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Training strategy for local development in engineering students

Estrategia de formación para el desarrollo local en los estudiantes de las carreras de ingeniería

Estratégia de formação para o desenvolvimento local de estudantes de engenharia

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ABSTRACT

The training strategy for local development in engineering courses and the active insertion of university students in this process is an issue that should be given more attention to strengthen the Cuban social project; in addition to the importance of guaranteeing, promoting and encouraging the correct planning of local development strategies. The objective of the article is to socialize a training process strategy for local development in engineering students belonging to the Faculty of Technical Sciences, in the context of "Hermanos Saíz Montes de Oca" University of Pinar del Río. The main methods used were based on the dialectical-materialist method, such as the SWOT Matrix and a set of empirical methods among which were in-depth sessions, the Delphi method and expert criteria. As a main result, the strategy assumes a consistent approach to direct student training towards local development issues, as a logical derivation of their diploma paper and, subsequently, the work of these professionals in solving problems in the localities. The strategy demonstrated, based on the progress that was made, its contribution to improving the training process for local development through the subsequent contributions that were necessary for the purpose of the research and its structure was defined with the premises and principles; in addition to three specific strategic actions, aimed at strengthening this process in the Faculty of Technical Sciences.

Keywords: local development; strategy; university student; training; engineering, process; university.

RESUMEN

La estrategia de formación para el desarrollo local en las carreras de ingeniería y la inserción activa del estudiante universitario en este proceso es un tema al que se le debe prestar más atención para fortalecer el proyecto social cubano; además de la importancia que tiene el garantizar, impulsar e incentivar la correcta

planificación de estrategias de desarrollo local. El objetivo del artículo es socializar una estrategia de proceso de formación para el desarrollo local en los estudiantes de las carreras de ingeniería pertenecientes a la Facultad de Ciencias Técnicas, en el contexto de la Universidad de Pinar del Río "Hermanos Saíz Montes de Oca". Los principales métodos utilizados partieron del método dialéctico-materialista, como la Matriz DAFO y un conjunto de métodos empíricos entre los que se encontraron las sesiones a profundidad, el método Delphy y criterio de expertos. Como principal resultado se asume en la estrategia un enfoque consistente en dirigir la formación del estudiante hacia los temas de desarrollo local, como derivación lógica de sus trabajos de diploma y, posteriormente, el trabajo de estos profesionales en la resolución de problemas en las localidades. La estrategia demostró, a partir de los avances que se lograron evidenciar, su contribución en el mejoramiento del proceso de formación para el desarrollo local a través de las consiguientes aportaciones que fueron necesarias con el objetivo de la investigación y se definió su estructura con las premisas y principios; además de tres acciones estratégicas específicas, encaminadas a potenciar dicho proceso en la Facultad de Ciencias Técnicas.

Palabras clave: desarrollo local; estrategia; estudiante universitario; formación; ingeniería, proceso; universidad.

RESUMO

A estratégia de formação para o desenvolvimento local nas carreiras de engenharia e a inserção ativa do estudante universitário neste processo é uma questão que deveria receber mais atenção para fortalecer o projeto social cubano; além da importância de garantir, promover e incentivar o correto planejamento das estratégias de desenvolvimento local. O objetivo do artigo é socializar uma estratégia de processo formativo para o desenvolvimento local em estudantes das carreiras de engenharia pertencentes à

Faculdade de Ciências Técnicas, no contexto da Universidade de Pinar del Río "Hermanos Saíz Montes de Oca". Os principais métodos utilizados basearam-se no método dialéctico-materialista, como a Matriz SWOT e um conjunto de métodos empíricos incluindo sessões aprofundadas, o método Delphy e critérios de especialistas. Como principal resultado, a estratégia assume uma abordagem que consiste em direcionar a formação do aluno para questões de desenvolvimento local, como derivação lógica do seu trabalho de diploma e, posteriormente, do trabalho destes profissionais na resolução de problemas nas localidades. A estratégia demonstrou, com base nos progressos evidenciados, a sua contribuição para a melhoria do processo de formação para o desenvolvimento local através dos consequentes contributos necessários ao objectivo da investigação e a sua estrutura foi definida com as premissas e princípios; além de três ações estratégicas específicas, que visam potenciar este processo na Faculdade de Ciências Técnicas.

