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ABP and STEAM as Active Learning Methodologies

El ABP y el STEAM como metodologías activas en el aprendizaje

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IX CONGRESO INTERNACIONAL DE INVESTIGACIÓN DE LA RED ECUATORIANA DE UNIVERSIDADES Y ESCUELAS POLITÉCNICAS Y IX CONGRESO INTERNACIONAL DE CIENCIA TECNOLOGÍA EMPRENDIMIENTO E INNOVACIÓN SECTEI-ESPOCH 2022

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Abstract

The present research aims to determine the effectiveness of the PBL and STEAM as active learning methodologies in higher education. These were applied in the context of the Escuela Superior Politécnica de Chimborazo, representing tools for the progress of educational research and university training in practice. The aforementioned study was framed in the quantitative paradigm, done in the academic period from April to August 2022 for the Software major, with a total of 32 students, 27 male and 5 female. They responded to a dichotomous questionnaire with closed answers Yes and No, applied in the context of the classroom in person from the perspective of the active methodology used in classes by teachers and the perspective of the improvement of learning by the subjects involved in the specific academic context. The conclusions allowed us to infer that the participants in the academic process have seen important progress in the field of teaching and learning in the practice of the specialty, exposing that they require innovations in instruction to be implemented, modifying the teaching method. With this, it is possible to obtain better and greater skills and achievements at a collective and individual level, so all of them coincide in the value of using the two active learning methodologies, PBL and STEAM in the development of skills and abilities in the software engineering major at the Polytechnic of Chimborazo (ESPOCH), Chimborazo, Ecuador.

Keywords: *active methodologies, PBL, STEAM, software, higher education, university learning.*

Resumen

La presente investigación tuvo como objetivo determinar la eficacia de la metodología ABP y STEAM como metodologías activas del aprendizaje en la educación superior, estas fueron aplicadas en el contexto de la Escuela Superior Politécnica de Chimborazo, representan herramientas para el progreso de la investigación educativa y de la formación universitaria en la práctica. El referido estudio estuvo enmarcado en el paradigma cuantitativo, realizado en el periodo académico de abril a agosto de 2022 de la carrera de Software, siendo en total 32 estudiantes, 27 masculinos y 5 femeninos. Los cuales respondieron a un cuestionario dicotómico, con respuestas cerradas Sí y No, aplicado en el contexto del aula de clases, de forma presencial sobre la perspectiva de la metodología activa empleada en clases por los docentes y la perspectiva de mejora de los aprendizajes por parte de los sujetos involucrados en el contexto académico puntual.

Las conclusiones permitieron inferir que los participantes del proceso académico han visto importantes progresos en el ámbito de la enseñanza y el aprendizaje en la práctica de la especialidad, exponiendo que requieren sean implementadas innovaciones en la instrucción, modificando el método de enseñanza, expresaron que con esto es posible obtener mejores y mayores destrezas y logros a nivel colectivo e individual, por lo que la totalidad de los mismos coinciden en el valor de usar las dos metodologías activas de aprendizaje: ABP y STEAM en el desarrollo de las habilidades y destrezas en la Carrera de ingeniería de software en la Escuela Politécnica de Chimborazo, Chimborazo, Ecuador.

Palabras Clave: *Metodologías Activas, ABP, STEAM, Software, Educación Superior, Aprendizaje Universitario.*

1. Introduction

University education has received important transformations after the due updates that the same academic environment has suggested. Many of the protagonists of the scenes themselves in the institutions have warned that there is a need to transform the ways in which knowledge is transferred by more current methods. The United Nations Educational, Scientific and Cultural Organization (UNESCO) is the one that globally promotes the change from traditional literacy programs to literacy programs [1] so that the advances and progress of STEAM education or through other methods such as implementations that favor the application of means of growth and development of the academic context in all subsystems. A teaching method is the set of techniques and activities that a teacher uses in order to achieve one or several educational objectives, which make sense as a whole and which responds to a name known and shared by the scientific community [2].

In this sense, active learning methodologies correspond to the demands of the various educational systems, because they are those in which the participants of the process are contextualized as protagonists and not as mere recipients of it, in the broadest sense. Priority is given to the student body to select their methods or resources for academic training. So, teachers and students are both actors in a medium where the importance lies in what the student manages to know after the transfer of knowledge, which is verifiable in practice.

