	6.4	16.4	64.5	10
11	Justifies the research, considering the reasons of Why?, What for?, the impact and the relevance of the research.	2.7	27.3	23.6	19.1	27.3
12	Considers the limitations of the research.	1.8	24.5	56.4	14.5	2.8
	$\bar{X}$ %	1.35	9.78	20.98	32.41	35.48

Table 6. Achievement of research competences in terms of general data an approach to the problem

With regard to the approach to the problem component, it was found that, in general terms, the 110 theses evaluated did not reach favorable levels. These show evaluations (item 8 and 9) of 1.8 % in the initial phase and 4.5% in progress; these indicators still show deficiencies in delimiting and formulating the problem. For the same item, those reporting achieved and fully achieved did not exceed 50%.

In terms of formulating the objectives, 6.4% and 16% are in the initial stage and in progress, respectively, while 64% achieve the competence and only 10% fully achieve it. With regard to the justification component, the competence is not achieved, as more than 50% are in the initial stage or in progress.

With regard to the skills including the aspects of the drafting and citation of national and international background information according to APA rules, the search for up-to-date information, organization of the theoretical foundation and the definition of basic terms related to the study variables, it is shown that 50% are in the process of achieving these research competences.

However, 60% have achieved or fully achieved the formulation of the hypotheses, and 40% are in the process of achieving this competence. With regard to operationalization, 30% are in the initial phase or in the process of achieving this competence.

Items	Theoretical framework and hypothesis	Not present	Initial phase	In progress	Achieved	Fully achieved
		%	%	%	%	%
1	National and international background information is drafted and cited, taking into account the research topic, results and conclusions in accordance with APA or VANCOUVER rules.	2.7	24.5	52.7	13.7	6.4
2	Considers the research background, going back no further than seven years (up to 80%).	1.8	14.5	55.5	24.5	3.7
3	Organizes the theoretical foundation of the research according to its study variables, applying APA or VANCOUVER rules.	5.5	9	26.4	40	19.1
4	Defines the basic terms of the research, focused on the study variables with the corresponding citations.	6.4	1.8	6.4	29	56.4
5	Formulates the general and specific research hypotheses.	3.6	5.5	29.1	10	51.8
6	Identifies and operationalizes the variables, dimensions and/or indicators of the study.	2.7	0.9	12.7	30	53.7
	$\bar{X}$ %	3.78	9.37	30.47	24.53	31.85

Table 7. Achievement of research competences with regard to the theoretical framework and hypotheses

Items	Methodology	Not present	Initial phase	In progress	Achieved	Fully achieved
		%	%	%	%	%
1	Identifies the research type, method and design.	0.9	5.5	19	27.3	47.3
2	Delimits the research population and sample according to statistical criteria.	0	8.2	23.6	20.9	47.3
3	Describes the techniques and instruments for data collection, considering the selection, validation and reliability of the instruments.	0	6.4	20	23.6	50
4	Describes the data processing and analysis techniques.	3.6	40	25.5	11.8	19.1
5	The ethical orientation is framed within the principles established in the UNDAC's Code of Research Ethics and international standards.	0	0	12.7	55.5	31.8
	Mean	0.9	12.02	20.16	27.82	39.1
	$\bar{X}$ %	5.4	72.12	120.96	166.92	234.6

Table 8. Achievement of research competences with regard to methodology

It is evidenced that 75% identify the research type, method and design, and only 25% are in the initial phase or in progress with regard to this indicator, 68% properly delimit the population and sample and 32% do not manage to clearly delimit the population and sample. A total of 74% manage to adequately describe the techniques and instruments used to collect data; however, a deficiency is found in the data

processing and analysis techniques, with 69% between the initial phase and in progress, and only 31% achieve this competence.

Items	Results, conclusions, recommendations and bibliography	Not present	Initial phase	In progress	Achieved	Fully achieved
		%	%	%	%	%
1	Analyzes and interprets the results according to the proposed objectives.	0.9	4.5	60	25.5	9.1
2	Organizes the contents of the tables and figures according to APA or VANCOUVER rules.	7.3	12.7	37.3	26.4	16.4
3	Discusses the results in light of the proposed background information and/or theoretical foundations focused on the research objectives.	0	4.5	39.1	25.5	30.9
4	Presents the conclusions according to the research results and the proposed objectives.	0	10	51.8	8.2	30
5	Proposes recommendations that permit extending the research, proposing improvements in the scope of their application.	0	56.4	21.8	13.6	8.2
6	Drafts the bibliography according to APA or VANCOUVER rules.	0	8.2	24.5	36.4	30.9
	$\bar{X}$ %	1.37	16.05	39.08	22.6	20.92

Table 9. Achievement of research competences in terms of results, conclusions, recommendations and bibliography

The presentation of recommendations, analysis and interpretation of the results and the drafting of the conclusions, presentation of tables and figures and results (items 5, 1, 4 and 2) show percentages of 78%, 65%, 62% and 57%, respectively. In light of this, it is considered that this competence has not been reached, and the students are in the initial and in progress stages.

