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Formative research itineraries in education students

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Abstract- A task to be solved in the Faculty of Education Sciences of the National University of San Agustín (UNSA) is the alignment of teaching practice with the precepts of formative research from university classrooms; understood as the opportunity to develop investigative skills in students from the daily task to investigate. Therefore, this article characterizes the evidence presented by teachers on the platform of the Information Registration System, product of developing these skills with students for knowledge management. The study is documentary, developed from the content analysis method which allowed evaluating the strategies for each cycle included in the formative research model at UNSA: heuristic search for information gathering, argumentative logic, techniques and instruments, systematization of experiences and final work of thesis and / or scientific poster as evidence in each of the academic semesters. This analysis allows us to understand the phenomena and difficulties in directing the investigative skills developed by the teachers, without the respective accompaniment processes and final review of the products registered in the system.

Keywords: Formative research, teacher training, knowledge management, investigative culture.

I. INTRODUCTION

The changes provided by University Law 30220 have determined that the National University of San Agustín de Arequipa (UNSA) will implement adaptations to the statute of the university, which has opened up the possibility of creating new scenarios for intellectual production and obtaining the academic degree through various modalities: thesis, patents, publications in journals or elaboration of books, originating substantial changes in the visibility of this University and of the university teacher at regional and international level, either by the incipient but constant development of scientific knowledge by the achievement of high professional competences of its graduates to identify, formulate and solve problems activating their knowledge; or by the combination of both (Villalba-Condori, Adúriz-Bravo, Lavonen, Wong, Wang, 2020). In this way, it is understood that these lines of university action must be sustained and strengthened based on strategies for strengthening formative research (FR) at UNSA, so that they lead to the gradual development of disciplinary, inter- and transdisciplinary skills that contribute to the strengthening of methodological processes in the consolidation of the research lines, integrating academic knowledge with practical knowledge, to provide feedback to the curriculum (Rubio, Vilá y Berlanga, 2015).

As it stands (Mendoza et al, 2019) at present, a deep change is necessary with strategic characteristics that allow an epistemological and methodological reconstruction in the formation of each subject, whose function is training through research. In the training of teachers, research must be incorporated in their curricula as a requirement. A model of teacher training is required that contributes effectively to the optimization to the research practice and knowledge, which take place in the educational context and in the daily work of education.

In the formation reasearch FR implementation in the universities, as a result of the accreditation and quality improvement processes and academic visibility, a work of qualitative differences was carried out between research formation and formative research of university students, finding a linear teaching, in both, with problems in the choice of the subject, statistics and scientific writing (González, Egleontina, Delgado y Hernández, 2019), Another quasi-experimental study showed the research identity of the students who carried FR, as opposed to those who did not show positive effects on the development of communication skills, highlighting the importance of the teacher's profile as a promoter of research (García, Paca, Arista, Valdez y Gómez, 2018). Likewise, in curricular development, FR has a preponderant value since teachers and students showed a consumption of knowledge through interaction, confrontation and association of individual and group results creating a research culture (Gamboa-

Suárez, Vargas-Toloza and Hernández-Suárez, 2017), Similarly, another study found a close relationship between the contents of the modules proposed in a journalism curriculum and the research proposals developed by the students, connecting in a pedagogical and disciplinary way the theoretical contents with the FR proposal that allowed the opening of the research lines emphasizing the tutorial action (Cortés, Acevedo y Rodríguez, 2019).

According to the consulted works it is evident that there are many works independent of the FR development from a single subject and evaluated by the authors, isolated from the formative curriculum of a career or university with respect to establishing an analysis of the gradualness of the FR processes in a group of teachers and their level of effectiveness. What will be the level of responsibility, relevance of the methodological and contextual aspects of the evidence presented on FR, guided by teachers and developed by university students in accordance with the subject and the virtual register in the platform of the Registration System of Information SIRI?