This is how, two of the methodology used at present, in the university subsystem in Ecuador are the PBL and the STEAM methodology, as active learning methodologies. In the case of Project-Based Learning (PBL), the relevance of this teaching scheme is to formulate achievable and achievable projects with clearly defined goals, with resources that can be managed by the students themselves and that facilitate the achievement

of the initial objectives. Those that are also related to daily practice in which they demonstrate their knowledge.

The PBL is characterized by presenting a globalized problem that needs research to be solved, by collaborative work, by the link between reality and the university, as well as by the role of students in the entire learning process, in the decisions related to the contents and in the evaluation. Faced with the mere transmission of knowledge, PBL has involved the implementation of shared tasks among the participants to respond to the problem initially raised. Throughout this process, "individual and autonomous learning is promoted within a work plan defined by objectives and procedures" [3].

One of the principles of learning by project development or Project Based Learning (ABP) is precisely the growth that is given to the academic population when they struggle in the teaching environment to achieve common and particular goals. Thus, the need to know and experience the curriculum must be assessed as it is the reference of the knowledge that should be fostered in students [4], without forgetting the obligation to establish strategies for formative evaluation.

In this order, Project-Based Learning or PBL, represents an innovative approach which is applicable in Higher Education case studies such as the example of: the Metropolitan University (Caracas, Venezuela), where in the chair of Community Service; participants in the teaching process are introduced to real-world problems through various strategies that are part of the educational program, transforming the quality of teaching, and giving the student responsibility for their own learning. This means that the teacher sheds his role as controller and provider of knowledge, and becomes a facilitator of the process, also promoting the transdisciplinary approach and the work of multidisciplinary teams [5].

In such a way that, in practical cases that have already been verified, it has been verified that with the application of the PBL (Project-Based Learning) the academic goals are [6]:

1. The consolidation of the specific objectives of the study considering the cases raised.

2. Give value to the concepts in which the group of future teachers have a certain area of knowledge. For example: Systems engineering, with which work can be carried out in the referred field, generating new solutions.

3. Analyze the PBL model and the possibilities it offers for the didactic-disciplinary training of students in a certain specialty, that is, create the character of the profession.

4. Encourage training based on research, observation and creation from knowledge and experience of the study curriculum.

5. Generate evaluation instruments in accordance with the curricular structure of the area for the stage where it is studied.

In this way, the achievements obtained with the implementation of project-based learning (ABP) is the leading role of the teaching-learning process for the student, overcoming his position as receptionist of the contents developed in class by the teacher. Through the execution of the project, the investigative process is carried out that will allow solving the problem that gave rise to it; which requires the development of knowledge and skills of the student body to plan, design, organize and implement the execution of the tasks and activities contemplated, while acquiring new ones [7].

Many authors agree that the development of the skills necessary for students to consolidate knowledge in areas of practical attention largely derives from the methods used by the teacher. One of them is "...innovative practices continue to be a challenge for teachers. Everything indicates that the pompous, plausible and eloquent speeches, as well as the convincing and mass rhetorical writings, have only generated an ambitious and utopian impression that cannot be extrapolated to the classroom. It is still pending to examine the opinion of the teaching staff regarding the curricular reforms -possibly this is a factor that helps to elucidate this framework-, but what is essential to avoid today is the frontal commitment that the teaching staff must assume to incorporate more innovative practices in the classroom of class" [8].

This is how, in addition to the implementation of the PBL or the model based on project-based learning, there is one of the study approaches called STEAM, which has become popular in other countries around the world, due to the fact that it is possible to combine the arts with science, technology and mathematics, engineering and art; which generates innovation and motivation, in addition to associating logical thinking with creativity, making science more attractive to students [9], becoming very relevant in recent years, both in educational policy framework documents and in the literature. specialized, in the general media, in debate forums on education and training, as well as in multiple economic and social forums [10], generating in the same way special interest in the academic sphere of the higher education system.

So, active learning methodologies represent a contribution to educational sciences, but also to those that are directly linked to specific skills, such as the area of engineering that within the branch is subdivided into specific tasks of the professional in training. In this way, it is necessary to establish models to follow within the proposed projects and tasks that lead to consolidate the skills of the students to train them in the field

of technology in which the student is required to achieve the transferred knowledge. Which undoubtedly requires changes in the forms of planning of the subjects that make up this discipline, of the didactic activities as a system that promotes the participation of the students and of the evaluation, in such a way that the learning process responds to a constructivist perspective [11].

