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Promotion of a university research culture through Project-Based Learning (PBL) methodology in ELT(English Language Teaching)

Fomento de una cultura investigativa universitaria mediante la metodología de aprendizaje basado en proyectos (ABP) en la ELI (Enseñanza de la Lengua Inglesa)

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Abstract

Introduction: The furtherance of a university research culture is essential to promote processes of innovation and improvement in academic praxis. **Objective**: Therefore, this research aimed to promote formative research skills in a group of fifty-one students at a UPTC campus, through the project-based learning (PBL) methodology in an English language teaching (ELT) course. **Methodology**: Given the qualitative nature of this analysis, we selected a case study method. We used surveys, focus group interviews, and teacher journals as instruments to collect data. Likewise, we utilized grounded theory to analyze and conceptualize the information collected. **Results**: The PBL methodology significantly supported and improved the research skills of the students. Through the different activities, they also increased their interest and awareness of the need for research in their undergraduate programs. In addition, the students furthered their English speaking and writing skills, as the reports and presentations were conducted in this language. **Conclusions**: The promotion of a research culture, from the ELT, not only generates knowledge for development, internationalization, and professional qualification but also highlights the importance and role of higher education in society.

Key words: Project-Based Learning, personal qualification, higher education, ELT, formative research.

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Resumen

Introducción: El fomento de una cultura investigativa universitaria es fundamental para impulsar procesos de innovación y mejora en la praxis académica. **Objetivo**: Por consiguiente, esta investigación pretendió promover habilidades de investigación formativa en un grupo de cincuenta y un estudiantes en una sede de la UPTC, mediante la metodología de aprendizaje basado en proyectos (ABP) en un curso de enseñanza de la lengua inglesa (ELI). **Metodología:** Dada la naturaleza cualitativa de este análisis, seleccionamos un método de estudio de caso. Usamos encuestas, entrevistas de grupos focales, y diarios de profesores como instrumentos para recopilar datos. Asimismo, utilizamos la teoría fundamentada para analizar y conceptualizar la información. **Resultados:** La metodología ABP significativamente apoyó y mejoró las habilidades de investigación de los estudiantes. Mediante la aplicación de diferentes actividades, éstos aumentaron su interés y conciencia sobre la necesidad de investigar en sus carreras. Además, ellos también fomentaron sus habilidades de habla y escritura en inglés, ya que los informes y presentaciones se realizaron en este idioma. **Conclusiones**: La promoción de una cultura investigativa, desde la ELI, no solo genera conocimientos al desarrollo, internacionalización y cualificación profesional, sino que también resalta la importancia y el rol de la educación superior en la sociedad.

Palabras clave: Aprendizaje basado en proyectos, cualificación profesional, educación superior, ELI, investigación formativa.

Introducción

The promotion of formative research in higher education is essential to promote processes of innovation and improvement in academic praxis in a globalized world that requires professionals with abilities to respond to different local, national, or global issues through research. Due to the needs and interests of current society, bilingualism and research constitute two imperative pillars for higher education institutions.

Research practice, considered a way to produce knowledge, is one of universities' development, innovation, and quality indicators. It is within higher education that research is recognized as formative or scientific. Thus, it is paramount to form, as a constant and consistent activity, new researchers with abilities to maintain the connection between the academy and society and extend the systems of knowledge production (Rojas, 2010). Nonetheless, doing research in some institutions becomes a complex task considering the capacity that universities have in terms of running focused on the levels of productivity, impacts, products, and processes. Nowadays, one of the main problems that Colombian higher education institutions face is the budget deficit to invest in research projects. Even so, public and private universities continue to develop investigation, and research hotbeds have increased especially in topics related to formative research and the formation of researchers (Hernández et al., 2020).

Universities seek the construction of knowledge, universal knowledge, basic and applied, based on the demands of the social environment in which they are supported from the historical, but also the functional sense of the university itself. The interaction and relation between academy and research become significant when it has a social projection and

society grants a cultural value to education, to science, and to the institutions dedicated to the training of new generations of students-researchers (Rojas, 2010).

Most higher education institutions in Colombia adopted English as a language of instruction to achieve different objectives such as the internationalization of students and teachers and the improvement of english language level of students. That is why nowadays it is common to find syllabuses taught in this language or intensive courses so those students can develop more abilities and thus, be more competitive. Nevertheless, as Kremer & Valcke (2014) state,

> *"Although the shift to teaching in English has often been welcomed by teachers and students, the research community is only beginning to understand the dynamics of these changes within the learning environment. One of the reasons for this is that there is very little research available into the effects on disciplinary learning in higher education when the language used to teach a course is changed in this way"* (p. 1430).

Understanding the dynamics of promoting formative research from the teaching of English is crucial within this study since implicitly, students are learning vocabulary and are making an effort to elaborate their presentations in the mentioned foreign language. One of the main issues of this study was that teaching in a foreign language (English in this case) is more demanding and requires more effort on the students' and teachers' part. Nonetheless, the main objective of this study was not to improve English language skills in students explicitly but to understand that the ELT classroom is a space where the language is not only learned and taught as a system but also, as a means to communicate and produce knowledge through research.

This study took place in one of Universidad Pedagógica y Tecnológica de Colombia campus, a public university of Colombia. The entity in charge of offering foreign language courses in this institution is an institute assigned to the academic vice chancellor of the university. English language teaching at this university aims to improve students' language skills and foster their professional learning processes with activities that enhance the use of language for social and academic purposes. Nevertheless, the opportunities to use the language both written and spoken in academic scenarios are few, since the syllabuses of the four levels that were offered until the year 2018 were mainly focused on grammar and language use. From that year, the institute started offering two additional levels of foreign language. Therefore, the English language professors of the institute where this research took place decided to improve not only students' English language knowledge but also their research skills considering two aspects, first, the teachers created a research group in the year 2019, and second, this headquarter is recognized for its great contribution to the university and society in terms of research. Consequently, in complete agreement, the coordinator and the eight English language teachers that belong to this institute as well as the coordinator of the research group decided to create a proposal with new syllabuses for each of the 6 levels as follows: level 1 and 2 were focused on grammar and language use. Levels 3 and 4 were focused on critical thinking and levels 5 and 6 were focused on research. The curricular committee and the dean of the faculty approved the proposal. The main goal of this plan was to promote research skills in students so that they could be engaged in a research culture, instructed in a foreign language, an aspect that is not common in

universities where English is taken as a complementary subject because several syllabuses are grammar and language-based.

Thus, during the second semester of 2019, students of the three groups of level 5 and one of level 6 answered a survey about their experience and understandi ng of research, so that the two teachers -researchers of this study- in charge of these five groups could have a general idea of what students knew about investigation. Nevertheless, students seemed to have little knowledge and information about how to do research. In that sense, we decided to implement project-based learning (PBL) as a methodology to teach how to do research, in this case, by projects. Accordingly, based on the lack of research training that these students had, one of the main objectives of this study was to promote formative research skills through PBL methodology. Likewise, we intended to make students aware of the importance of investigation within their academic and professional qualifications. Thus, the initial question that led to developing this research study was *What does PBL methodology reveal about the promotion of formative research in a group of students of higher education*? It is worth mentioning that we carried out this study virtually, due to the COVID-19 pandemic. Nonetheless, the remote methodology is not an essential part of the study.