II. THEORETICAL FRAME

It is important to establish clearly the difference between formative research and scientific research, which is not the same; because there are different approaches and points of view, particularly considers formative research as training in and for research, recognized as a teaching strategy, while scientific research is based on scientific products such as articles, theses, technical reports, among others (Villalba-Condori, Adúriz-Bravo, García-Peñalvo and Lavonen, 2019).

Formative Research Role and Foundations

Formative research (FR) is a pedagogical strategy of a teaching nature for the development of the curriculum (Parra, 2004), which leads to research from the concrete, based on needs in real contexts of society (Roncacio and Espinosa, 2010), through the structuring or development of research projects, as well as the transformation of programs, curricula, and practices (Molina, 2017). Therefore, it refers to a set of learning strategies of inquiry, exploration of reality and construction of knowledge; focused on action or practice (Restrepo, 2003), to develop research processes from the subject it teaches (Morillo, Daza and Flechas, 2015; Parra, 2004), focused on the development of critical and autonomous thinking (Alvitres, Chambergo and Fupuy, 2016), (Quispe-Bendezú, et. al., 2020).

Therefore, three dimensions of FR are the key pieces for flexibility in the classroom that allow the articulation of the curriculum with the development of the student profile, which are detailed: (i) teaching techniques, (ii) teaching style and (iii) specific training purpose. The first refers to the acquisition of skills to carry out bibliographic searches, for the classification and arrangement of information from previous categories (Villalba-Condori, et.al. 2019). The second element demands that teachers adopt a dynamic and progressive approach to their discipline that leads students to develop cognitive processes, revealing real situations in order to solve problems and provide solutions. In this sense (Sáenz, Seville and Patiño, 2015) he sought to contextualize, integrate and articulate the content of the curriculum with academic research, with itineraries of user, product, context and activity interaction. Together with this experience (Valencia, Macias and Valencia, 2014), it proposes to interact the student profile based on dialogue and practice with research for the development of a research culture.

The research culture begins with university teachers, who are the ones who give the necessary guidelines, to increase the levels of knowledge management integrated to reality. To assume these research processes with students is a greater effort than usual since it implies being willing to continually reorient the topics and teaching strategies (Rojas-Betancur and Méndez-Villamizar, 2013). Therefore, a need must be created in students to foster curiosity and critical inquiry to promote meaningful and collaborative dialogue (Rojas-Betancur and Méndez-Villamizar, 2013), to find new findings by gradually applying scientific principles. Montoya and Peláez (2013) proposed four processes: (i) Awareness raising: Based on motivating the student by using autobiographies, essays, reports, critical analysis and other types of reports, (ii) Characterization of the research project, which leads to the proposal of the project, (iii)systematization of the project, is the final product and (iv) socialization of the work that allows the sharing and feedback of the proposal, thus establishing the pillars of a research culture that must be complemented with the mission axes of the University: teaching, research and social responsibility.

Research Competencies Training

Research training implies an articulation associated to the curriculum, to pedagogical and didactic practices, as well as to the concepts of skills and competences, which implies that the subject being trained acquires a series of research and analysis competences (Llontop and Gonzales, 2017). Learning to investigate invites to immerse oneself in reality, from one's own perceptions and previous knowledge where one can interpret, argue, explain, observe and systematize the investigative experiences, producing "useful and necessary knowledge" for the teaching work (Levison, and Salguero, 2009). In this sense, the link between technology and training has been consolidated in ubiquitous contexts, strengthening evaluation with substantive accompaniment and follow-up (Velandia-Mesa, 2017).

Therefore, investigative competition involves: (1). Implementing strategies and actions to become a researcher, (2) Fostering diverse research experiences, and (3) Understanding that research is a professional way and lifestyle, so it depends on training, initiative, curiosity and level of commitment (Levison and Salguero, 2009). Therefore, research competencies involve developing skills that all research teachers must develop, such as: observation, synthesis, abstraction, communication, critical thinking, among others (Rojas and Aguirre, 2015).