Palavras-chave: desenvolvimento local; estratégia; estudante universitário; treinamento; engenharia, processo; universidade.

INTRODUCTION

With the arrival of the Industrial Revolution in the 18th century, local development took a new turn. Industrialization transformed local economies, creating new employment opportunities and stimulating economic growth. However, it also brought with it significant challenges, including labor exploitation and environmental degradation.

In response to these challenges, the modern concept of local development emerged in the 20th century. This approach emphasizes sustainability, social equity, and community participation. Rather than focusing only on

economic growth, local development seeks to improve peoples' quality of life and to preserve the environment for future generations.

Local development is a necessary element that is transversal to the integrated professional development of engineering students. Therefore, universities, key knowledge actors, play an important role in the battle for local development. The insistence on the latter distinguishes the position of the University Management of Knowledge and Innovation for Development network in the group of actors working for local development in Cuba.

An important aspect is the need to promote development through the efforts of each nation. The Sustainable Development Goals (SDG) emphasize this need, as there is concern and uncertainty about financing to achieve the 17 objectives set out in them. There is strong questioning about the unsustainability of current development styles that threaten the resources and well-being of future generations (Girón, 2016). This situation threatens all Latin American countries, so efforts must focus on seeking all avenues to promote development.

Universities have a key position as training institutions in the tide of knowledge, the amount of technology and processes that take place at great speed and that emerge and are constantly being built in the contemporary world. These societies try to improve the quality of life of their populations and have sought alternatives such as working towards "the local" within them. Here universities play an essential role, and it is also for this reason that the processes that take place in them must be prioritized at all levels, especially their function of training for local development through the human resources that are trained there; it is to provide human capital with innovative scientific and technological knowledge that allows strengthening the unavoidable social needs so that it can function in the knowledge society, and to advocate for a sustainable environment, as attention to the comprehensive training of the student (Tobón, 2015).

While it is true that the main contributions of universities to local development at a national level are concentrated in diagnoses and strategies, Cuban universities have shown great willingness to adapt to the changing contexts that are increasingly required, which enables their contribution to the expansion of the frontiers of knowledge and, therefore, to the training of human resources that they have to contribute to development from intelligent proposals, not only at a theoretical level but also practical.

The particular case of training for local development has precedents of significant importance, such as the work of Palop (2015) and Pérez (2011), with their local initiatives that constitute mandatory consultation materials due to their enlightening nature.

Thinking strategically consists, to a large extent, in the ability to identify the main actions or means that allow achieving the greatest results in the shortest possible time. It is, then, considered that the possibilities for creating a local development strategy, among other things, are given by the feasibility of exploiting the potential of resources (physical, human, economic, financial, technological, sociocultural or social capital, etc.).

From the above, it can be inferred that strategies are always conscious, intentional, participatory and aimed at solving problems in practice; therefore, each of these definitions contributes greatly when it comes to assuming one of them in favor of our final objective.

The strategy that is socialized is based on the training practice as an important element, where the active collaborators (students, teachers) are the beneficiaries themselves. This work aims to present a training strategy for local development in the engineering courses of the Faculty of Technical Sciences of the "Hermanos Saíz Montes de Oca" University of Pinar del Río.

MATERIALS AND METHODS

To obtain the results of this strategy, different methods were used as part of the diagnosis and that start from a dialectical-materialist approach, which allowed to highlight the contradictory and developing nature of the relationships of the components of training for local development from the training processes [Faculty of Technical Sciences (FCT) (Table 1)].