One of the common answers found in the survey was the difficulty when they must think about ideas to do research. The methodology implemented allows teachers to guide students and get them involved in the different phases of research such as creating the question, describing the real problem, designing the problem- solving and other investigative activities, besides letting them work autonomously and gain knowledge from what they do. (Blumenfeld & Krajcik, 2006; Guo et al. 2020). Through PBL, students are engaged in more significant, and achievable ideas for research projects. With the help of researchers, students are more oriented and conscious about the process of how to start doing research, identifying a topic of interest and a problem first. Thus, they have the opportunity to learn about specific tasks carried out in research in a process in which both the teacher and students play an important role (Landazabal et al. 2010).

Likewise, PBL is a form of situated learning in which students can gain a deeper understanding of the material or any topic when they actively construct their understanding by working with and using ideas. This model "allows students to investigate questions, propose hypotheses and explanations, discuss their ideas, challenge the ideas of others, and try out new ideas. Research has demonstrated that students in project-based learning classrooms get higher scores than students in traditional classrooms"; William & Linn, 2003, as cited in Blumenfeld and Krajcik, 2006, p.1).

PBL aims to develop projects systematically, in which the different steps are given by specific tasks in order to foster ownership, critical thinking, creativity, and collaboration, among others (Blumenfeld & Krajcik, 2006; Guo et al. 2020); Lestari et al. 2018; Shin, 2018). Projects emerged from PBL attempt to minimize the traditional way to do research, that is to say, most students argue that when it comes to doing a research project, they do not have enough training or tools to do it. This may happen due to the lack of knowledge some teachers and students have about how to carry out projects that can be also meaningful in the learning process for students.

Given the qualitative nature of our research, we opted for a case study method. Before, during, and after the study, we used some surveys and focus group interviews with students, as well as teacher journals as instruments to collect data. We used grounded theory to analyze and conceptualize the information collected. The results revealed that the PBL methodology significantly supported and improved students' research skills. In addition, we evidenced through the different activities and excerpts that the students increased their interest and awareness about the need to investigate within their undergraduate programs. The formation of a research culture, from teaching of the English language (ELT), is crucial since is not only generating and contributing knowledge to development, internationalization, and professional qualification but also highlights the importance and role of higher education in society and its connection to the world.

A review of some of the studies completed in this field allows us to conclude certain deductions in the face of the need to form students more committed to doing research in higher education, research more focused on its context and its capacity agent to solve problems and propose alternatives from their undergraduate programs. Benjumea and Sanchez (2011) concluded that besides teachers recognizing the importance of scientific knowledge in the solution of social problems, sometimes, the educational system and the teachers' duties at universities do not allow teachers to promote or foster formative research. From a personal perspective, we evidenced that we faced situations in which it was not only the lack of knowledge about research but also the little knowledge of the English language students had. In that sense, we focused some classes on formative research and some others on the English language teaching, so that the process could be more meaningful and the language was not a barrier.

Valencia et al. (2015) state that research is crucial and plays an important role in the formation process of students in higher education institutions. They found out that formative research stimulates students' skills enhancing the quality, structure, and results of the research projects that their students carried out within their professional training. In this study, we obtained similar results, in which students recognized the advance and knowledge they had obtained during the process. Likewise, the implementation of this methodology exposed challenges and needs in the academic curriculum in order to strengthen the link between the undergraduate program and academic research in the field of professional practice.

Another study, carried out by Velandia et al. (2017), concluded that U-learning environments reinforce and consolidate formative research as an ongoing practice for undertaking educational research through personalization, adaptation, and situational learning, marking significant differences with respect to E-learning locations during the systematization stage. Indeed, research should become a constant practice considering aspects such as needs, interests, and problematics according to the context of the researcher, it is to say, research becomes more meaningful when the researcher is engaged in the social, local, or national issues that they intend to inquire about. The undergraduate programs of the headquarter this study took place mainly focus on three fields: technology, administration, and earth sciences. In view of this, the first aspect that participants and we considered was to think about a local problem related to any of those fields, bearing in mind their programs.

Hernández et al. (2020) identified a difference between the high interest in research and the low level of knowledge about its practice, in the data obtained from a 22-item Likert-type questionnaire with scores based on a 5-point scale applied to a sample of 193 selected students in a private university in Lima. It allows us to make a contrast with the study we carried out since, at the beginning of the process, we found out that most of the students who participated in the research were interested in learning about how to do research. Nevertheless, they recognized that the little knowledge and experience they had made them feel that they needed a course with the main fundamentals of investigation. Likewise, they accepted that based on what they learned in the subjects in which they developed a research project, they perceived some variances between learning and doing research in human sciences –English, in this case- and doing research in engineering, for instance. Those differences lie in the citation style, procedures, methods, and instruments, among others.

For Hernández et al. (2020), *academic investigation is an important part of education, development, and improvement, whose results are observed in the socioeconomic progress of a country. This has been evidenced in the investment of resources that developing countries make in order to carry out this activity and increase their knowledge production. Nonetheless, they argue that this panorama is not the same in Latin America. Although governments and institutions recognize the importance and need for research, it seems that resources are not enough to cover all that this process implies. In that sense, several researchers in universities try to look for different strategies to promote and enhance students' research skills during undergraduate and postgraduate studies. The authors of this study made a diagnosis of the research awareness of the entrants to a private university in Lima, in order to implement a future formative research program. In the same we did, the authors identified a difference between the high interest in research and the low level of knowledge about its practice. There is a considerable interest in learning how to do research, which is one of the main reasons to promote formative research in any area of knowledge, creating a path between subjects and programs.*

Lastly, in a research study carried out by Turpo et al. (2020) at one university in Peru, the authors found insights into the understanding and transcendence of formative research in order to determine the meanings assigned to its pedagogical implementation in teacher training. According to the study, findings revealed that teachers express diverse educational perspectives regarding formative research, related more closely to the training of researchers than to teaching. Likewise, they subtly distinguish formative research from scientific research in a strict sense, which leads to confusion between them. One of the main difficulties that we found in our study was the way research is carried out in science and the way it is developed in human sciences. Even so, we tried to find common patterns to do research, despite the area of study.

The previous contributions guided and supported this research since they gave insights about what formative research has been, developed, and applied in research studies and universities. The different findings show positive results toward students' attitudes and motivation to learn. Furthermore, some reflections arise on the importance of including a component of formative research in all institutions, particularly in higher education, in order

to improve professional qualification and develop a research culture prepared to face and solve current problems.

