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INNOVATION PROCESSES IN THE TEACHING PRACTICE OF PROFESSORS AT THE UNIVERSIDAD POPULAR DEL CESAR: AN APPROACH FROM EDUCATIONAL PSYCHOLOGY AND THE TRANSVERSALITY OF TEACHING

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Summary
Educational innovation in the teaching practice of engineering professors at the Universidad Popular del Cesar is analyzed through a focus on educational psychology and the transversality of teaching. The case study method is applied and, based on interviews and discussion groups with 49 teachers, innovations, psychological factors that favor them, and obstacles that limit their development are identified. These findings, together with the transversality approach in teaching that incorporates competency-based training, are the basis for an intervention proposal that seeks to promote innovation in teaching practice and that is designed and developed for its application.
Engineering education faces global challenges. In Latin America and the Caribbean, attempts are being made to overcome the traditional teaching approach and greater innovation in teaching practice is required. At the Universidad Popular del Cesar, Colombia, teaching practices are recognized as a critical factor in training; however, there is little development in the educational innovation of engineering professors. Educational psychology provides a basis for the study of innovation and factors have been identified that hinder or favor educational innovation in teaching practice in other contexts. A competency-based teaching approach requires consideration of the transversality of teaching in the training of engineers.

1. INTRODUCTION

Education is in a permanent process of transformation. There are constant changes in content, methodologies and resources. A quality education requires teachers capable of responding to these changes, of continuously improving their teaching practice and of contributing to the construction of knowledge in students. Educational innovation thus becomes a key concept, not only at the institutional level and in educational policies, but also at the level of the strategies used by teachers in the exercise of teaching. A frame of reference that can help teachers in the process of innovation and educational transformation is educational psychology, since for more than a century it has studied in depth the nature of teaching-learning processes. Likewise, approaching teaching from a perspective that contemplates transversality in the formation of competencies can offer a complementary approach in the innovation process.
Higher education systems are intended to prepare professionals and generate knowledge and culture. Therefore, the focus is on the quality of the teaching-learning process, often lacking in-depth research through the identification and analysis of the teaching practices of teachers. It is understood that it is possible to generate knowledge in the classroom, but there is no clarity or certainty about how it is produced. Educational improvement and innovation are an individual and collective responsibility and involve all members of the community. In this

sense, the innovation process of the teaching-learning processes in engineering is analyzed from the teaching practices of the professors.

2. THEORETICAL FRAMEWORK

The first chapter of the work presents concepts, theories and proposals on three fundamental aspects for research: educational innovation, the psychology of learning and the transversality of teaching. The research is framed in educational psychology, which studies the processes of teaching and learning in formative contexts, analyzing experts in the area and the institutional context of the Universidad Popular del Cesar, Colombia.

Innovation, in general terms, involves the creation and application of a new idea or project or one that already references an improved practice, which generates added value. In the educational field, a teaching practice is considered innovative if it is done differently from how it has been done before, if a new pedagogical approach is used that allows the student to achieve significant learning or if technology is used. In the field of engineering, it is recognized that the application of a different approach to the teaching of subjects related to basic sciences, as a proposal for investigative teaching-learning, allows students to make a connection between the specific content and its application. The application of an innovative proposal in the subject of electrical circuits, which seeks to promote meaningful learning through the use of specialized software, improves academic performance and students' perception of the subject.

2.1. Educational innovation in engineering

Educational innovation in the field of engineering is a trend that is gaining increasing strength in teaching practice, as a result of the search for new forms of teaching and learning that allow training competent professionals to perform their work. Innovation is identified with the introduction of relevant changes in the teaching-learning process; changes that may encompass curricular aspects, projects and teaching methods, student participation, learning assessment, use of new technologies and, in general, elements that are related to educational experiences in engineering. Innovations are not only proposals for new teaching practices, but also come from the incorporation of theoretical and practical knowledge that affects and enriches the work of the teacher.