Table 1- Local development from training processes

Total students	Course	Sample/%	
716	Regular daytime	250 for 34.91%	
389	By meeting	194 for 49.87%	
Total number of teachers	Type	Sample/%	
97	Fixed template	78 for 80.41%	
14	Part time	14 for 100%	
Total number of managers	Post	Sample/%	Level
11	Dean of TCF	1 for 100%	Dr. C.
	Director GEDEL	1 for 100%	Dr. C.
	Director of Training	1 for 100%	Ms. C.
	Department heads (7)	7 for 100%	2 Dr. C. / 5 Ms. C.
	Head of the Strategic Management Centre for Local Development in Pinar del Río (Provincial Government)	1 for 100%	Ms. C.

The selection, in the case of students and teachers, was probabilistic and was carried out

by simple random sampling for finite populations with a margin of error of 5% and a confidence level of 95%, also based on the latest update of enrollment data by the secretariat which was carried out on February 2, 2024. In the case of directors, the selection was by non-random sampling or by pure intentional sampling, taking into account their contribution.

In-depth sessions were also used within the empirical methods.

Among the methods used to validate the strategy, the Expert Criterion method was used, which constitutes a tool in the Social Sciences to achieve reliability in empirical or theoretical inquiries; within this, the Delphy Method was used, taking into account that their competencies and the sources that allow them to argue their criteria are reflected in it. For the application of the Delphy method, a questionnaire was used with the purpose of selecting the experts within a group of potential experts.

RESULTS

Results for each method used

SWOT Matrix: Based on the matrix analysis carried out, those combinations that have the greatest impact on the training process for the local development of engineering students were determined, calculating the highest absolute matrix value of each quadrant, which allowed establishing the main strengths, weaknesses, threats and opportunities in order of impact, which are presented below.

The result of the diagnosis revealed the following *weaknesses*:

- Insufficient knowledge of local development as a process associated with the comprehensive training of engineering students.
- Insufficient training actions for process actors at all levels.
- Insufficient recognition of local development as an important process for solving demands for social problems.

The following *threats* were determined:

- Accelerated social, scientific, technological and productive changes imply constant transformations in educational processes that threaten the systematicity of the training process for local development.
- The participation in scientific events by students and teachers who can make contributions in terms of local development is limited by resolutions that do not allow progress towards technological improvements.
- Government participation must be effective in terms of budgeting for projects, otherwise they will stagnate in the initial models.

The following were identified as *strengths*:

- There is a faculty of excellence interested, in addition, in promoting the resolution of social problems based on strategic processes for the country, managing them efficiently.
- Existence of a significant potential of students in engineering courses, also interested in providing solutions to the problems that arise.
- There is full will on the part of the governing body to carry out and endorse agreements at all levels to achieve local development for the Pinar del Río community.

Opportunities were identified:

- Development of research in the field of local development.
- Existence of the Strategic Management Center for Local Development (GEDEL), as a basis for the management of the local development process from the training processes that Pinar del Río university needs.
- There is also a Strategic Management Center for Local Development (government), which already works together with the TCF Smart City Project in the Telecommunications and Electronics Engineering program.

In-depth sessions: students show a greater understanding and motivation of what local development means and the importance it has for their professional training and their actions in society. Teachers achieve a greater understanding and involvement in working "on the local" from the first years of their studies, explaining, directing and encouraging students as the articulating axis, in favor of participating in science and technology forums and scientific events in general, always keeping in mind that their contributions have a strong sense of social and local development, which favors the quality, efficiency, relevance and effectiveness of this important process.

There is a growing awareness among the directors of managing the work of the faculty from science and technology, with a strong foundation towards "the local". In this same way, they will work with those responsible for processes such as the Academic Year Principal Professors (PPAA) and department heads of the area, in favor of the integrality in the functioning of the processes of the faculty and the University.

Delphy Method: In this case, among the directors (11), the following were taken into account within the CTF: dean, GEDEL director, UPR Training director, head of the Center for Strategic Management of Local Development in

Pinar del Río (Provincial Government) and seven department heads from the different careers of the faculty.