3.1. Proof of the Hypotheses

Ha: There is no direct relationship between formative research and the achievement of competences based on the theses by university higher education undergraduates.

Ho: There is a direct relationship between formative research and the achievement of competences based on the theses by university higher education undergraduates.

Chi-square tests			
	Value	df	Asymptotic significance (bilateral)
Pearson's chi-square	8.670	9	.468
Likelihood ratio	9.902	9	.358
Linear-by-linear association	.356	1	.551
N of valid cases	110		

Table 10. Chi-square test of the general hypothesis

Statistical conclusion: the asymptotic significance (bilateral) is greater than the degree of significance (0.468 > 0.05), with 9 degrees of freedom. With these results, the null Ho hypothesis would not be rejected.

Conclusion: there is sufficient statistical evidence at a level of significance of α=0.05 to conclude that there is a direct relationship between formative research and the achievement of competences based on the theses by university higher education undergraduates.

4. Discussion

The results of the formative research show a positive relationship in the achievement of competences based on the undergraduate theses in university higher education.

According to the statistical test, we can state that there is a direct relationship between formative research and the achievement of competences. These results agree with Paucca (2021), whose research shows through a Spearman's Rho correlation that there is a strong relationship (r = .718) and a positive trend; furthermore, the p value is less than the degree of statistical significance (p = .000 < 0.05), thus confirming that there is a direct and significant relationship between formative research and the achievement of competences in students in the 9th cycle in the colleges of technology, initial education, social sciences and humanities at the National University of Education in 2020. On the other hand, Mamani (2018) indicates that the implementation of the formative research courses leads to the achievement of the competences in order to write the thesis. These skills are part of the process accounted for in the syllabus, in which the students acquire knowledge, values and aptitudes, among others, which allow them to consolidate the culmination of the thesis. In turn, Yangali, Vasquez, Huaita and Luza (2020) remark on the importance of empowering an investigative culture with the exercise of critical thinking in relation to the ethical and cultural behavior in research. On a similar note, García, Paca, Arista, Valdez and Gómez (2018) sustain that in order to stimulate research at the university, it is necessary to articulate the instruction, the curriculum and the research focused on the specialty, but with pedagogical considerations, since research is essential in the training of university students and is a strategy in the teaching-learning process. Furthermore, according to Miyahira (2012) formative research develops the skills of interpretation, analysis and synthesis of information, the search for unsolved problems, critical thinking and other capacities, such as observation, description and comparison. As a result, it has an influence on improving their cognitive structure and changing attitudes, values, perceptions and behavioral patterns (Cuahonte, Hernández & Ramos, 2019).

Turpo-Gebera, Mango, Cuadros and Gonzales-Miñán (2020) also state that formative research at the universities is associated with the curriculum with regard to the following: (a) familiarity-doing, understanding of the interaction, suitability, action and organized behavior; (b) knowing-doing, development of different skills and abilities; (c) knowing-being, referring to the research attitudes; and (d) doing-thinking, based on reflection and cooperative work. Likewise, Márquez, Delgado, Fernández and Acosta (2018) observe that in the academic field, the study program must teach about the science that provides its theoretical foundations, the research methods, values and attitudes typically found in a researcher; how to develop presentations, present them and debate, and how to use technology. Communication among instructors is essential if the intent is to engage in cooperative work in the training and development of research competences in students (Banderas, Cárdenas & Martínez, 2018). Meanwhile, Núñez (2016) refer to the fact that higher education must establish objectives aimed at fully achieving the graduate profile. Consequently, Minkévich (2005) establish that in the different procedures that are used to develop research, there is a connection between the research problem, the contextual conditions and theory. In a similar manner, Chambi (2017) indicates a medium level of scientific rigor with regard to the theses; Aiquipa et al. (2017) stress that "in spite of the need for greater scientific research that provides responses to the various problems of the country, the studies are still insufficient. One of the ways to promote research is through the writing of theses." Likewise, research, as part of the university's mission, trains professionals with a comprehensive profile, and the curriculum is the differentiating element in the learning (Guerra, 2017), with a model consisting not only of teaching concepts, but also of applying them to practical situations (Núñez, 2016) and building research skills, including conceptual, procedural and attitudinal skills (Yangali et al., 2020).