From the perspective of educational psychology, innovation in teaching practice is associated with the creation of new learning experiences that must be introduced by the teacher. This creation is a process that does not always occur easily; it requires stimuli and impulses that facilitate the overcoming of the psychological difficulties inherent in the action of innovating. These psychological processes are, for example, the need for a positive perception of the advantages of innovating, for an adequate classroom climate to put the new method into practice, for confidence in the teacher's ability to face the challenges presented by the students' behavior in the face of change, and for motivation that favors the adoption of an innovative method in daily practice.

2.2. Educational psychology and learning in university contexts

Learning processes are conditioned by the nature of the educational context and, consequently, manifest themselves differently by virtue of the characteristics of the students, their life experiences, their interests and their motivations. In this sense, belonging to a specific professional culture can significantly alter and influence learning processes. Educational psychology investigates these characteristics and conditioning factors, as well as the teaching and learning processes that can be carried out in a given professional culture. Therefore, in this analysis, the perspective of educational psychology and its contributions to the educational design of the curriculum must be incorporated.

The culture of engineering has its own characteristics that mark the way in which students approach, understand and build knowledge in this discipline. When characteristics of engineering students are mentioned, they are generalizations, since each individual has particular characteristics and experiences. However, there are common characteristics that shape their way of thinking and their proposed solution to problems. Variables that influence during the training stage have been identified, such as: commitment and dedication to study; ability to work in a team; high math skills; interpersonal skills; training, both theoretical and practical, related to the use of instruments; among others. These variables allow us to establish differences with students from other areas of knowledge.

2.3. Transversality of teaching and competences

The transversality of teaching in the training of engineers stands out as one of the objectives of Colombian Higher Education, and of special concern in the Popular University of Cesar through the work carried out by the research groups of the Faculty of Engineering, which have implemented strategies to contribute to the formation of transversal competencies in students. The informal applications of curriculum design, which consider the transversal axes in their formulation, are evident in the Academic Programs and in the Teaching Guides of the different subjects but not in the practical development and even less in the evaluation of teaching.

Transversal pedagogical projects are one of the proposals put forward by the National Council for the Accreditation of Higher Education in Colombia (CNA) for the integration of transversal competencies in the training of students. According to the Ministry of National Education of Colombia, transversal competencies are the ability to solve problems in a context different from the one in which they were acquired, using knowledge, skills, and attitudes1.

3. METHODOLOGY

A quantitative, descriptive and non-experimental approach is used, since the variables are not modified or the groups are manipulated. A group of engineering professors is investigated through a survey, whose data are analyzed using inferential statistics. The population is made up of 84 teachers and the sample is made up of 49 selected through non-probabilistic sampling. The validation questionnaire is developed collaboratively and is then applied to teachers.

The validity of the content is established by expert judgment and the reliability coefficient by Cronbach's alpha, whose ratio 0.897 indicates high consistency. Data analysis is carried out using the SPSS statistical software, to determine the innovative practices of teachers based on their description and four psychological factors.

The present research adopts a quantitative, descriptive and non-experimental approach, since no variables are modified or groups are manipulated. A study is carried out on a group of engineering professors through the application of a survey, whose data are analyzed using inferential statistics. The study population is composed of a total of 84 teachers, from which a sample of 49 is selected, chosen through non-probabilistic sampling. The validation questionnaire is developed collaboratively and is later applied to the teachers involved. This process seeks to obtain an accurate understanding of the current situation of the teaching staff, allowing the identification of areas for improvement and strengthening the quality of education in the field of engineering.

Content validity is established through expert judgment, while the reliability coefficient is determined by Cronbach's Alpha, whose ratio of 0.897 suggests high consistency. The data analysis is carried out through the use of the SPSS statistical software, with the aim of identifying the innovative practices of teachers, based on their descriptions and four psychological factors. This approach allows for a deep understanding of the impact that these variables have on educational performance, as well as on the effectiveness of the pedagogical strategies implemented in the classroom. Meticulousness in data collection and analysis is essential to ensure results that reflect the reality of the educational process and the ability of educators to adapt to the changing needs of their students.