The importance of this research lies in the fact of considering the English language teaching classroom as a space for learning about formative research and not as that traditional encounter to learn the language as a structural system. It is necessary to transcend the traditional limits of teaching English and learning about formative research to build new needs and new theoretical-practical approaches. It should be noted that this is the first time that a syllabus focused on the teaching and learning of formative research has been designed within the topics to be addressed in the subject of English within this educational institution, topics generally focused on improving linguistic aspects (grammar, phonetics, vocabulary, among others). We are confident that the contributions obtained from this study will provide insights both for future research in which English is seen as a means for communication and knowledge production and for syllabus reform that allows the integration of the language with other areas of knowledge, thus promoting interdisciplinarity between sciences, disciplines, and subjects. This type of research allows students to promote their creativity, autonomy, criticality, and collaborative learning and to expand their interdisciplinary knowledge; ensuring thereby the formation of professionals with communication and research skills that respond to the current needs (Asis et al., 2022). In this order of ideas, despite the good results obtained through this study, we consider that university professors should also be highly involved in research training and courses that allow them to be updated to the new ways of research as well as establish connections between their professions and research skills, this is to say, the relation between the knowledge provided and constructed by teachers, and students along with knowledge supported by research is crucial for scientific knowledge production.

Methodology

Method

This research is framed within a qualitative case study method. This method is highly descriptive because it is grounded in deep and diverse sources of information. It uses quotes of participants from interviews, and other literary techniques to create interpretations and representations of the phenomenon being studied (Harrison et al., 2017; Hancock & Algozzine, 2006, Rebolj, 2013). Based on this method, we implemented entry and exit surveys (including closed-ended and opened-ended questions) and focus-group interviews to gather data from the 55 students who participated in the study. Yin (2016) notes that the instruments that collect the data are oriented at taking and describing the phenomena under study as well as its context and individuals involved. This implies that the instruments serve to explore and understand the meaning that individuals give to social and human issues (Creswell, 2009).

The analysis carried out through this research made use of fragments written and said by the participants, which allowed identifying common patterns of thought at the beginning, during, and at the end of the study. The different activities, class sessions, participations, doubts, and topics covered for the promotion of formative research accounted for the development and evaluation of the process carried out with a group of students.

Participants and contexts

We developed this research with fifty-one students who were taking English language courses, levels 5 and 6, with an intermediate level, in one of the four branches of Universidad Pedagógica y Tecnológica de Colombia, a public university located in the department of Boyacá, Colombia. Students take the English language in this institution as a requirement to graduate. This subject does not have any credits within the curriculum nor belongs to any specific program. Since 2018, the institute in charge of offering English language courses implemented two more levels for a total of six that students can course at any moment of their undergraduate status in any of the four headquarters that the university has. Most levels are grammar and language-based. Nevertheless, the English language teachers of each institute have the faculty to modify the syllabus of instruction at each one of the levels, according to the National Standards of Education.

Thirty-two females and nineteen males participated in this study. Most of them were in the seventh semester. There were three groups of level five and one group of level six. We were in charge of teaching these four groups, two groups each. We sent a document describing all the parameters established for this research in order to know their opinion and acceptance to be part of this project.

This population argued that despite the fact of having little research experience, they were interested in learning and developing research skills in the foreign language, regardless of their English language level. Likewise, they stated that research is certainly a fundamental pillar in their professional training qualification.

We, the researchers, worked as English language teachers at this university when we developed the project. We hold postgraduate studies in the area of study and have experience doing research, writing research articles, and using different teaching methodologies in rural, urban, public and private schools and universities.

Data collection instruments

Focus-group interview: we applied this instrument during and at the end of the process in order to interact with participants and know the opinions and attitudes of a determined public about the process of developing formative research through PBL (Yin, 2016). We made two meetings through Google meet, one after six weeks of the process, and the other encounter seven weeks after the first interview. We selected two students per group at random to participate in the first interview, and then we chose other eight students to participate in the second interview to contrast answers. The semi-structured interviews had a minimum of 8 open- closed questions each related to their perceptions before, during, and at the end of the research process, the need for research within their professional qualification, attitudes towards how the university has carried out this research, and opinions about doing research in English. The software that we used for coding and analyzing transcripts from interviews was Atlas ti, a tool which helped us to recognize and organize the general or common patterns of what participants answered. Once the general patterns were recognized, we used grounded theory to analyze and compare the information collected with the other instruments.

Survey: This instrument was used to collect "information from a sample of individuals through their responses to questions" (p. 160), using different strategies such as questionnaires, and open-ended questions, among others (Check & Schutt, 2012). We applied three surveys to all participants. One, at the beginning of the process, in order to know their perceptions towards the research study, their experience and knowledge about research, and their interests in research topics. We applied the second interview during the process to identify opinions about the development of the process and the new knowledge they acquired. We used the last survey at the end of the process to evaluate the impact of the study and analyze to what extent students' perceptions towards doing research had changed. Each one of the surveys contained 10 open-closed questions. We designed the three surveys, considering the research method, and we sent these through google surveys. 134 surveys were collected at the end. 49 before starting the study, 45 at the seventh week, and 40 at the end of the process, week fourteen.

Teachers' journals: we used journals to register the different ideas, questions, comments, thoughts, reflections, and opinions that we observed in the researched population while the development of the research projects (Rose, 2019). In each session of these classes, during the fourteen weeks that the study was active, we wrote quotes and paramount information not only about how the process was developed or students' opinions but also about their own perceptions, to be analyzed at the end of the research study. In the end, we gathered twenty-two journals, eleven each. At the end of each week, we used to join to discuss the next steps and failures and wise decisions found in every encounter.

Procedure

During the first semester of 2020, the new syllabus implemented at levels 5 and 6 aimed to promote and improve fundamental research skills in students. During the fourteen weeks, this study lasted, each one of us met twice a week with each group via *Google meet*. In each session of class, we planned to teach different steps of what research is and how to attempt it. To guide this process better, the participants had the opportunity to choose one of the sustainable development goals (SDGs) created by the United Nations in the year 2015. According to their preferences, interests, and program approach, they formed their own group research. We considered these goals in order to help students identify a problem at the local level and be able to give a possible or ideal solution. The expected result was either to create a web poster or a video, to open the space to give a talk in the location the study took place, or create a blog or content for social media to make people aware of the problem they researched about. After the participants formed their groups, we designed a format so that students could register the information required, once we had explained the topic in class. With this orientation, we expected that students could acquire more knowledge and information about how to do research considering PBL methodology.