Teachers, therefore, must be qualified not only for the didactics of the subject they teach, but also to assume new responsibilities in their role as tutors and researchers (Navarro, Panunzio, Nader, and Moya, 2019). Consequently, the aim is to develop research skills in students as a transversal axis (Fiallo, 2001; Machado and Montes de Oca, 2009), which allow them to start from a problem, using creatively the knowledge and habits acquired (Lanuez and Pérez, 2005), for a gradual development of modes of action, in the solution of theoretical and practical problems (Martínez and Márquez, 2014).

Research Skills Development

They allow the gradual development of action modes to work the scientific method and metacognitive strategies (Martinez and Marquez, 2014), for this purpose characterize them as follows: (i) Basic research skills, which allow the search for information to obtain: locate; select; evaluate; organize; gather the information (López, 2001); (ii) skills to problematize, theorize and check the objective reality (Chirino, 2002) that leads to professional pedagogical performance, (iii) perception, instrumental, thinking, conceptual construction, methodological construction, social construction of knowledge and metacognitive skills (Moreno, 2005) that lead to Process: process; organize, identify key ideas; re-elaborate information, compare results and, (IV) more integrated research skills to solve professional problems, model, execute, obtain, process, communicate information and control (Machadoc et al., 2008).

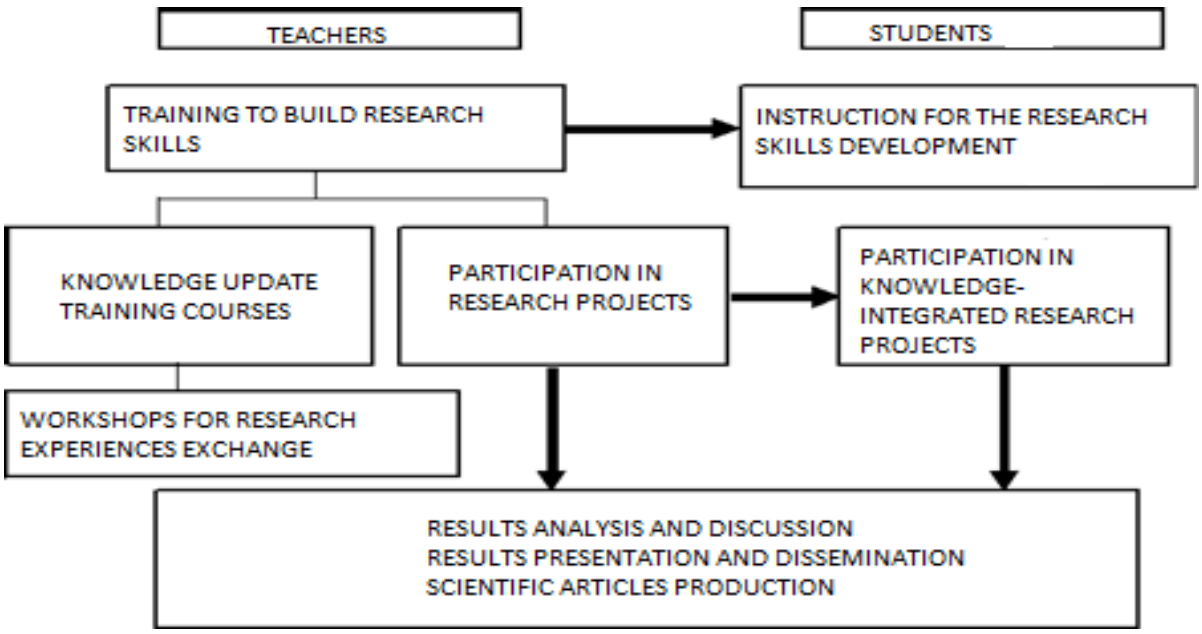

FIGURE 1. *Methodological scheme for the research skills development in students*
Source: Adaptación de Rodríguez, et al. (2018)

Three essential components are integrated in the development of research skills: (a) The preparation of teachers to participate and transmit research skills, (b) The involvement and participation of students, and (c) The analysis, discussion and dissemination of results, as well as may end in the preparation and presentation of scientific articles (Rodríguez, et al., 2018), (Arias-Chávez, et.al.,2020). Therefore, research skills are based on the didactics of the teaching and learning process, with a gradual development for the solution and transformation of theoretical and practical problems, which are carried out by the students taking into account the complexity, periodicity, frequency, flexibility and feedback that the teacher must provide (Rodríguez & Delgado 2014).