3.1. Research design

The research focuses on a quantitative approach, through measurements and statistical analysis, it seeks to quantify the innovations implemented in the teaching of engineering professors of the Popular University of Cesar. Structured surveys will be used to collect data on innovation processes, as well as on the psychological factors that affect these processes. Hypotheses will be formulated that answer three key questions: what are the most prevalent innovations in the teaching of engineering careers at the UPC?, what psychological factors are identified as facilitators or inhibitors of these innovation processes? And to what extent is the transversality of teaching manifested in the teaching practice of engineering?

The three questions guide the analysis of the data and the discussion of the results. This discussion is organized around a theoretical framework constituted by three elements: a review of innovation in engineering education, the concepts of learning and psychological processes in the university context and the transversality of teaching. The findings indicate that innovations have been identified in the areas of motivation and the use of technological tools in teaching practice. Psychological factors linked to teachers' creativity, personality and cognitions are the most commented on in innovation processes, and their influence is directly connected to motivation. The transversality of teaching is reflected in the incorporation of components that do not belong to the area of specialty of the teachers, but that open the door to a comprehensive training of future engineers.

3.2. Population and sample

The population is composed of 84 professors from the Faculty of Engineering of the Popular University of Cesar, belonging to the higher education level of Colombia. A random sample of 49 teachers is selected, calculated with a confidence level of 95% and a margin of error of 10%.

The choice is based on the representation of the different areas of knowledge: 13 environmental and sanitary engineering; 11 in systems engineering, of which 10 are dedicated exclusively to this career; 14 of electronic engineering, 11 of agro-industrial engineering.

3.3. Instruments and procedures

Data were collected through interviews and surveys. The interview was applied to 10 engineering professors with more than 5 years of experience; the duration of the duration was recorded and transcribed in its entirety. A survey was designed using closed and open questions, valid and reliable through expert judgment and a pilot test; It was applied to 33 teachers. The content analysis technique was used to identify innovations in teaching practice and their relationship with psychological factors; The analysis of response frequencies allowed to determine the transversality in teaching.

The interview showed that the psychological factors that most influence innovation are personality, motivation and learning. The survey revealed that transversality is mainly incorporated in the teacher-student relationship and in the relationship with the environment. A set of strategies was proposed that favor innovation in teaching practice in accordance with educational psychology and favor its transversality.

3.4. Criteria of rigor and ethics

To guarantee the quality of the research, internal and external validity and ethics criteria were considered. Internal validity explored whether the sources and instruments allowed the question posed to be addressed. In terms of external validity, the approach and methodology used favored the generalization of the results, since the

construction of categories was based on triangulation and contrast with the theoretical framework. Likewise, in the collection of information, the teaching experience of the participants and the transversality of teaching were taken into account as possible factors that could influence innovation.
With regard to ethics, measures were incorporated to preserve the privacy and well-being of the participants. Prior to data collection, their informed consent was requested and they were assured that the information would be used exclusively for research purposes. The principle of non-maleficence was adopted, as participation in the research did not involve any risk to the informants.

4. Institutional context: Popular University of Cesar

The Popular University of Cesar (UPC) is a public institution of higher education located in the city of Valledupar, Colombia. Founded in 1972, its mission is to offer quality and accessible education to the population of the department of Cesar and surrounding regions, through the execution of projects that generate research, innovation and sustainable development. Its academic community, made up of 1255 students and 259 teachers, advocates for the construction of a more equitable and just society, which respects its cultural and social context and preserves the environment.
The UPC presents an academic offer of 18 undergraduate programs and 7 graduate programs, which are grouped into 7 faculties. The Faculty of Engineering offers 4 undergraduate programs: electronic engineering, agro-industrial engineering, systems engineering, and environmental and sanitary engineering. Currently, teaching is developed in 39 undergraduate subjects, in which the development of specific competencies of each program is sought and the incorporation of transversality as a mechanism of articulation between the different areas of knowledge is proposed. However, the decisions that guide the educational process are based more on administrative criteria than on true motivation, and experiences that involve innovation processes are rare. The review of the students' final projects shows the lack of practice in the development of transversal competencies, and the professors recognize that they are not incorporating transversality in their teaching practice.