We designed the research study to go step by step according to the common parameters established to do research, it is to say, we explained each one of the foundations of PBL as well as each one of the steps to do research. The first four weeks of class were mainly theoretical, analyzing some real samples. We explained each one of the steps involved

when doing research. Aspects such as how to identify a problem, what a research question should contain, how objectives should be coherent and related to the question, types of research, and what a theoretical and methodological framework consists of were considered in the different sessions of class. As we explained each step, students provided us with their ideas about how they would approach their projects. Subsequently, the practice commenced and the students began to create their research projects. As we oriented each session of class, we were taking note of what occurred in each of the meetings to later analyze and compare them with the other instruments used. As the purpose of each group was to advance at the same level, we created a plan and a chronogram in order to guarantee the same dynamic. Still, we were conscious that we were going to find some difficulties during the process. To face that situation, we designed make-up days to cover doubts and questions and analyze the sequence of the process.

When we concluded the theoretical process, approximately in the eighth week, the students initiated implementing their drafts-projects. These were micro-projects since there were certain limitations such as time and the COVID-19 pandemic. The main objective for students was to learn to do research projects and thus be able to achieve the objective set in this study. Likewise, it was significant for them to build new knowledge from what they found in each of their studies. Constant feedback on drafts was fundamental during this process. Students received feedback in each one of the steps, in order to promote and facilitate access to knowledge, developing skills, habits, and attitudes in order to find answers and solutions to the situations of the context in which the professional or student in training is located (Landazabal et al., 2010).

Data analysis

The analysis of the data collected is based on a grounded theory. This method of analysis intends to find new concepts, constructs, categories, and relationships established among them. Núñez et al. (2013) note that in this method the analysis and theory are totally connected and the theory is derived from the real-world data itself. Furthermore, Núñez and Téllez (2012) also highlight *"the effectiveness of this approach used for the qualitative research, because it involves the constant comparison of the data in order to group and classify them for the construction of a theory"* (p. 63).

Urquhart (2013) describes three principles of grounded theory to analyze data. The first phase of the methodology accounts for the first step, Open Coding. In this phase, we underlined all relevant and iterative information gathered in the first interview, the first survey, and the first journals. Then, we classified the information into charts in which we recorded and interpreted the frequency of the answers. In this step, we found a number of general codes as common patterns.

In the next step, as more data was collected, we started to compare the most recent data with the first codes, in order to find more details and connections between codes; this process is called central or axial Coding. We grouped those common patterns into concepts that we named and classified into two categories, according to their meaning and iteration. Then, we established a number of subcategories for each one of the codes (main categories) that emerged.

Once we gathered, analyzed, and compared the last data with the open and axial codes, we commenced the last phase called **theoretical or selective coding. We considered the theory that strongly supported the different categories and subcategories, proposed and named by us. *"Theoretical coding is when we relate the codes to each other and look at the nature of the relationships between those codes"* (Urquhart, 2013, p. 26). Figure 1 shows the schema of the process.

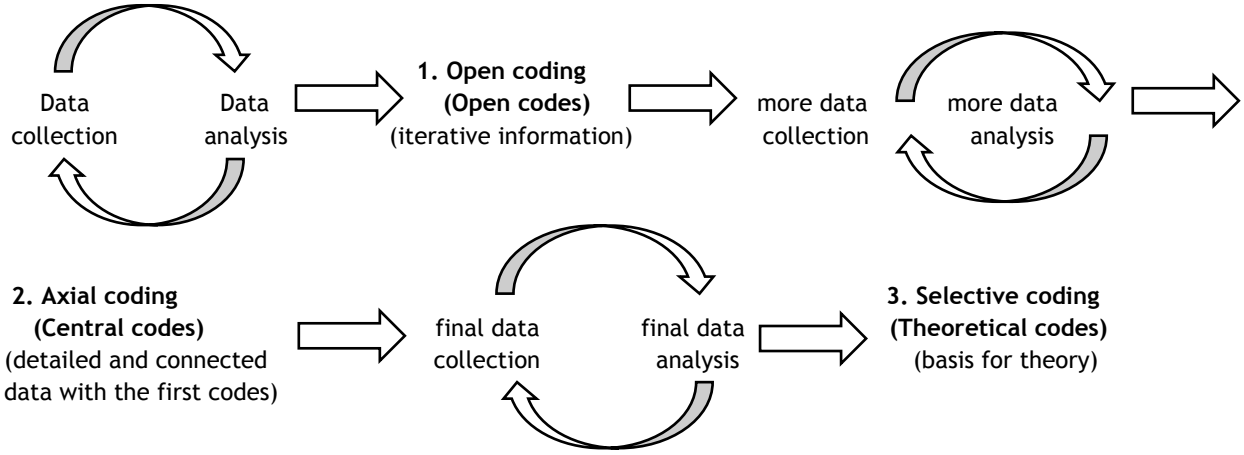

Figure 1. Schema of the process to establish categories

During the analysis of the data, we used a number of codifications to identify the pieces of information from each data collection instrument. Table 1 illustrates the codifications adopted in this research to better understand the source of the excerpts presented in the findings.

Table 1. Codifications of instruments

Codification	Meaning
FG	Focus-group
S1, S2, S3	Survey 1
TJ- 2	Teacher journal
Celeste, Systemic, Franz…	Pseudonym of students

Findings and Discussion

The results of this research present positive insights that we discuss throughout each one of the categories and subcategories that emerged from the data analysis. Likewise, these coincide with some of the findings mentioned in the studies presented in the introduction.

In the study, the students expressed their perceptions, thoughts, and points of view regarding the research process. Their answers as well as our perceptions and interpretations remark and support the importance of good training to promote and foster research and professional skills in higher education.

Table 2 shows the categories and subcategories that emerged after the process of data analysis.

Table 2. Emerging categories and subcategories

Research question	What does PBL methodology reveal about the promotion of formative research in a group of students of higher education?	
Categories	**1. Learning how to do research through PBL**	**2. Building the path between academy and research**
Subcategories	1.1 Learning in-depth: I research, I solve, I do	2.1 Research culture awareness
	1.2 Solving problems actively	2.2 Professional training qualification

1. Learning how to do research through PBL

The methodology implemented was new and diverse in the process of doing research for most students. What makes it different from other research methods is the fact that the main activities must involve the transformation and construction of knowledge on the part of learners, that is to say, students become the main characters in the generation of new knowledge, rather than repeating theories or other existing knowledge.

> *"Personally, this was a new way to do research. You (the teacher) oriented the process, explaining each one of the steps, and then we were responsible of our own project. I didn't feel very lost like some other times that I used to do research"* (FG, Celeste).

A number of teachers focus their teaching lessons on helping students do research. These teachers also guide or direct their students' research projects. These actions help students prepare for problems when they find unfamiliar issues in research due to the lack of knowledge and training they have. Formative research principles include planning how and what to teach, designing and implementing activities, observing them, reflecting on their efficacy, and then analyzing to what extent that research formation was meaningful for students. Research at this university is taught and directed by teachers with different backgrounds. Some of them have been doing research for years. Some others are recently encouraged by this formation. The different research tasks are carried out by both teachers and students. Nonetheless, in most cases, many educators consider research skills to be foreign to the practice of their profession as a result of the low research training of teachers. (Burgo et al., 2019). In that sense, we found that on the one hand, one of the main issues of this study was that teaching in a foreign language (English in this case) is more demanding and requires more effort on the students' and teachers' part. On the other hand, the constant revision of theory about formative research was necessary to gain some more information about how to carry out certain research topics, since the way that research is developed by the different undergraduate programs differs.