In this order, it is important to point out that STEAM is one of the comprehensive teaching methods that is applied in first world countries for the development of skills and competencies based on the individual abilities of each student and taking into account the development of multiple intelligences and the role that the generation of such spaces plays in educational inclusion [12], since the use of active methodologies such as STEAM significantly improves academic results, which adds value over and above the use of master classes, because you learn by doing, from the integral pedagogical practice where you work on different curricular contents [13].

The acronym arises in 2008 when Yackman, trying to promote interdisciplinarity, introduces the "A" as the initial of "Arts" in English, which translated into Spanish means "Art", incorporating it into another existing acronym: STEM, which includes the initials in English of the disciplines Science (S), Technology (T), Engineering (E) and Mathematics (M) or, in Spanish, of Science, Technology, Engineering and Mathematics, respectively([14, 15]).

This is how, given the importance of the STEAM methodology to promote transformative processes in education (14), the objective of this work was to carry out a review of the conceptual and theoretical bases of the STEAM methodology, as an active learning methodology in higher education. The STEAM education described in this research, the practical application of two learning projects based on the STEAM methodology carried out by the authors with students of higher education careers.

In such a way that, active methodologies, in general, focus on the student at the center of their learning, thus leaving aside the ideology of traditional or banking education, so that reference is made to the fact that it is the teacher who is the one who has all the knowledge and the absolute truth, and that the student needs to be instructed without intervening in the knowledge process [15]. In practice, all these aspects have been progressively displaced due to the fact that lights have been shed on the need for the student to participate actively in the growth and progress in the various stages of learning, as well as in the choice of media and instructional methods.

Therefore, it is worth noting that the teaching method that can be considered as "a logical and rational organization, according to the learning principles of a theory, of a series of specific events destined to obtain certain learning objectives, this procedure

is related with the application of techniques that come to be joint actions planned by the teacher and carried out for the acquisition of knowledge" [16].

In contrast, the PBL methodology of STEAM is structured in phases that lead to the achievement of knowledge consolidation:

1. **Preparatory phase**. Previous evaluations and selection of the topic.
2. **Experimental phase**. Design, resolution and evaluation proposal of the project from the experience of the curriculum.
3. **Report phase**. In which the final assessments and data analysis are made. Data analysis in qualitative research must be carried out continuously and progressively from the beginning of data collection, which implies modifications in the research questions.

The relevance of the STEAM methodology lies in the fact that it contributes to the development of a pedagogical method that is directed towards the condition of overcoming fragmented bridges in academic subjects that have traditionally been generated in curricular development in the areas of Science, Technology, Engineering, Arts and Mathematics [14]. In this way, with the STEAM methodology, complex problems are worked on from different disciplines, giving creative and innovative solutions by taking advantage of possible technologies [17].

Regarding the holistic approach of STEAM, its main objective is to train individuals with complex thinking and its priority interest is to compensate for the deficiencies of the traditional school [19], as it is focused on the teaching-learning process and on the needs of the student or from teacher. In relation to other methodologies related to interdisciplinary learning of the STEAM methodology, [15] many other educational theories have somehow shown their support for interdisciplinary education: discovery learning theories [14].

What is pursued with both methodologies is to achieve functionally literate people; that is, people who know how to learn and adapt to their environment that also changes rapidly. So that through this learning the possibility is given to people to define differences that exist in the different ways of receiving the information imparted in teacher-student exchanges and in turn with other students who are part of the context and academic purposes, it is done based on what the student already knows and with this, cognitive abilities and skills in key areas can be improved.

Learning is a process whose purpose is to increase knowledge and the acquisition of skills that allow people to potentiate and transform their mental schemes, providing them with the ability to think and understand their environment; in this, biological,

psychological and social factors converge [16]. Therefore, it could be said that it arises from the need to know more about life itself, taking advantage of the opportunities that are presented to enhance the skills that each one has.

This is why the interactive approach of the STEAM methodology exposes that the STEAM methodology is an interactive learning model, which invites students to build together, for which it demands combining efforts, talents and skills through a series of transactions that allow them to achieve the goals established in consensus, with learning based on projects (ABP).