Monitoring and Institutional Commitment to Formative Research

Research processes, the teacher is an intermediary between theory and practice that allows him/her to build knowledge, change his/her discourses, methodology and methods, transforming his/her teaching processes, encouraging in the students spaces to develop argumentation, creative and critical thinking (Villalba-Condori, Oliva-Córdova, 2019). Therefore, the classrooms constitute the differentiating element of the teaching-learning process, as a natural component of quality in the training process in higher education and must be intervened through the evaluation of the interactions in the process and with an innovative and renewed didactic proposal (Montoya and Peláez, 2013).

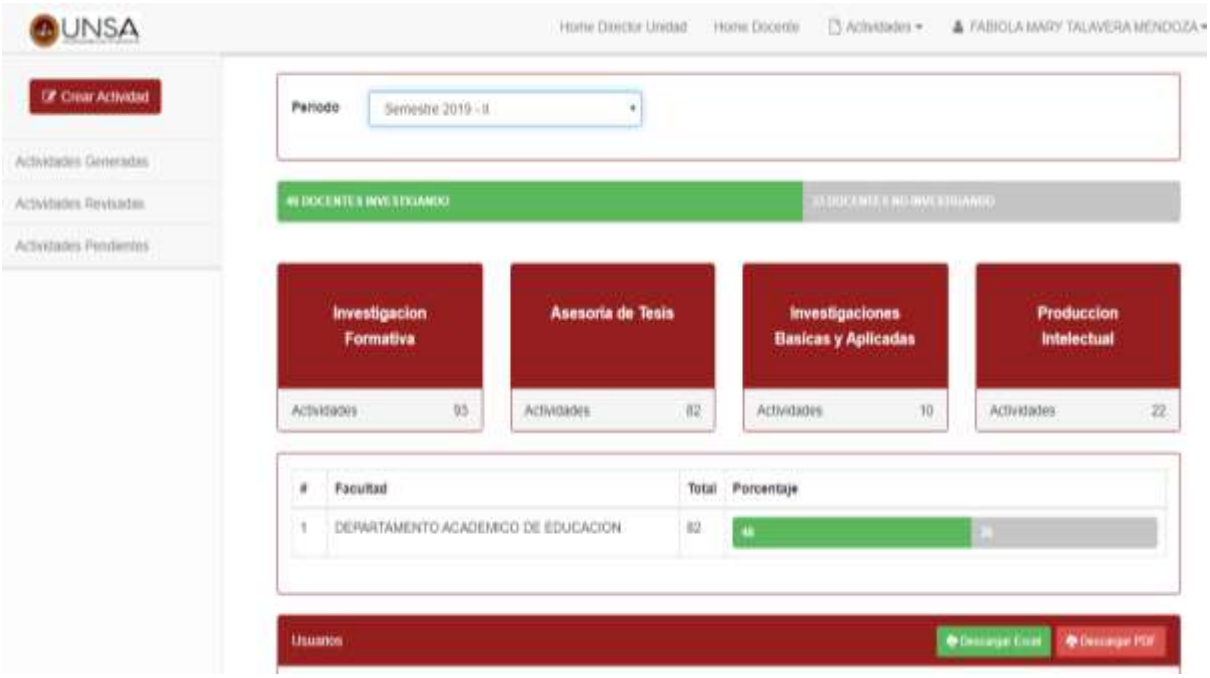

FIG. 2. *Structure of the platform for the control of the teachers activities in research*

Source: Research registration system of the National University of San Agustín from Arequipa.