In the previous excerpt, besides the recognition of the PBL methodology for doing research, it is also possible to analyze a common feeling among students when doing research; that is, "to feel lost". In a survey we applied at the beginning of the research process, more than 75% of students answered that two of the biggest obstacles they find

when doing research are the number of requirements and the requested steps to do research. These seem to be two of the strongest reasons why students are hardly engaged or interested in research.

Figure 2 shows the results of one of the questions applied in the survey previously mentioned.

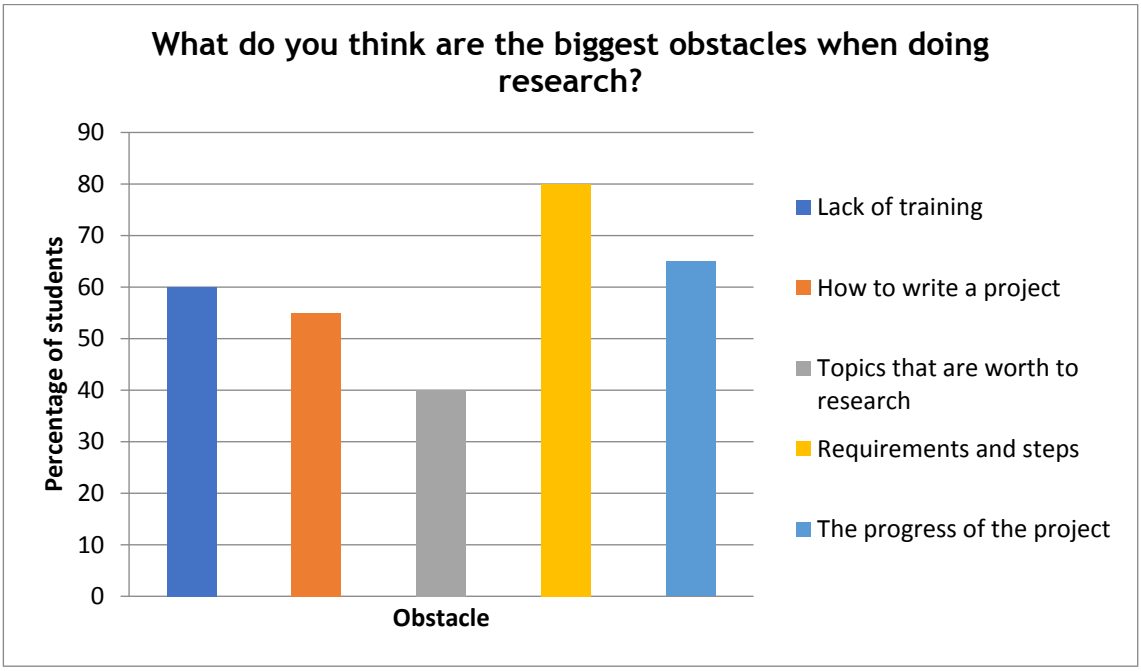

Figure 2. Obstacles when doing research

> *"I have had bad experiences doing research, because I have seen that everything is always wrong or incorrect and sometimes each teacher has a different vision and definition of what research is, how to do it and the quantity of requirements and steps to do it. The way we do research in engineering is quite different than the research I did this semester. Although there are some similar things, this time was a bit different; we went step by step in a methodology that I didn't know…"* (S3, Franz).

Clearly, the way in which research is done in the different engineering programs, as it is done in the human or accounting sciences, is often noticeable. Nonetheless, through this project, the aim was to promote formative research through PBL, which can be applied to any field of knowledge. This fragment allowed us to identify one of the major concerns of students during the research process: the definition of certain concepts such as method, type of research, approach, and paradigm, among others. The PBL methodology guides the process of why a research is completed for, what the bases are to start an investigation and thus, allows students to learn based on projects. This model aims to organize learning around projects and assist teachers to guide students and get them involved in the different steps of research such as creating the question, describing the real problem, designing the problem- solving and other investigative activities, besides letting them work autonomously and gain knowledge from what they do.

"I had already done research, but never with PBL. I realized that research under PBL is not to look for information and theory and that's it. We improved communication skills and the most important thing, the teacher allowed us to research about what we were interested in" (S3, Systemic).

In the previous excerpt, on the one hand, the student recognizes not only the effectiveness of the PBL methodology. According to Vaca et al. (2017), students will develop personal investment and interest in the material or topic if they get involved in real, meaningful tasks and problems that somehow are similar to what experts and professionals do in real-world situations. This kind of methodology allows students to learn by doing and applying ideas. Students engage in real-world activities, make decisions and negotiate to complete the project.

On the other hand, the student highlights other skills developed such as critical thinking and communication skills. Students went through different steps and actions for the development of their project. They started from the basic step of remembering what they learned either in school or university, passing through skills such as understanding the context, problem, and/or population being studied, applying different methods and instruments, analyzing results, evaluating hypotheses and findings, to the creation of possible solutions to these problems. Although the pandemic situation did not allow personal teamwork, it did allow the development of communication skills through technological means. Additionally, the students had the opportunity to use a foreign language as a means of communication for the presentation of their projects.

1.1 Learning in-depth: I research, I solve, I do.

In this subcategory, we observed how the student is the main character of his/her own learning and research. The fragments that we took as an example in this subcategory showed the interest that the PBL methodology has aroused in them. Unlike other research projects, on this occasion, and with the guidance of the research professors, the students learned beyond the theory of how to do research.

The practice allowed them to carry out an autonomous exercise of both learning and research. Formative research considers the learning process as a knowledge-building process which according to Naseem and Fleming (2018) "Students get access to up-to-date knowledge which fosters students' intellectual development and provides them an opportunity to get an insight into the research process (e.g. planning, data collection methods, analysis, and ethics)" (p. 228). In accordance with this, it is possible to conclude that formative research is a pedagogical strategy that focuses on two perspectives: first, the possibility of guiding students' learning processes to develop pedagogical and research skills, under a new perspective of building knowledge from their own reality. Second, the possibility for teachers to reflect on their practice and implement new strategies that help their students understand the role of research in the solution of social and political issues that occur in society.

The following excerpt illustrates what happened in some sessions.

"Class after class, students have several questions. They ask about how to write research objectives, what kind of questions is admitted in research, what is the difference

between theoretical and conceptual framework…It seems they are really interested in learning how to do research…It calls my attention to this frequent question "Can I research about this? Have we made research a really hard and/ or impossible process? (TJ, July).