In this context, Márquez et al. (2018) indicate that competence training in the research process is acquired as the result of lived experiences in problem solving and it develops communication skills, self-learning and critical thinking; it teaches how to work as a team; it awakens greater motivation; it articulates theory with practice; it develops responsibility and social commitment; it teaches decision-making; it promotes attitudes toward change and innovation; it tackles the problem in comprehensive manner and

acknowledges the unlimited possibilities for learning. In that sense, it will depend a great deal on the methodological strategies instructors use to achieve the research competences and skills in students, who will be responsible for the expectations and needs of an increasingly demanding society, as there is a need to transition from a society that consumes knowledge to a society that produces it. This aspect coincides with the proposal by Rubio, Vila and Berlanga (2015), who indicate that formative research involves the following principles: first, the question ("the doubt"); the building of knowledge based on a question, observation or vacuum, assuming a role as the self-manager of the process and self-learning; second, the instructor assumes the role of an adviser or facilitator, who guides and supports while respecting the opinions of the students, thus triggering autonomous learning in them; and third, inductive instruction, which must promote the cross-curricular approach to the research problems so that the students articulate different knowledges. According to Banderas et al. (2018), it is clear that there is no agreement among instructors with regard to teaching research competences, and thus is would be appropriate to establish ties between each stage of the training in these skills in order to provide continuity and soundness to this training; furthermore, in this process if achieving research competences for thesis writing, a sufficient level of communication is required among the instructors.

In general terms, there is a lot of work to be done on the process of formative research, in order to improve the quality of the theses, which while reaching a certain level of achievement, fail to reach the next level of full achievement. We find deficiencies ranging from the approach to the problem, with no clear focus on what is being investigated; to theoretical bases that do not fully support the foundation of the elements of the problem identified. Furthermore, the required writing styles are not adequately reflected in the background information presented and the contribution of the research is not explicitly indicated in the development of the thesis. On a similar note, with regard to scientific rigor, Chambi (2017) found insufficient arguments in the approach to the study to emphasize the problematic reality that supports the substantiation of the hypotheses, a lack of consistency in the analysis of the theoretical bases and background; in the methodology, the strategies, type of study, population and the use of instruments are properly delimited and typified, but there is no coherence in the operationalization of variables or in the presentation of the discussion, and finally, there are problems associated with writing composition. As a result, Perdomo, Portales, Horna, Barrutia, Villon and Martinez (2020) indicate that the abstract must be written to present relevant information, as it expresses the importance of the research and generates interest on the part of the reader to evaluate the research.

5. Conclusions

A direct relationship is shown between formative research and the achievement of competences based on the review of undergraduate theses. A relationship among formative research and general aspects, the problem, the theoretical framework, methodology, results and discussions of these theses is also evidenced.

The achievement of competences reaches acceptable levels with regard to the different components of the thesis, but improvement is necessary in the competences with regard to aspects related to the theoretical framework, results, discussion and written composition, in order to improve the quality of the thesis.

The results show that most of the students are satisfied with their educational process; however, expectations are not being met with regard to institutional support, such as the implementation of laboratories, infrastructure, offices, technological equipment, open calls for the execution of projects, regular evaluation of the curricula in the various programs of study and strategic alliances with other national and international universities.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

References

Aiquipa, J., Ramos, C.M., Curay, R., & Guizado, L. (2017). Factores implicados para realizar o no realizar tesis en estudiantes de psicología. *Propósitos y Representaciones*, 6. https://doi.org/10.20511/pyr2018.v6n1.180

Alarcón, H., Flores, K., & Alarcón, M. (2018). Perú: Políticas que aseguran la calidad en la Educación superior. *InterMeio: Revista do Programa de Pós-Graduação em Educação - UFMS*, 24(47), 17-35.