The research activities of teachers are registered on the basis of four aspects: Formative research, thesis consulting, basic and applied research, and intellectual production. Teachers are obliged to carry out a certain number of hours for these activities as part of their teaching and non-teaching work; in relation to FR, there is a procedure for recording and supervising teaching activity with four phases:

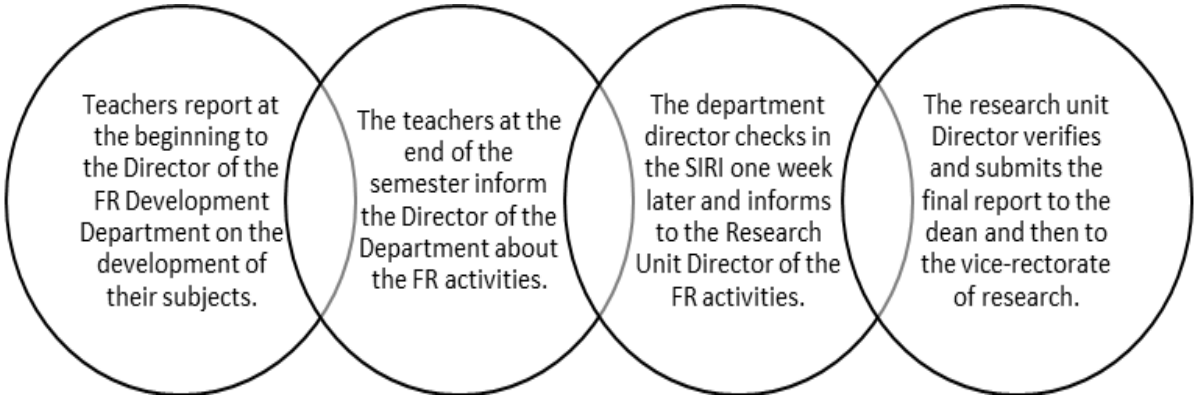

FIG. 3. *Registration and monitoring procedure of the activity under investigation*

Source: Teachers' Research Regulations

For this purpose, the teachers comply with the filling in the platform, pointing out the general and specific data such as: the description of the training activity, the syllabus and the products related to the assumed deliverables, which can be verified by the director of the department and the director of the research unit, the latter is the one who issues the list of the teachers who complied or not with the procedures and products.

FIG. 4. *Procedure for filling the FR product*

Source: FR Research Registration System

III. METHODOLOGY

The study is retrospective, based on the research of the level of responsibility, compliance and delivery of the FR product, as well as the articulation with the development of research skills and the generation of knowledge management established according to the specifications of the university law and research regulations, in the platform of the teachers research register (SIRI).

The approach is quantitative which considers a set of processes in a sequential and probative way, each stage precedes the next, the order is rigorous, the variables are measured, the measurements are analyzed with statistical methods to draw conclusions regarding the hypothesis (Sampieri, 2014).

The study is documentary, the research technique used is content analysis, which is based on reading as an instrument for collecting information, the most used methods are frequency lists, identification and thematic classification (Andréu, 2001) and checklist according to Susana Bianchi quoted by (Hernández-Suarez, 2012), she considers it as "a list of questions, in the form of a questionnaire that serves to verify the degree of compliance with certain rules established a priori for a given purpose" which allows for the objective and systematic quantification of messages or content for statistical analysis (Sampieri, 2018), which made it possible to evaluate the presentation of deliverable products in the Research Registration System (SIRI).

Due to the research nature, the study focused on the collection of the information found in the SIRI, in principle the students' formative research products that are received and evaluated by each of the teachers, in order to systematically and objectively identify the strategies used, according to the formative research guide assumed by the teachers. Once the information was obtained from the SIRI, the researchers proceeded to process, analyze and interpret it. The unit of analysis was determined by the data of inclusion or exclusion of each of the 93 FI works (see Table 1), articulated to the development of the subjects, carried out during the II period 2019 from August 19 to December 20, 2019.