The methodology implemented greatly motivated the students' interest in learning about research. Nonetheless, it is imperative to note that while a number of students had seen or taken research classes, many had several gaps in how to conduct research. In this case, we analyzed that it is not the act of writing an objective or a question, but rather writing research objectives and research questions. Perhaps, this was one of the major problems, understanding that not all the questions or objectives that apprentices formulate are part of the research process.

The processes in the formative research aim to engage students with the scientific and research culture. It can be accomplished when the different processes, methodologies, and techniques used in the training process are recognized and applied in different contexts (Tejada et al., 2008). The concept of formative research is understood as an integral and pedagogical strategy in professional training through which university students can acquire enquiry competences through learning by doing. In that sense, this strategy fosters their awareness about the importance of research in their professional qualification (Esteban et al., 2021).

The constant question at the beginning of the formative research process was "*Can I research about this*? As evidenced by the data collection instruments, the question arises whether the investigation has been a difficult or almost impossible process to carry out. One of the biggest problems when doing research is to establish a research question that is feasible with what is intended to do. In this sense, one of the questions that emerged after this analysis was why it is difficult to construct a research question.

From our own experience as teachers, learners, and researchers we have found that in most cases formulating a research question is a difficult task because the knowledge and information about the topic are not clear, it is to say, one may have the topic defined, but not enough information about it. Therefore, we would say that the question comes from what the student believes is happening with respect to the phenomenon, that is to say, a prejudice. Likewise, in several cases, students tend to formulate two types of questions. On the one hand, they formulate yes/ no questions or questions that are already answered. This is a common mistake when one does not have enough training to make a difference between questions and researchable questions. Hence, it is paramount to understand that in research, one cannot ask questions to find information about it, for instance, *what is PBL?* Instead, it must be a question that considers the population, the problem, the perspective, and the place, all this involved in a process that uses techniques, methods, and instruments to collect data, among others. On the other hand, the question is too ambitious and cannot be answered in the time available to the student. It is important for the student to do a kind of backward design, that is, to think about the expected result of the work and to ask the question from there.

Research has always been a process and a result that contributes to different dynamics in the field of education and society, in terms of methods and as a possibility of approaching

knowledge in a different way, where creativity and innovation play an important role (Restrepo, 2003, as cited in Ramírez, 2015). The possibility to break the traditional concept of research, seen as a process of hypotheses, theories, and results, is considered formative research. Instead, what is achieved through formative research is the concept of searching and constructing knowledge and new ways of teaching and learning, in which both, students and teachers, play a significant role.

The difficulty with which research is usually seen was recorded in the following fragment.

> *"We all know that research methodology is a subject that is not interesting for many. Sorry, but this is so boring. However, under PBL methodology, I have been involved in the process doing different tasks and learning not only English, but also research"* (FG, Sánchez).

Through projects, students can increase their interest because they get involved in solving authentic problems, working with others, and constructing real solutions. Moreover, projects have the potential to enhance deep understanding, since students need to acquire and apply information, concepts, and principle. Shin (2018) stated that the core of PBL is that students resolve questions or problems in a practical and cooperative way. Krajcik and Shin, (2014, as cited in Guo et al., 2020) indicated six hallmarks of PBL, "including a driving question, the focus on learning goals, participation in educational activities, collaboration among students, the use of scaffolding technologies, and the creation of tangible artifacts" (p. 2). This creation process requires learners to work together to find solutions to authentic problems in the process of knowledge integration, application, and construction. Instructors and community members (e.g. clients), normally as facilitators, provide feedback and support for learners to assist their learning process.

1.2 Solving problems actively

In this subcategory, we analyzed the active role of students when trying to find solutions to their research problems. The fragments below reflect how both the students and we dealt with the process of getting involved in the analysis of results and answers to what they intended to solve.

The following excerpt from the teachers' journal depicts what happened in some sessions.

> "*One of the main aspects to start research with students was to analyze the word PROBLEM… during the whole process, they got involved in solving authentic problems, working with others and making real solutions*" (TJ, Sep).

As previously mentioned, one of the main difficulties to establish a research question is the lack of information students have about the topic or problem. This last word has the tendency to be related to something negative that is happening in a community. According to the Cambridge Dictionary, a problem is a situation, person, or thing that needs attention and needs to be dealt with or solved. Similarly, it refers to something that causes difficulty or that is hard to deal with. In this regard, trying to find solutions to something that is difficult to solve or deal with is not an easy task, since researchers never know what the results are going to be.

Bereiter & Scardamalia (1999, as cited in Thomas, 2000) state that:

> Projects involve students in a constructive investigation. An investigation is a goal directed process that involves inquiry, knowledge building, and resolution. Investigations may be design, decision-making, problem-finding, problem-solving, discovery, or model-building processes. But, in order to be considered as a PBL project, the central activities of the project must involve the transformation and construction of knowledge (by definition: new understandings, new skills) on the students end (p. 3).

Despite the theory related to project or problem-based learning, both underpin the goal to design a problem-solving plan for a topic of interest and necessity. Through the search for solutions, students can get a deeper understanding of the material or any topic when they actively construct their understanding by working with and using ideas. Furthermore, the analysis of the material, topic, and solutions allows students to get a better understanding and evaluation of the world they live in. In this regard, the different excerpts support the idea that higher education is engaged with the development of a country by incorporating values into a society to deal with.

> *"In engineering, we understand PBL as problem-based learning. In this case, that P was for project. However, I and my group realized everything was about giving solutions to real problems. In my career, I have learned to identify problems, I mean, social problems and we take into account those problems to do my research with my friends*" (FG, Carcel).

Additionally, PBL is a form of situated learning and it is based on the constructivist finding that students can gain a deeper understanding of the material or any topic when they actively construct their understanding by working with and using ideas. Lestari et al. (2018) argued that *"Project-based learning can increase students' learning interest, learning becomes more meaningful, helping students in solving real-life problems, and supporting future careers"* (p. 19).

2. Building the path between academy and research

This second category portrays some meaningful fragments in relation to the construction of a path between the academy and research. Students who participated in this study belong to eight different undergraduate programs. Their perception of knowledge, topics, and subjects immersed in reality also implies a different way of approaching, reading, comprehending, and understanding reality, and in this way, the relationship between the academy and society is improved (Sánchez, 2017). In that sense, this relation will determine the course and development of the knowledge production and the education of researchers (Cerdá, 2007).

According to Restrepo (2003), *"formative research explores a pedagogy that seeks for active students in their own processes through the research dynamics, which also implies a different relation to knowledge"* (p. 5). It is conceived as the research process that is developed so that the students are educated considering problematic situations close to their context and their professional future, this idea of formative research becomes the concept highly meaningful in the learning process (Restrepo, 2003).

> *"Teaching formative research has remarked the importance of transversal curriculums. In this case, with the new syllabus proposed for English 5, in which we integrate language and research, we are starting to construct the path between academy and research. In the same way, within this process, I have realized that research is the bridge between education and society*" (TJ, Oct).