Albornoz, M., Barrere, R., & Sokil, J. (2017). Las universidades lideran en América Latina. In Albornoz, M., & Barrere, R. (Coord.), *El Estado de la Ciencia. Principales Indicadores de Ciencia y Tecnología Buenos AIberoamericanos /Interamericanos*. Available at: http://www.ricyt.org/wp-content/uploads/2017/10/files_Estado-de-la-Ciencia-2017_E_2017_2_1_Las_Universidades_lideran_id.pdf

Aldana, G., Babativa, D., Carballo, G., & Rey, C. (2020). Escala de actitudes hacia la investigación (EACIN): Evaluación de sus propiedades psicométricas en una muestra colombiana. *CES Psicología*, 13, 89-103. https://doi.org/10.21615/cesp.13.1.6

Aparicio, O., Ostos, O., Cortés, M., & García, C. (2019). Análisis sistemático de los artículos publicados en la revista interamericana de educación, investigación y pedagogía (RIIEP) durante 2014 a 2019. *Revista Interamericana de Investigación, Educación y Pedagogía, RIIEP*, 12, 225-240. https://doi.org/10.15332/25005421.5015

Babini, D. (2019). La comunicación científica en América Latina es abierta, colaborativa y no comercial. Desafíos para las revistas. *Palabra Clave (La Plata)*, 8(2), e065-e065. https://doi.org/10.24215/18539912e065

Banderas, C., Cárdenas, G., & Martínez, M. (2018). Perspectivas docentes sobre la formación de competencias investigativas en relación con los programas de asignatura. *Sincronía*, 74, 589-616. https://doi.org/10.32870/sincronia.axxii.n74.29b18

Barrientos, P. (2018). Modelo educativo y desafíos en la formación docente. *Horizonte de la Ciencia*, 8(15), 175-191. https://doi.org/10.26490/uncp.horizonteciencia.2018.15.462

Bolívar, A. (2008). El discurso de las competencias en España: Educación básica y educación superior. *Revista de Docencia Universitaria*, 6(2). Available at: https://revistas.um.es/redu/article/view/35241 https://doi.org/10.4995/redu.2008.6268

Chambi, E. (2017). Nivel de rigor científico de las tesis de Maestría en Educación, el caso de una Universidad Pública. *CONSENSUS,* 22(1), 37-47. https://doi.org/10.33539/consensus.v22n1.991

Cuahonte, L.C., Hernández, G., & Ramos, B.L. (2019). Implementación de la Zona de Desarrollo Próximo para alentar la investigación educativa. In *La investigación educativa como objeto de indagación empírica* (51-62). Available at: https://www.researchgate.net/publication/323918862_La_formacion_en_investigacion_de_la_teoria_a_la_practica

Espinoza, E. (2020). La investigación formativa, una reflexión teórica. *Revista pedagógica de la Universidad de Cienfuegos*, 16(74), 45-53.

Fajardo-Ramos, E., Henao-Castaño, A.M., & Vergara-Escobar, O.J. (2015). Vista de La investigación formativa, perspectiva desde los estudiantes de Enfermería. *Salud Uninorte*, 31(3), 558-564. https://doi.org/10.14482/sun.31.3.8000

García, N.M., Paca, N.K., Arista, S.M., Valdez, B.B., & Gómez, I.I. (2018). Investigación formativa en el desarrollo de habilidades comunicativas e investigativas. *Revista de Investigaciones Altoandinas - Journal of High Andean Research*, 20(1), 128-136. https://doi.org/10.18271/ria.2018.336

Guerra, R. (2017). ¿Formación para la investigación o investigación formativa? La investigación y la formación como pilar común de desarrollo. *Boletin virtual*, 84-89.

Ley universitaria 30220 (2014). Ley universitaria 30220: pages 1-35. Available at: http://www.minedu.gob.pe/reforma-universitaria/pdf/ley_universitaria.pdf

Mamani, O. (2018). Calidad metodológica y características de las tesis de pregrado de psicología de una universidad privada del Perú. *Propósitos y Representaciones*, 6(2), 301-319. https://doi.org/10.20511/PYR2018.V6N2.224

Márquez, A., Delgado, S., Fernández, M., & Acosta, R. (2018). Formación de competencias investigativas en pregrado: Su diagnóstico. *InterCambios*, 5(2), 45-51.