Table 1. *Teacher and Work Register*

SIRI	
Research papers reviewed	93
Teachers	82

Source: Information Management System (SIRI)

Table 2. *Proposal of deliverable products of formative research*

SEMESTER II	**SEMESTER IV**	**SEMESTER VI**	**SEMESTER VIII**	**SEMESTER X**
Heuristic search equation.	Scientific argument.	Interviews elaboration and/or surveys.	Experience report	Report of the final thesis and/or scientific poster.
As an Inquiry (Stenhouse y Redduck, 1998)		As Understanding Quintero (2006)	As a Solution García et al. (2018)	

Source: Own elaboration.

To develop this proposal, three models for FR development were emphasized: (i) As Inquiry because students need to develop skills through a process of research or search of information in data base, which allows to discriminate the sources of information, (ii) the Understanding, is framed what students describe, seeks to understand the educational phenomena and (iii) as a solution, describes the research as a process that seeks to give or propose improvement alternatives to educational problems, this conception was conceived through a study by categories (Borjas et. al., 2016).

Table 3. *Development of Investigative Skills*

Dimension	**Indicators**	**Bibliographic Search**	**Argumentative logic**	**Use of subjective methods**	**Experiences report**	**Final work report**
Research skills characteristics	Develops basic skills, heuristic search for information. (López, 2001)	**X**				
	Develops perception, instrumental, thinking, conceptual construction, methodological construction, social construction of		**X**	**X**		

	knowledge and metacognitive skills (Moreno, 2005)					
	Develops skills to problematize, theorize and check objective reality (Chirino, 2002)				**X**	**X**
Associative methodologies that generate educational material and learning inputs (product) (castro, & arriagada, 2019)	Ways of presenting information using digital resources	**X**	**x**	**x**	**X**	**X**
Procedure for registration and supervision of FR.	Level of compliance with the procedure.	**x**	**x**	**x**	**X**	**X**
Innovative methodologies of complex systematization for results presentation. (castro, & arriagada, 2019)	Linking teachers and students with the axes and lines of research.	**x**	**x**	**x**	**X**	**X**

Source: Adapted from Martínez and Márquez (2014) and Castro and Arriagada (2019).

Around units of analysis in the observation, it was qualified according to its importance and extension (López and Sandoval, 2016), using the type of data as reports of: The products delivered, technological presentation of FI products, level of compliance with procedures according to current regulations and development of the topics in accordance with the lines of research.

IV. RESULTS

The following are the results of the study, which are grouped according to the quantified dimensions of the data type:

DIMENSION 1: Research skills Characteristics

Table 4. *Review and reporting of FR products, according to the characteristics of the investigative skills*

SEMESTER	Strategy	Work carried out	%	CORRECT	%	INCIPIENT	%
II	Bibliographic search, classification and organization of information.	21	23	9	20	12	26
IV	Argumentative Logic (Critical and conceptual analysis of the information in the bibliographic search)	17	18	10	22	7	15
VI	Use of subjective methods (surveys and/or interviews)	22	24	16	35	6	13

VIII	Experience report	18	19	8	17	10	21
X	Report of the final thesis and/or scientific poster.	3	3	3	7	0	0
THERS	Bibliography, Photos and PPT	12	13	0	0	12	25
TOTAL		93	100	46	100	47	100

Source: SIRI product checklist.

Of the 46 FR works, 35% (16) have demonstrated a greater development of skills in the methodological and social construction of knowledge through carrying out surveys and/or interviews. Followed by 22% (10) who have written their state of the question on a research topic according to the parameters of the subject, demonstrating thinking skills for conceptual construction.

DIMENSION 2. Associative methodologies that generate educational material and learning inputs.