The university in which we carried out this study is focused on a curriculum reform that aims to integrate different themes into transversal curriculums. This allows the different subjects to consider topics from other fields of knowledge in order to establish channels that foster integral and solid syllabuses and curriculums. Based on the research projects that the participants developed, it was allowed to get into problems that specific communities have in order to counteract the levels of those problems and therefore, foster a more critical awareness in students considering what is happening around them.

Higher education institutions have strongly focused on investigation, first, because this is an indicator of how the process of generating new knowledge goes, and second because research projects aim to solve problems with a high impact both academically and socially. Parra (2004) affirms that *"to reflect about research in the university is to reflect about the university itself; this makes the research a very important process in higher education since this should not be an "extra" aspect in the entire education process"* (p. 63). University has been mostly seen as an academic space where students acquire the knowledge they should have in their professional qualifications. Nevertheless, research has also become more significant since both teachers and students explore problematic situations in their local contexts in order to solve them. Indeed, research has become a paramount base in the universities in regards of professionals formation.

> *"It was so interesting not only to carry out a project, but to develop a project under a methodology very interesting, PBL. Many times, even in the school, teachers just ask us to make a research project, but we don't have idea of how to do it. In this case, we learn by doing step by step and applying our own ideas"* (S2, Tinjacá).

From Chale's (2018) perspective, the role of research in higher education is principally to develop students' critical and argumentative skills. In this respect, formative research not only seeks to foster research skills,

> …*"but contributes to a flexible, alternative and scientific thinking in the students applicable to teaching and everyday problems, as a method of work through scientific means so that they are able to solve the problems, difficulties, shortcomings of daily life, their work performance and their integral and professional training"* (p. 257).

Arakaki (2009) states that formative research is crucial for professional development with critical, reflective, and active thinking. It stimulates the ability of students to ask and respond to issues or situations around them. Formative research is established as a pedagogical strategy that stimulates and goes beyond the knowledge acquired during the student's undergraduate program. The excerpt above shows a difficulty mentioned by most students, developing a research project without much training or information about how to do it. It is paramount to highlight the importance of creating a research culture not only from the subjects directly related to research but from any science or subject in order to

contribute to the creation of transversal curriculums in which students can research from any field of knowledge, and can have a big variety of what to research about.

2.1 Research culture awareness

In this subcategory, we analyzed the importance of building a research culture in which students played an active role in the development and application of projects. In the fragments presented below, we show the reflections of both the students and ourselves regarding the role of research in the university. Formative research is understood as a process of learning in order to develop a research culture that allows involving students in the advancements of scientific and technological knowledge (Tapia et al., 2017). This process of research aims to stimulate research abilities and interests in students and thus, they can strengthen their professional abilities.

> "*Through this course, I analyzed the importance of creating a research culture. Universities are evaluated based on research production and it is known that the best way to produce knowledge is through research. PBL allowed us to direct projects in a different way in which students learned, but they also applied their knowledge. Likewise, doing research in higher Education showed us the multiple solutions there can be for the same problem, from different perspectives, approaches, fields, and programs*…." (TJ, Oct).

Fostering a research culture is paramount within an academic context such as higher education since it includes the thoughts, ideas, expectations, and attitudes of research communities. It affects the path that the researchers build to investigate and determines the way their investigation is conducted and transmitted. Similarly, developing a research culture provides accurate and timely information on the needs, attitudes, and interests of the population studied. It plays a vital social role because, through research, students can create solutions or develop services, policies, and products that are responsive to an identified need.

> *"I had never been aware of the importance of research in my process of professional formation. Based on what we saw and learnt, this methodology is very interesting because it helps us to see research from a different perspective, and different perceptions too, because we worked in groups" (S2, Eagle).*

As seen in the excerpt above, being conscious of the importance of research is a core part of being responsible and innovative in action, aiming to foster the capacity for social and academic reflection. Furthermore, being aware of research enhances services and treatments not only for the researcher but also for future generations. The individuality of students is fundamental to recognizing their interests, experiences, and work dynamic that can vary from individual to individual, but that individuality and differentiation must take shape through teamwork, dialogue of knowledge, and research discussion (Jaén, 2006).

According to Asis et al. (2022) formative research orients students towards the production and communication of academic studies, giving them the first insights into what research is and the importance of cooperating with peers, which leads to the enhancement of scientific research and to a contribution of new knowledge to the knowledge society. It is essential to mention that the way research has been carried out in Colombia has made scholars and

researchers reflect on what parameters research should follow and why our country is not recognized for research and knowledge production worldwide. On one hand, it has been thought that the vision we have about research comes from an Eurocentric perspective that we have followed for decades, recognizing and empowering the way research is conducted in those countries. On the other hand, a more critical vision focused on epistemologies of the south has been extended to identify the way research is conducted in Latin America, recognizing the different thoughts, visions, and own experiences. One of the main aspects of formative research should be the differentiation between carrying out research in a developed country with a population with different perspectives and visions, and developing research in underdeveloped countries with different contexts, experiences, and visions of the world.

Consequently, during the process, students gained some awareness and ability to identify what their interests are when doing research bearing in mind their own ideas, perspectives, visions and experiences. That interest was reinforced and shaped by interacting with participants who despite having different perceptions, they had the same intentions, to solve a problem that was signified in their field. As noted by Harasim (2012) "*the role of the teacher is essential for facilitating the process and providing the learners with the resources and kinds of activities that will help them to build knowledge collaboratively*" (p. 97).

2.2 Professional training qualification

This subcategory focuses on the relationship between research and professional training qualification. "The articulation of educational research with professional practice requires the systematization of the pedagogical experience, which is understood as an ongoing exercise in the production of critical knowledge from practice" (Jara, 2012, p. 67). This process implies considering and interpreting what takes place and reconstructing what has happened by engaging in the identification of elements that have intervened in the experience from a critical perspective in order to understand it from the basis of the practice itself (Velandia et al, 2017).

> "*This semester English language was different. I was expecting to learn about advanced grammar topics, but it was not the case. We learnt about research, and perhaps, one of the most interesting things was to do research in English. I thought it was going to be very difficult, but I enjoyed it. We stopped seeing English as a language to learn structures, and we focused on communicating knowledge and our own ideas*" (S3, Salo).

We pointed to applying new paradigms of English language teaching in this institution. Ramos and Aguirre (2011) state that "teaching English is not only related to the structural aspects of the English language but that it also accounts for the social dimension English language teaching implies" (170). In this regard, this methodology let students be aware of the interference of research within both their professional training and English language learning. In this institution, English language instruction is grammar and language-based. Thus, the opportunities or scenarios to use the language to transmit academic knowledge are few since students are not enough trained to do so. Although the results in Saber-Pro (a national exam that evaluates quality in Higher education in Colombia) show a medium level of foreign language, this kind of exam evaluates mostly grammar and reading comprehension. In that sense, skills are not taken as integrated skills, but these are oriented

as isolated, focused mostly on knowing the structure of the language or understanding basic commands.