The objective of creating a final product, generating learning through the tasks that are carried out to create it([17, 18]). So, the student is caused to find a problem without any type of structuring and where he is the protagonist, since he identifies and learns from a problem through research and manages to reach a viable solution. Likewise, both methodologies, project-based learning and problem-based learning, use the great methodological umbrella of cooperative learning.

Therefore, because the STEAM methodology allows the interdisciplinary learning approaches described above to be put into practice, as well as curricular integrality through the development of learning projects, which starts from a problem that requires intervention to transform it and/or give solution.

So, with STEAM learning, the activation of social skills to solve problems is promoted, it is a skill that must be reaffirmed in the training of students, so that they assume the attitudes and knowledge necessary to solve problems, collect and analyze evidence, integrated into the efforts shared with the team in the planning and execution of healthy projects, in addition to the determination of appropriate learning experiences in the STEAM model. We consider this element very important since it allows students and teachers to work together to solve real-life problems through the project, promoting creativity in the process of addressing the problem, where the members of the project STEAM learners have the freedom to propose multiple ways and solutions as alternatives to a given problem through collective construction.

Based on what has already been stated, and taking into account the reality of classrooms in which students often have difficulty achieving the expected skills and abilities, it is necessary to improve modern learning processes, following principles of adequacy of the academic environment and the practicality of the case studies. From this point of view, it is the teaching professionals who are responsible for determining if the current education models used are the most efficient for the achievement of learning in such a way that it is necessary to establish a context of reflection and interpretation on this. For this reason, the present investigation is justified.

For this reason, the development of this study in the Software Career has been proposed, in order to determine the effectiveness of the PBL and STEAM methodology as active learning methodologies in higher education, which were applied in the context of Escuela Superior Politécnica de Chimborazo.

2. Materials and methods

The research carried out was an experimental study, therefore located within the quantitative paradigm. Descriptive research works on factual realities, and its fundamental characteristic is to present a correct interpretation [19]. For descriptive research, its primary concern lies in discovering some fundamental characteristics of homogeneous sets of phenomena, using systematic criteria that make it possible to reveal their structure or compartment. In this way, the notes that characterize the studied reality can be obtained (p.51)

In it, a data collection questionnaire has been made, which was applied to students of the Software Career to find out how they evaluate the implementation of the work methodology in classes with PBL and the STEAM model.

In principle, the establishment of the study plan was done in a conventional way, that is, under the traditional teaching methodology, where the instruction and evaluation strategies were based on the face-to-face class and later on the application of exams to quantify the number of solutions. contributed by the students. This is how, two academic plans were applied in a period of two weeks or fifteen days [15] which were at different times, therefore, the study was developed in a period of two months, being in one month for fifteen days. application of Project Based Learning while the STEAM model was applied in the following month, in both cases the same data collection questionnaire was applied after the implementation of the model. The results are expressed in the present study.

2.1. Procedure

Before starting the research that is presented, a previous selection of the students was made, who are studying the subject of Oral and Written Communication, who do academic life within the Escuela Superior Politécnica de Chimborazo, specifically in the Faculty of Informatics. and Electronics, students of the Software Career. Reason for which it was necessary to develop a data collection instrument, of a dichotomous scale with which it was possible to consult about a series of questions referring to teaching

methodology based on two types, the ABP and the STEAM method. The students gave answers about the perception they have of both.

2.2. Sample

The subjects of the sample are people who are studying the subject of Oral and Written Communication of the Software Degree, a total of thirty-two, 27 male and 5 female. The ages are between 19 and 23 years old, and they belong to a low average social condition, a total of thirty-two students.

2.3. Sampling Strategies

The type of sampling was intentional, it was applied in the population under study, because it was intended to know the appreciation of the students regarding the implementation of the two teaching methodologies in the university context: PBL and STEAM. This is how the set of students that were relevant for data collection was selected, subjects who met the inclusion criteria previously defined by the study authors.

2.4. Reference to the type of statistical analysis used

The analysis used was descriptive with count measures such as the average of the affirmative and negative responses of the instrument developed and applied to students taken as a sample, as well as the typical or standard deviation for the evaluation of the main criteria of the evaluations in the two moments in which knowledge tests were applied within the investigation.

2.5. Information processing and analysis

1. The design of the instruments was fulfilled.
2. The instrument was applied.
3. The results were recorded.
4. The tabulation or distribution of the results obtained was made.
5. The results were analyzed and contrasted with other studies.