4.1. Profile of the Faculty of Engineering

The Faculty of Engineering of the Popular University of Cesar offers undergraduate programs in electronic engineering, systems engineering, agroindustrial engineering, and environmental and sanitary engineering. The Faculty, despite having been created relatively recently and being of public origin, presents adequate conditions to guarantee a comprehensive training process for future professionals. The main objective of the University is to contribute to the development of the Department of Cesar through the creation of a new man, a man who integrates knowledge, doing and feeling (U.P.C., 1998). To this end, the University offers vocational training in the areas of agriculture, business, health sciences, education and engineering. The Faculty of Engineering offers the necessary conditions for its students to develop competencies that allow them to provide viable solutions to the social and economic problems of Cesar, in addition to generating, applying and disseminating knowledge in the field of engineering (U.P.C., 1998).
The Popular University of Cesar has an Institutional Educational Project (PEI) that reflects a clear intention to train a comprehensive professional, aware of their environment, capable of understanding and using scientific and technical knowledge to conceive, design and apply solutions that meet the needs of society. It also states that the comprehensive training of the student is a process oriented towards the development of competencies that allow him to perform efficiently in personal and professional life, and that the preparation of the professional must contemplate, in addition to the specific component of the profession, other contents that help him to observe reality in a global way and from complementary angles. However, the reality indicates that their training is mainly based on the teaching of basic and specific concepts of the different disciplines, and that these teachings tend to be watertight compartments, without any integration and without the intention of contributing to the full development of competencies.

4.2. Current teaching practices

The teaching practice of UPC engineering professors is based on the centralized presentation of the content of the subjects and their corresponding evaluation through theoretical exams, with little attention to the development of competencies. The focus of the process is on the knowledge that the teacher must transmit and that the student must learn. Delivering knowledge in an organized and student-centered way does not always produce curiosity or desire to learn. However, this form of teaching continues to be the most widely used, despite the fact that the transmission of knowledge through exposure is the one that contributes the least to its learning. Some psychological factors influence the lack of innovation: the perception that the student is not ready to assume his or her active role, the lack of motivation and interest on the part of the student, and the difficulty of assessing skills and competencies. The identification of these elements can help to manage learning situations that have a positive impact on learning, attitudes and performance, but the main task falls on the teacher.
Although engineering teaching focuses on the development of competencies, the focus of teaching practice is usually that of knowledge tests. Evaluation is limited to giving a different weight to each test, but the true inclusion of competencies in the process is superficially raised. This process is based on the student's learning and not on their evaluation. Decisions about how to assess are a reflection of the teaching and learning design. In order to address the transversality of teaching and learning and adequately cover the learning processes and development of competencies, the profile of engineering graduates must be consistent with that of the university's other training programs.

5. RESULTS AND FINDINGS

5.1. Innovative practices identified

The processes of educational innovation in the teaching practice of the professors of the Systems Engineering program of the Popular University of Cesar are approached from two perspectives. First, the identification of pedagogical innovation practices carried out by the teaching engineers of this university. Secondly, the establishment of the psychological variables or factors of educational psychology that affect educational innovation in teaching practice.

In the case of the first perspective, the inquiry was aimed at determining what pedagogical innovation practices are carried out, to a greater extent, by engineering professors at the Popular University of Cesar. For this purpose, a survey was applied with a list of innovation practices, for subsequent analysis through descriptive statistics. A sample was selected made up of 12 of the 17 engineers of the program, who, based on their training, work in the design, development and management of software. The review of the information allowed us to conclude that teachers practice some type of innovation in their pedagogical work, highlighting practices related to contextualization processes; those that favor the construction of learning environments; those that seek the motivation of students; those that allow the integration of technological tools and classroom projects.

5.2. Psychological factors influencing innovation

The processes of educational innovation in the teaching practice of the professors of the Systems Engineering program of the Popular University of Cesar are approached from two perspectives. First, the identification of pedagogical innovation practices carried out by the teaching engineers of this university. Secondly, the establishment of the psychological variables or factors of educational psychology that affect educational innovation in teaching practice.