> *"I think it is important to recognize that we not only took a number of subjects in the university, but we also were trained to make research projects, although it is not easy. That takes time, a lot of time to search for information, apply instruments to collect data… At least, I felt it was a different way and this is going to help me when I have to make other research projects in English, because I study finance and international trade* (FG, Eli).

From Anzola's (2005) perspective, the role of research in higher education is fundamental in order to develop students' critical and argumentative skills. In that sense, formative research not only seeks to foster research skills, *but "also competences that are important in the cognitive development of students, such as the unlimited use of language to facilitate communication, thinking in terms of a process, and evaluation in terms of decisions and attitudes"* (p. 71).

Higher education is generally thought of as the institution where students take a number of subjects, learn certain topics to graduate, and get a diploma in that field. Nonetheless, according to what the student stated above, the process of developing formative research helped the participant understand that higher education goes beyond. Professional qualifications, besides vocational training courses that relate to a specific industry or career path, also account for the production of new knowledge and solutions to real problems through the development and application of research projects. This study also highlights the importance of the incorporation of PBL where self-confidence, cooperation, and tolerance appeared as the most remarkable social and professional values that interfered with teamwork.

According to Espinoza (2020), research has some advantages within professional training qualification , for instance, students learn to research, developing cognitively, processual and attitudinally; they gain cognitive independence when learning by doing; the use of productive methods and collaborative and cooperative spaces for meaningful learning is promoted and helps to solve pedagogical problems. The limitations of this type of research are given by its link to the teaching-learning process, namely: they are limited to the study of a phenomenon, and the procedures, methods, and techniques used are not up to the rigor of scientific research. They are implemented as curriculum work; therefore, the implementation of these projects takes time and most of the time, projects are not completely applied and developed.

Conclusions

The present study aimed to promote formative research skills in higher education through the implementation of PBL by using the English language. This study offered an approach in which critical thinking abilities can support undergraduate professional training, and enhance motivation to interact and collaborate with others. Attitudes towards learning English especially the ability to communicate in real contexts were meaningful to the students and their curriculum.

The data collected helped us improve research training in the university and contribute to language education and the understanding of formative research as a positive path to encourage research in higher education. In that sense, the construction of a positive relationship among the academy, research, and society enhanced creating awareness of the need to foster a research culture not only in this institution but also in the country, a research culture that accounts for the skills that higher education students have to face current issues. The connection and articulation of formative research with professional praxis require processes in which the academic experience of both teachers and learners attend to reinforce the production of critical and scientific knowledge. The promotion of this kind of project fosters a more comprehensive education with social meaning and projection for their professional practice and qualification. Moreover, educative institutions are benefited because the participation of students in groups and hotbeds of research renovates scientific spirits and provides a fundamental contribution to academic production. Consequently, it promotes the need to reflect and explore new areas of knowledge and fosters the link academy society.

We found that if research is well founded in terms of theory and practice, following and shaping both students' interests and society's needs, it is formative. Day after day, the different problems in all fields account for the need to produce and communicate scientific activity. It is paramount that higher education teachers see research not only as a pedagogical and didactical praxis but also as a contribution to the formation of a critical group of researchers. The construction and promotion of a scientific community should be the basis for a more equitable and democratic society where everybody can make part of the solutions, advance and technological, scientific, academic, and social evolution provided through the development of research. When those goals are not clear, neither are the horizons of the researchers. It is essential that the study plans of each university professional career must consider a line of research in the organization of their curriculums. Formative investigations aim to provide students with the possibility of assuming favorable attitudes towards research processes; teaching-learning strategies based on productive methods and significant learning by discovery are considered; They are not exclusive to the university environment, they can be used in other teaching subsystems.

Furthermore, given the essential nature of integrating English into research training, oral and writing skills appeared as key components to foster when learning a second language. We identified some limitations regarding students' proficiency in English level. Therefore, after analyzing the results, we consider that an aspect to improve in future implementations is to create a writing course to develop more academic skills needed to develop a research project. Likewise, we consider that findings on the effectiveness of this development may differ if the scenario changes, it is to say, all this process was carried out virtually and most of the information that participants posted was shared through social media. Nevertheless, a physical or real scenario may provide different results considering relationships among participants, time, problematics, and willingness of the population to participate, among others.

Formative research is research between students and teachers and it must be present in all learning processes, both in student learning and in renewed teacher practice. That is why we decided to modify the syllabuses and implement this new strategy in the upper levels of

English language teaching courses. This type of research aims to teach research so that students develop cognitive and research skills such as analysis, productive thinking and problem solving to be more innovative and creative and develop a research culture, which educates them about the stages of research and the issues raised. In addition, formative research provides students with competencies in addition to research skills, such as fostering broad language use to promote communication, reflection and decision-making, evaluating attitudes, all of these which provides them with first concepts and research strategies. The analysis made in the literature provides an opportunity to state that scientific research is part of the material tasks of higher education, which requires the gradual development of research skills in the student formation, for which the teacher can use formative research. Universities have used a number of techniques in the development of development research, such as: theoretical essays, seminars, research centers, institutional research projects, problem-based learning, research project planning, monographs, professional practice, degree projects, case studies, active learning and project-based learning.

We consider that in order to achieve the objectives necessary to carry out a complete scientific research process, it is essential to develop investigative skills in students, for which teachers must consider the principles of formative research. For this, the adequacy of the syllabus and curriculums with contents related to the research methodology and problem-solving methods is strictly necessary. In this sense, we see how day after day higher education institutions have been interested in developing and promoting scientific research in professional training, both as an object of study and as a way to solve the problems related to each program, through hotbeds and/or research groups, courses or training in research or from interdisciplinarity, since research is not external to any area of knowledge. It is necessary that the research training is covered from the first years of study so that other research status of greater rigor can be achieved. To reach these levels, it is important to have a highly trained faculty to fulfill their functions both for learning and for the development of research skills in their students. Summarizing, there are some obstacles that lie in the load and teaching activity within the institution, which require time for a conscious and systematic implementation of the research work, for which integrated curriculums are proposed where the contents are related to research and are not take them as two separate topics.

To end with, the importance of promoting and fostering formative research during the pandemic time helped us conclude that virtual sessions also played a significant role. Students developed technological and autonomous skills, and because participants registered and shared the information, teachers could constantly monitor the content and development of the process, as well as create spaces to discuss topics and create knowledge collectively. A fact to highlight is that according to the different projects that students developed, they considered the following sustainable goals the most: good health and well-being, decent work and economic growth, and climate action. It allowed us to see how engaged and committed students are to providing solutions to these social and environmental problems, but it also showed us the serious problems that the current society faces in terms of mental and physical health, feeding habits, global heating, unemployment, decreased economy. We identified and recognized that most of these topics increased during

the COVID-19 pandemic. Some of these topics seem to be associated more with problems of a social and historical nature than with scientific capacity.

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