Medina, D. (2018). El rol de las universidades peruanas frente a la investigación y el desarrollo tecnológico. *Propósitos y Representaciones*, 6(2), 703-720. https://doi.org/10.20511/pyr2018.v6n2.244

Minkévich, O. (2005). Marcos teórico-metodológicos en la investigación en Educación Física. *Apunts*, *4° Trimestre,* 71-75. Available at: https://raco.cat/index.php/ApuntsEFD/article/view/300883/390328

Miyahira, J. (2012). La investigación formativa y la formación para la investigación en el pregrado. *Revista Médica Herediana*, 20(3), 119-119. https://doi.org/10.20453/rmh.v20i3.1010

Núñez, J.A. (2016). El modelo competencial y la competencia comunicativa en la educación superior en América Latina. *Foro de Educación*, 14(20), 467-488. https://doi.org/10.14516/fde.2016.014.020.023

Ñaupas, H., Majía, E., Novoa, E., & Villagómez, A. (2014). *Metodología de la Investigación, Cuantitativa–Culitativa y Redacción de la Tesis* (4th ed.). Ediciones de la U.

Ortega, R.J., Veloso, R.D., & Hansen, O.S. (2018). Percepción y actitudes hacia la investigación científica. *Academo,* 5(2), 101-109. https://doi.org/10.30545/academo.2018.jul-dic.2

Parra, Y., Colunga, S., & Carvajal, B. (2016). Niveles y patrones de logro para la formación de la competencia investigativa en el psicólogo. *Humanidades Médicas*, 16(3), 475-488.

Paucca, N. (2021). Investigación formativa y logro de competencias en estudiantes de una universidad pública – Lima. *PURIQ*, 3(2), 365-384. https://doi.org/10.37073/puriq.3.2.167

Perdomo, B., Portales, M., Horna, I., Barrutia, I., Villon, S., & Martinez, E. (2020). Calidad de las tesis de pregrado en universidades. *Revista Espacios*, 5(20). Available at: https://www.revistaespacios.com/a20v41n02/20410205.html

Rojas, C., & Aguirre, S. (2014). La formación investigativa en la educación superior en América Latina y el Caribe: Una aproximación a su estado del arte. *Eleuthera*, 12, 197-222. https://doi.org/10.17151/eleu.2015.12.11

Rubio, M., Vila, R., & Berlanga, V. (2015). La Investigación Formativa Como Metodología de Aprendizaje en la Mejora de Competencias Transversales. Lector mejorado de Elsevier. *Procedia - Ciencias Sociales y del Comporta*, 196, 177-182.

Turpo-Gebera, O., Mango, P., Cuadros, L., & Gonzales-Miñán, M. (2020). La investigación formativa: Sentidos asignados por el profesorado de la Facultad de Educación (vol. 46, e215876). São Paulo: Educ. Pesqui. https://www.revistas.usp.br/ep/article/view/187052/172723

UNESCO (1998). *Conferencia mundial sobre la educación superior. La educación superior en el siglo XXIS: Visión y acción*. 1-21.

UNESCO (2014). *América Latina y el Caribe: Revisión Regional al 2015 de "Educación para Todos" (EPT)*. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000232701_spa?posInSet=21&queryId=N-EXPLORE-519362cc-d32f-461c-8571-6835d8568cba

Universidad Nacional Daniel Alcides Carrión (UNDA) (2014). *Modelo Educativo.*

Universidad Nacional Daniel Alcides Carrión (UNDA) (2019). *Manual de proceso de investigación formativa*. https://undac.edu.pe/sgc/

Valero, V. (2021). La investigación formativa en la universidad. *Revista Latinoamericana Ogmios*, 1, 7-8. https://doi.org/10.53595/rlo.2021.1.001

Vallejos, A. (2019). Gestión de la información: Implementando las bases para la Investigación científica desde nuestra experiencia—Information Management: Implementing the foundation for scientific research from our experience. *Apuntes Universitarios,* 4(1), 129-138. https://doi.org/10.17162/au.v4i1.43

Villalba, J.C., & Gonzáles, A. (2017). La importancia de los semilleros de investigación. *Prolegómenos*, 20(39), 9-10. https://doi.org/10.18359/prole.2719

Yangali, J.S., Vasquez, M.R., Huaita, D.M., & Luza, F.F. (2020). Research culture and investigative skills of university teachers in Southern Lima. *Revista Venezolana de Gerencia*, 25(91), 1159-1179. https://doi.org/10.37960/rvg.v25i91.33197

Published by OmniaScience (www.omniascience.com)

Journal of Technology and Science Education, 2023 (www.jotse.org)