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5.1. Innovative practices identified

Five groups of innovative practices in university teaching were identified: practices that incorporate novel activities in the classroom; practices that break the traditional classroom framework; practices that consider the characteristics of the context; practices that address cross-cutting issues; and practices that promote the co-creation of knowledge.

The results show that, in the Faculty of Engineering of the Popular University of Cesar, innovations in the teaching practice of engineering professors are scarce; they are limited, for the most part, to the incorporation of novel activities in the classroom; and its execution is conditioned by highly complex psychological factors: beliefs, motivations, objectives and self-regulation. The analysis is articulated with educational psychology, which seeks to understand and explain learning in educational contexts, and the transversality of teaching, which promotes the development of competencies in all students.

5.2. Psychological factors influencing innovation

The identification of psychological factors that impact educational innovation in the Faculty of Engineering of the Popular University of Cesar is based on the postulates of R. S. Wood (2007) and Cohen (2017) on second-order thought processes and mental routines. The information comes from a questionnaire designed by the author and answered by 37 teachers, whose analysis reveals that their teaching practice is rarely directed towards sustainable and positive change. Cohen's (2017) work and his proposal of resources such as the Learning Prototype Group and the Curriculum Innovation Change Model —available on his website— are also useful to expand the conceptualization of innovation.

Mental routines are considered factors that hinder innovation, and the five routines that most affect teachers emerge from the questionnaire administered: the lack of evaluation of teaching, the use of very similar materials in courses, the lack of interaction with students, the non-use of case studies and the poor relationship with industry. Other routines that are perceived as factors that hinder innovation are: not involving students in research projects, not attending refresher courses, not introducing changes in the way of evaluating, not having deadlines for the delivery of work and not offering oral exams.

5.3. Role of transversality in engineering education

The educational innovation works collected during the research explicitly show that the design of courses and transversal learning activities has an important impact on the teaching-learning process. The nature of engineering and staff training programs is reinforced by the implementation of a set of strategies designed from this perspective.

The teaching practice in the training of engineers at the Popular University of Cesar lacks, in general, a teaching perspective that contemplates the strategy of transversality. However, this is an essential characteristic in the

professional training of engineers, given that the practice of engineering takes place in an environment in which decisions and actions are carried out in an integral and multidisciplinary way, in very diverse work teams.

6. DISCUSSION

The results indicate that the professors of the Faculty of Engineering of the Popular University of Cesar have implemented a varied spectrum of innovation processes in their teaching practice. At a lower level, innovative practices related to the preparation, implementation and evaluation of teaching activities have been identified, such as the planning and implementation of active learning dynamics, the preparation of appropriate guides for laboratory practices, and the inclusion of resources that promote formative and diversified assessment. At a second level of transcendence, practices have been detected that, although they are of the academic knowledge of the teachers, present a low degree of implementation, such as the realization of integrative work and projects between subjects that are of interest to the students.

Innovation in engineering teaching practice is oriented towards the search for meaningful learning and towards the attention of the psychological factors that affect it. It starts from a recognition that creating or recreating the psychology of learning in the classroom is a difficult task, and that student motivation is an essential requirement of learning. Associated with the above, teachers are aware of the competencies and skills that their students must develop, and that it is their responsibility to guide them in their training as professionals. However, such factors are not enough to address the challenges of engineering education today, and transversality becomes a principle of great relevance.

6.1. Interpretation of the results against the theoretical framework

First, the innovation actions identified among teachers are consistent with Brinton and Holtzapple's postulates on good practices in engineering education, and with the Meaningful Learning teaching model proposed by David Ausubel and his collaborators. Likewise, the findings are related to the proposal of Bertram and Rallis, who insist that research in educational innovation should focus on teaching and learning processes; in particular about what the teacher teaches and what the student learns.

Secondly, the study allows us to conclude that, indeed, psychological factors play a relevant role in educational innovation in university contexts. The results show that the beliefs of university students about learning and instruction, and the attitudes of teachers towards their teaching practice, are variables that influence the daily decisions made by teachers about how they teach. These decisions are not arbitrary or fortuitous, but are guided by beliefs and attitudes that teachers hold about their own practice.