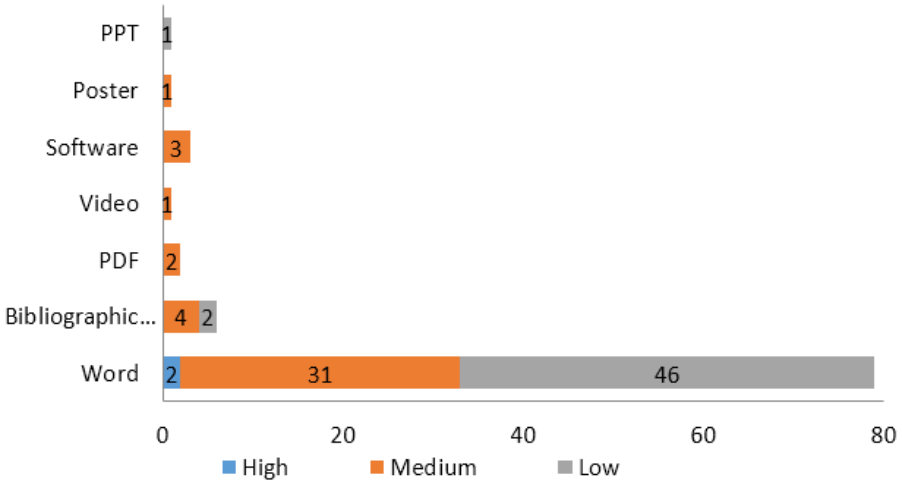

FIG. 5. *Report of the technological presentation of IF products*

Source: SIRI Product Checklist.

The form of presentation of FR products is inclined to reports written in Word, of which a minority use bibliographic managers. Understanding that FR expresses a dynamic relationship between student learning and the renewal of teacher practice, a non-formal structure is evident, leading to an incipient research culture.

DIMENSION 3: Procedures for the registration of the FR.

Table 5. *Registration procedure and supervision for FR*

Registration Procedure	Teachers	%
Correct Procedure	32	39
Incorrect Procedure	14	17
Did not comply	36	44
TOTAL	82	100

Source: Own elaboration

With the changes produced in the university law, the research regulations were gradually approved, establishing the procedures to register the research products, being informed at the beginning of the semester to the academic department and at the end of the semester with the products that have been registered in the SIRI. Before this requirement, 44% (36) of the 82 teachers did not comply with the procedures (understanding that it is not only the FR, but is linked to the consultancies, participation in research projects and intellectual production), such indicator leads to rethink the development of a research culture that should start by proposing updates, courses and workshops to systematize experiences.

DIMENSION 4: Innovative methodologies of complex systematization of results presentation.

TABLE 6. *Development of the topics according to the research lines*

EJES	Results Presentation					
	F	%	YES	%	NO	%
Educational practices and training processes	2	2	0	0	2	3
Technological Innovation and Education	21	23	0	0	21	26
Management, Design and Evaluation	6	6	3	23	3	4
Society and Education	29	31	5	38	24	30
Didactics	35	38	5	38	30	38
TOTAL	93	100	13	100	80	100

Source: Own elaboration

The themes worked on in each of the subjects were framed around the axes developed in the lines of research, the axis of didactics and little implemented being that of educational practices and training processes. Of the 93 papers, only 13 have been socialized in workshops or seminars.

V. DISCUSSION

The highest limitations are found in the works presented in Bibliographic Search, with few skills to locate, select, organize, collect and evaluate information and in other cases teachers uploaded works that are not related to research skills delivering other products without any rigor, unlike the experience, (Gamboa, et al., 2017) achieved that students consume knowledge with the management of technology, techniques to track information in specialized databases and use software for information analysis (Villalba-Condori, Oliva-Córdova, 2019).

Likewise, the final report of the thesis or poster reveals little synchrony between theory and practice, due to the smaller proportion of the products delivered, an indicator of which is the scarce familiarity of the last cycle of pre-professional practices with research training, which denotes little capacity to problematize and provide answers, however, (Cortez, et al., 2019) showed the importance of connecting academic knowledge with everyday knowledge, achieving the creation of communities and knowledge among students (Oliva Córdova, Amado-Salvatierra & Villalba Condori, 2019).