The following characterization of their competence coefficient was followed. All of them had years of experience in management positions and in functions directly linked to the topic, and therefore also had an implicit interest in it. This method is used taking into account that it reflects their competences and the sources that allow them to argue their criteria. For the application of the Delphy method, a questionnaire was used, with the purpose of selecting the experts within a group of potential experts. In it, the behavior of these values in the group of experts is observed. Subsequently, the necessary empirical information was collected from the subjects selected as experts, who were given a document containing the fundamental aspects of this research and a questionnaire where, based on six indicators, the proposal made was subject to individual assessment. The analysis of the information offered by the experts on the proposed indicators to verify the validity of the proposed strategy and its implementation in the Faculty of Technical Sciences of "Hermanos Saíz Montes de Oca" University of Pinar del Río reveals the necessary results. The cut-off points allowed determining the category of each indicator according to the experts' opinion.

By applying the expert consultation, the proposed strategy was enriched with respect to strategic actions in two moments: the first was directed to the development of the training program for engineering students and the second to the training of teachers and directors of the faculty in this important subject. The consultation carried out contributed to enrich the foundations of the proposed strategy and to arrive at the following conclusions regarding the level of importance of the proposed actions to enhance the training process for local development in engineering students of the Faculty of Technical Sciences of "Hermanos Saíz Montes de Oca" University of Pinar del Río.

Expert opinion results

- All the experts also concluded that the strategy was essential, as well as, its relationships, the determination of its stages, training components and principles in its structure based on its impact. They considered the foundations of the strategy to be useful, determined that the specific actions of the strategy were very useful and recognized the value of each indicator as very useful and essential, highlighting the contribution of each of them to enhance the proposed training strategy.
- The attention to the systematic and pertinent insertion of students and teachers in projects of local and community development, linked to prior social problematics of the territories, as formative axis of engineering careers.
- The adequate students' formation in the meaning of the science, the technology and the technological innovation as a resource for engineering careers.

The design of the strategy structure took into account the determination of the potential of human resources that is underutilized and unaware of the issue of local development and its social importance, in addition to the needs to be met not only at an institutional level but for society as a whole (Silva, 2003).

To do this, it was designed as follows:

I. Introduction: The principles and premises of the strategy are determined in a precise and concrete manner.

II. Diagnosis: to identify the existing strengths, weaknesses, threats and opportunities to implement the fundamentals through the strategy, as well as its structuring.

III. General objective: aimed at enhancing the training process for local development among engineering

students at the Faculty of Technical Sciences.

IV. Specific strategic actions: promoting training for local development of engineering students from the Faculty of Technical Sciences.

V. Strategy evaluation: evaluates the development of training for local development of engineering students, taking into account the theoretical foundation expressed during the research.

The proposal of this logical method constitutes a tool that allows to strength the formation and development of learnings for local development. This It is executed by means of a succession of the stages and phases that make up the diagnosis of the students and professors' formative needs until the assessment of the proposal, contributing to the integration of knowledge, skills and values relative to the local development, to the students' socioprofessional context, for solving local problems in an innovating creative way. Although the evident results that in the research are associated to the innovation and knowledge management for local development from the implementation of good practices, there is still a limited treatment from the disciplines and subjects in relation to the model of professional formation.

Foundation of the structure

Introduction: The strategy proposed based on training for local development in engineering students of the Faculty of Technical Sciences and its specific strategic actions, implies the dialectical articulation among the research problem, objectives and methodology, so that this transversalizes the process itself.

Therefore, the proposed strategy is based on the following *premises*:

- It must present alternatives that encourage change agents to work not

only for the benefit of economic indicators but also for social, economic, political, ecological, etc. indicators; in addition to integrating, raising awareness and motivating the social actors involved in this process.

- Be dynamic, flexible and able to adapt to changing situations.
- It must be structured based on specific actions that direct local development from the curricular and extracurricular dimensions, with the conception of the local as a multidimensional, integrative and transdisciplinary process.
- It should be based on the results of the diagnosis to enhance local development work in students and to train the teaching staff, including the education-instruction process in formation and taking into account the role of the theory-practice link as a way of integrating the individual into society and its concretization in the teaching-learning development process.