2.6. Inclusion criteria

Students duly enrolled in the semester (period, April 2022- August 2022).

Students who voluntarily wished to respond to the instrument designed for this research.

2.7. Exclusion criteria

Students who expressed their desire not to answer the questions raised even when they are enrolled (registered).

Tabla 1

Software students who were considered for the study.

Major	Men	Women
Software	27	5

3. Results

The results of the investigation are presented below, according to the data collection instrument applied in the sample and the scenario described above.

As can be seen in the results, 94% of the subjects surveyed in this study agree that active learning methodologies have had an impact on improving teaching processes. Most of the students openly described that their learning process has improved after the change in the methodology used by teachers with the implementation of PBL and STEAM.

The first step in the study of causality is to look for the possible association between the variables that are considered cause and effect, and only if a significant association is found between them can the causal inference analysis continue.

Thus, two variables have been selected to evaluate:

1. ABP or STEAM teaching method.
2. Improvements in learning obtained.

The results obtained allow us to infer that the students of the Software Degree in general knew about active learning methodologies. In which the importance and priority is given to the student in contrast to traditional methodologies in which the student is a mere recipient of the learning process. On the other hand, it was possible to verify that

Tabla 2

Results of the data collection instrument applied.

Item	Fr. Yes	Fr. No	%Fr.	%Fr. No
Do you evaluate the implementation of the PBL method in the teaching of the subject as correct?	20	12	63%	38%
Has the understanding of concepts improved with the Project-Based Learning method?	28	4	88%	13%
Do you consider that the use of PBL is relevant for collaborative learning?	30	2	94%	6%
Has the STEAM method fostered the development of your learning?	30	2	94%	6%
Has the change in the teaching method enhanced your skills and abilities in software?	32	0	100%	0
Can you describe the progress that has occurred in your cognitive level after implementing a PBL method or STEAM?	30	2	94%	6%
Did you know about active learning methodologies where attention is transferred from the teacher to the students?	30	2	94%	6%
Has the teacher correctly executed the PBL and STEAM methods during these two months of work in different teaching units?	10	22	31%	69%
Is it necessary, in your opinion, to implement PBL and the STEAM method in other subjects of the Software Degree?	20	12	63%	38%
Mean: Affirmative answers = 26, Negative answers= 6				
Standard Deviation affirmative answers = 12 Standard Deviation negative responses= 7				

Tabla 3

Summary of the research diagnosis.

Gender	Subjects in favor of the change in the teaching method	Perception of better learning
Male	**27**	**24**
Female	**3**	**4**
Percentage (%) of Subjects in favor of the Change of teaching method	**94%**	
Percentage (%) of Subjects who consider that they have had better learning	**88%**	

94% of those surveyed agree that in addition to individualistic learning, the use of PBL represents progress for the collaborative teaching model in which interaction is made

with other students and it is achieved by sharing weaknesses and strengthen strengths in an assertive and appropriate manner. Where the teacher represents the mediation between the various elements related to teaching and learning.

On the other hand, 88% of the students affirmed that with the implementation of the PBL and STEAM method, it was possible to increase the abilities and skills in the context of teaching and learning, only 12% stated that there was no progress in the field of the increased knowledge after the application of the principles of each of the aforementioned modes of instruction. Another relevant aspect is that all the students stated that the knowledge they possess in the field of Software Engineering and that can be measured through the development of abilities and skills has increased after the implementation of PBL and the STEAM method.

In this regard, it can be affirmed that the analyzed variables have a perfect relationship that allows us to infer the need to adapt the new teaching schemes to the active learning methodologies, since it is evident that for the subjects surveyed the process of understanding the various topics studied in the context of the subjects of the technical specialties have better development of skills and abilities through the implementation of projects within the PBL and the solution of problematic situations within the framework of the STEAM methodology.

When interpreting the results of the implementation of active learning models, or the so-called active learning methodologies, it has been possible to corroborate how the subjects under investigation gave an assertive opinion when affirming that the teachers who have implemented these changes in the factual subjects have managed to favorably impact student understanding.