On the other hand, the themes developed in the various subjects allowed the consolidation of the research lines, but the conceptual and methodological processes they employ are fragile, with little accompaniment and evaluation of the skills to foster the research culture in the student that allows him/her to search, process, argue, reflect and systematize his/her learning experiences in research, denoting works with little scientific literature and weak processes of research skills. On the contrary, in the works of Morillo, et al. (2015) and García et al. (2018), FR achieved processes of inquiry, to problematize, substantiate and obtain results. Likewise (Velandia, 2017) emphasized the strategy of research focuses that are the first spaces of discussion, reflection and construction of knowledge in a collective way to be socialized in seminars, workshops, forums, conferences, among others; to generate collaborative work (Oliva Córdova, et. al, 2019).

Almost all teachers only record one work as a result of the development of their subject, which made it difficult to carry out a deeper analysis of the methodological essence of the strategy worked. Unlike Hurtado et al. (2014), he used project learning as a method, using digital portfolios as a product of FR, developing superior thinking skills and communicative products. One of the values generated from the FR is the capacity of interaction between the teacher, disciplinary knowledge and experimental background of the students (Velandia, 2017).

The FR products socialization is minimal, since on the one hand they do not have adequate processes for heuristic search and reliability of information and most results are delivered in office Word processing, and on the other hand there is a lack in the communication field the student experience does not revolve around deliverables to be published in magazines, podcasts, blogs and websites. Therefore, it is necessary that they contain validity and rigor (Cortez, et al., 2019; Gamboa, et al., 2017), demonstrating that FR is a social process, which starts from the collective construction of knowledge (Velandia, 2017).

Likewise, the levels of responsibility are worrying in the fulfillment of the procedures of registration and FR delivery, which represents 44% of the population, which opens the possibilities for future studies to analyze the causes of noncompliance and the conceptions that can be attributed to the development of the same.

The characterization exposed allows us to understand the phenomena and difficulties in the level of responsibility and direction of the research skills developed by the teachers in pre grade, due to the scarce accompaniment, evaluation and feedback from them, besides the fact that the importance of the formal processes implemented in the university and faculty has not been internalized, as well as the

contribution that the teaching should make to the construction of theoretical and practical knowledge. This implies the binomial of practice and reflection, which generate commitments, to know and analyze the reality in which one lives guiding the learning processes (Gil and Gonzalez, 2019).

The importance of accompanying FR processes with virtualization is highlighted, since they allow efficiency, autonomy and flexibility, for the revision of the proposed contents and products that lead to their reasoning, discussion and construction of knowledge in a collective manner (Velandia, 2017). Thus, it was detected that the procedures, methods and techniques used do not have the scientific rigor and that the development of heuristic strategies should be strengthened as well as the understanding and solution of problems, which contribute to their transformation and innovation. In this way, practices are redirected towards achieving greater autonomy and flexibility in formative research (Tobón, López and Londoño, 2019).

The FR results must be valid and reliable, in such way that it allows the development of an investigative culture with a preponderant role of the teacher of the subject that carries out an accompaniment and evaluation of the investigative abilities developed in the students through microcurricular projects and/or integrators, where the teachers of the semester can cooperate for the obtaining of a single product using diverse strategies, besides dominating varied technological tools that allow to process and to systematize the information to be able to guide the products of formative investigation and the atomization of several FR products by subject is avoided.

In order to achieve an integral and investigative formation in undergraduate, it is necessary to adopt adequate strategies to consolidate an investigative culture, which contributes to the strengthening of basic and specialized abilities for research, the promotion of attitudes, based on the learning-by-doing method, until reaching a real commitment on the part of the educational institutions in the formation of integral human beings and promoters of knowledge (De Becerra, 2012).

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