6.2. Implications for teaching practice

The findings presented are interpreted, from educational psychology, as a guide to promote innovative processes in the classroom and, from the transversality of teaching, as an invitation to reflect on how engineering subjects can -should- contribute to the development of transversal competencies. In order to contribute to the teacher training process, a series of innovation strategies are proposed. Innovative practices, grouped into the categories of the CEA model of Contreras, Escobar, and Acevedo, are chosen because they propose changes in the context and imply a redesign of teaching practice. The information referring to psychological factors is adapted and applied to the academic field, from the perspective of the construction of knowledge. The transversality of teaching is incorporated as a critical dimension; The development of transversal competencies is considered an educational imperative and a challenge in all disciplines.

It contributes to the teacher training process by identifying innovation strategies in teaching practice that, based on educational psychology, favor learning processes in university contexts and that allow, from the transversality of teaching, an approach to the development of competencies. The proposal also responds to the interest of the professors of the Faculty of Engineering of the Popular University of Cesar to implement new practices that favor learning processes.

6.3. Challenges and recommendations

The above considerations account for the need to generate spaces for innovation in the teaching practice of teachers, spaces that allow finding new approaches to the problems presented by their groups of students and in the subjects that are taught. However, the fact that new and different approaches to instructional strategies and to different aspects of the teaching-learning process that are usually established in teaching practice are important should not lead one to think that each class should be a different teaching experience. On the contrary, it is important that there is a space where pedagogical or didactic innovation responds to a process of research-action that extends over several subjects and involves the networking of several teachers.

This is not only a challenge for the development of the culture of innovation in the field of teaching in engineering faculties, but also becomes a response to the need for engineering professionals to be able to work in teams, to solve complex problems and to assume responsibility for ethics in engineering and its application in professional practice. It is suggested, therefore, that this need be taken into account and that the creation of a network of teachers who integrate these dimensions associated with transversality in their subjects and who, consequently, articulate their teaching work within the framework of a single formulation of these competencies in their institution, be considered.

7. Proposal for educational intervention

The proposal responds to the need to promote innovation processes in engineering teaching, in contact with educational psychology and transversality, through the design of a set of pedagogical strategies oriented to teaching practice. Among a series of strategies, the program of accompaniment to teachers in innovation processes and a space for analysis, discussion and validation of experiences are suggested, aimed at publicizing and formalizing innovative practices already in operation. Its implementation should be incorporated into the Development Plan of the Faculty of Engineering of the Popular University of Cesar.

The proposal is materialized in a set of strategies and actions aimed at promoting teaching innovation in engineering education, under the perspective of educational psychology and in dialogue with transversality. Its formulation contributes to the development of proposals that incorporate these approaches, outlining a specific plan aimed at promoting innovation in engineering education. The actions suggest a program to accompany teachers in the implementation of innovation processes and a space for the presentation and discussion of innovative experiences. Its execution should be integrated into the Development Plan of the Faculty of Engineering of the Popular University of Cesar.

7.1. Pedagogical innovation strategies

A series of strategies are proposed that allow engineering professors at the Universidad Popular del Cesar to design and implement innovations in their teaching practices, while favoring the formation of competencies by students. To this end, five types of activities are proposed that can be used in a differentiated or combined way: the creation of a space (physical and virtual) where resources and experiences can be shared, a training day in educational innovation, a series of conferences on innovation in engineering, working groups on two specific topics, and a model guide for the design of innovations.

The creation of a space for educational innovation seeks to promote a progressive change in the teaching culture of the faculty, in such a way that it is not perceived as an imposition of the administration but as a need felt by a significant number of teachers. In this space, teaching resources can be shared (class materials, work completed by students, ...), innovation experiences, bibliographic references and any other information that may be useful when innovating. To encourage their use, some resources are being designed and uploaded to the faculty's virtual platform.