The results obtained allow contrasting with the reality seen in other studies, for example in the current one it has been verified from the perception of the students that the implementation of the PBL and STEAM method, which are mostly based on developments in the technological field to the consolidation of learning, having that all the respondents affirm that with the development of projects and activities framed in cooperative work under the principles of STEAM in the higher education scenario, it was possible to increase the potential of the abilities and skills of the students. Students of the Career, as they refer, there are many academic, psychological and social benefits that the cooperative methodology brings to the learning process and to the development of the student himself. According to the studies carried out by these authors, it is evident that these active learning methodologies not only stimulate cooperative work, but also promote autonomous learning and with it the cognitive independence, foster empathy among group members, enhance social skills, communication and decision making.

As it happened in the work "Use of ICT in the learning of mathematics at the higher level" in 91% of the total respondents reveal that they completely agree that teaching through ICT manages to improve learning in the students, and only 9% indicate a neutral answer; Indeed, the highest percentage ensures that through the use of ICT, the teaching-learning process in virtual environments guarantees pedagogical innovation based on the creation of conditions to develop the ability to learn and adapt(20). A work that was contrasted with the present, which served as a theory to carry out a critical analysis, two learning projects based on STEAM applied by the author in higher education careers, in this work it was possible to obtain that 94% of the respondents manifests the relevance that the implementation of a reliable and flexible method for the achievement of knowledge in the phase of construction of applications from the base of the cooperation promoted by both active learning methodologies.

Likewise, in another study [15] it was interpreted that, for the scope of the purposes and challenges posed, the design and implementation of STEAM-based learning projects is recommended as support resources to potentiate and favor transformative educational processes in higher education. So, it is necessary to consider the results in which 63% of the students surveyed affirmed that it is necessary for the Software Career to incorporate the favorable elements provided by these active learning methodologies, giving value to the elementary concepts of cooperation, coordination, planning as features that can be additional to the knowledge that in the execution of said systematics can be enshrined in the graduation profile of the Career at the university level.

Thus, strategies such as the PBL are recognized as an important constructivist strategy to create learning environments and improve academic results. Inspired by constructivism, it is characterized by "challenges" that move the student to resolve cognitive conflicts in collaboration with others and in interaction with the environment. Such benefits in other settings were demonstrated not only in the present study but also in the experience at the Tecnológico de Monterrey in Mexico [?], which allowed students to obtain an active participation in the process of consolidation of learning in key technical areas, so it is inferred the advantages that pedagogical changes have had on students at this level for the field of Higher Education.

4. Conclusions

After carrying out the presented research, analyzing the results, the need to innovate in teaching methodologies in the university context was verified, as it is well known, in STEAM methodology the structured learning is conceived, which covers several disciplines but does not enhance any in particular but rather that importance is given

to the transfer of content between subjects, in this way and from our point of view, the interdisciplinary nature of STEAM addresses the complexity of a problem for its resolution through the articulated integration of the different areas of knowledge that make up STEAM [18], to respond to the challenges of the real problems of daily life in a globalized and changing society. This is how, the relevance of the teaching method is verified, 88% of the students affirmed that with the implementation of the ABP and STEAM method it was possible to increase the abilities and skills, which is corroborated in each of the aforementioned modes of instruction, real world problems are almost always interdisciplinary [18]. In such a way that, the interdisciplinary learning of the STEAM methodology [12] can be covered from the analysis of various approaches: the constructivist approach, the holistic approach, the approach of other modern theories and functional literacy.

In this case, it was possible to expose the feasibility of the use of PBL and STEAM methodologies in theoretical subjects, key for students of technical careers, so that such results invite us to rethink teaching strategies within a new pedagogical modality that allows guaranteeing that in effect the objectives of the instructional processes are achieved. So, the STEAM method and the PBL are two ways to promote student learning where they consider themselves active subjects. It is worth expressing that the STEAM methodology is a pedagogical method that promotes the integration and development of scientific-technical and artistic subjects in a single framework. This is why, in the process of production, justification and acceptance of knowledge that arises in any learning activity of daily life. And they are very often the processes involved in learning of a scientific nature. The result of the research aims to describe that in the case of the methodologies addressed in the present study, these are of great relevance for scientific learning, added to the above, it is sustained to the extent that the teaching-learning process acts in a context of knowledge reconstruction, in which there are repeated and systematic opportunities to put into practice justification processes typical of scientific research and problem solving, and in which the scenario is favored so that this task can be carried out [16]. In this sense, when observing the results obtained, it is possible to describe the improvements that the participants themselves have in collaborative strategies for the achievement of learning, which is to be considered not only for the Software Career where both models and methods were applied but also for other specialties.

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