7.2. Implementation and monitoring plan

The seven proposed axes of innovation include educational psychology as a basis for learning, from motivation to evaluation; the intentionality and transdisciplinary approach that define teaching practices, beyond the development of competencies; the search for meaningful learning; reflection on the teaching-learning process; respect for the individual characteristics of students; and the use of information and communication technologies. Specific strategies are suggested in each axis, from the adaptation of curricula and the promotion of research activities and social projection of students to the design of refresher courses in constructivist methodologies.

The implementation of these strategies must be done through a plan that contemplates the monitoring of the process. A schedule defines the execution of each activity and establishes the form of control and evaluation, in charge of the planning office of the Faculty of Engineering. A quarterly follow-up is suggested to allow corrective decisions to be made or the process to be redirected if necessary. A final evaluation, to be carried out at the end of the first academic period of 2014, will determine the scope and impact of the proposal.

7.3. Impact assessment

Intervention monitoring is the process of determining the extent to which the objectives of an action are being met and provides continuous information and information on the status of the process. In this sense, impact assessment is the analysis of the effects of the intervention. In the case of the proposal, its impact will be evaluated through a quasi-experimental design, which, unlike the experimental one, it is not possible to control all the variables of the process. To this end, the impact evaluation model of the National Learning Service of Colombia (SENA) will be applied, which evaluates the effect of an intervention based on three elements, namely the problem, the intervention and the indicator.

The problem revolves around the quality of the teaching practice of engineering professors at the Popular University of Cesar and the uncertainty about the positive impact that innovation strategies have on teaching practice. The intervention is constituted by a set of innovation strategies that seek to support engineering teachers in improving their teaching practice and, therefore, in the learning of their students. Finally, the indicator that allows the impact to be evaluated is the budget of the population of alumni of the Faculty of Engineering who consider that their learning was related to the innovation strategies implemented by their professors. This indicator is the result of the application of a survey to alumni that corresponds to a cohort of graduates in a given year.

8. Ethical and educational policy considerations

The etymology of the term ethics comes from the Greek "ethos", which means customs. Ethics refers to the customs, uses and norms that regulate the behavior of individuals in society, the meaning of the term can be extracted from the expression of use and custom that characterizes an individual or human group. From the perspective of research, ethics is related to the significant reflections on good and evil that arise from the difficulties, from the problems of concrete life. When an individual applies a set of ethical norms, procedures, or principles rather than to cover the basic obligations of life, he or she does so to meet other needs that are at a

higher level of his or her scale of values. Ethics is then framed in the search, selection, creation and community of knowledge, in knowledge, in truth, in the human being, in his life and, therefore, in the future of humanity.
Educational policy is related in its broad sense to all the educational problems of the country and can take on different meanings, depending on the aspect that is analyzed or emphasized: action, formulates and decides the strategy and plans for the development of the educational system; executing action, planning, organizing, directing, coordinating and controlling the action of the educational system; regulatory action, formulates the regulations that ensure the unity and integrity of the educational system; Evaluation action, develops criteria, procedures and techniques that ensure the evaluation of the educational system, in the sense of the production and use of information. These various aspects must not, however, be understood in isolation or in a pro-independence way, but must be directly related and coordinated, within a single and continuous process.

9. CONCLUSIONS

The conclusions of the study validate the proposed theoretical approach, which positions innovation in the teaching practices of engineering teachers from the perspective of educational psychology and the use of transversality as an instrument for the formation of competencies. On the one hand, although the teaching practices of engineering professors at the Universidad Popular del Cesar correspond to the classifications of the theory of learning in context and educational psychology, the innovations they implement do incorporate elements of the theory of engineering learning. On the other hand, despite the fact that transversality is not part of learning theories, the identification of transversal competencies and their consideration in the department's educational proposal contribute, among other factors, to the implementation of innovations by teachers.
The intervention proposal derived from the study implies that the management teams of the engineering programs of the Popular University of Cesar, based on the design and validation of teaching innovation strategies, produce an instrument that establishes innovative activities adjusted to the typology of engineering learning, facilitates the incorporation and evaluation of transversal competencies in the subjects, and support overcoming the psychological factors that hinder innovation. The adoption and implementation of such protocols by the management teams of each programme over a period of three years should be sufficient to meet these targets.

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