The following are determined in the strategy as *principles* that support local development:

- Comprehensive and systemic approach to development. Harmonious action of the four dimensions: economic-productive, environmental, institutional and sociocultural. The four are inseparable and as such must be worked on.
- Strengthening institutions. The support and will of the faculty and university's main staff must always be at the center of the process, strengthening existing structures in three fundamental directions: horizontal relations; building appropriate work styles and methods for integration; and defining priorities for development.
- Promoting self-management participation. Participation of all factors (students, teachers, managers) must be taken into account, encouraging the exercise of responsibility and the importance of this indicator to achieve the necessary goals.

- Development of capacities and tools for information. Existing information from the diagnosis and the foundations are used.
- Knowledge management, innovation and technology transfer. Need to develop strategic alliances to establish close links with research centers, universities and other organizations to support proposed solutions. Likewise, the work and results of the Municipal University Centers (CUM), the Ministry of Science, Technology and Environment (CITMA), the Forum of Science and Technology, the National Association of Innovators and Rationalizers (ANIR), the Technical Youth Brigades (BTJ), and the National Association of Cuban Economists (ANEC) must be integrated as part of an innovation system that supports the demands of local development from the institution and towards the community.
- The systemic nature of the components involved in the professional training process of engineers in relation to local development, in which the availability of resources (human, material, business and financial) and the participation of public and private agents interested in the initiatives play a decisive role as key elements.
- The contextual character for local development in engineering students of the Faculty of Technical Sciences. From this principle, the student is conceived as a historical-social subject, whose experiences and life experiences, determined by the context, mediate his professional training, since this process does not develop outside the interaction of the environment with the context. In this aspect, the perspectives of the socio-formative approach to the context are also taken into consideration, since when working on local development from the training processes, aspects associated to its problems in each space of socialization are also worked.

Diagnosis is a process of continuous feedback and improvement, where the state of the phenomenon is taken into account throughout its history and with all its interrelations. It was carried out by applying techniques to identify strengths, weaknesses, threats and opportunities (SWOT Matrix), in order to implement the foundations through the strategy, as well as the structuring of the latter.

In this case, it was carried out on the five (5) engineering courses of the Faculty of Technical Sciences, aimed at determining the real state of the weaknesses and strengths of the process in question, in order to, based on the criteria and assessments of students, professors, managers and specialists in the subject of local development, reason a viable proposal, structure and propose the strategy (Fig. 1).



Fig. 1- Representation of matrix analysis

Diagnosis. SWOT matrix

Strengths-Opportunities (SO):

Based on the analysis of the results of this quadrant, it can be seen that the value of prepared and excellent human resources, as well as the trajectory of the process in the TSF, allows the use of opportunities, which can facilitate the link with society and the development of research in the field of local development, in a more conscious and directed way, as well as the existence of a study center. A high importance is

noted in the professional preparation of the members of the university community and the link with society, these being fundamental aspects to take into account in order to propose a strategy that impacts positively on the formative process for the local development of engineering students.

Strengths-Threats (ST):

This quadrant shows that it is necessary and essential in the training for local development of engineering students to contribute to the training of actors. This allows us to be in line with the current demands of accelerated social, scientific, technological and productive changes that imply constant transformations in educational and, above all, training processes, and to contribute to the comprehensive training of the university community and society; that is, to minimize threats from the environment, based on the use of the strengths of an excellent faculty and human resources.

Weaknesses-Opportunities (WO):

The analysis of this quadrant leads to prioritizing the training of social actors at all levels and working on the basis of a strategy that allows optimizing the training process for local development in engineering students, taking into account the opportunities of the environment to eliminate or to reduce the main weaknesses, which are related to the lack of knowledge of local development as a training process.

Weaknesses-Threats (WT):

The lack of knowledge of local development and its importance for the integrality of the student in engineering courses, the lack of training for the actors in the process at all levels, together with the changing conditions of the environment that impose new challenges on Higher Education, leave a mark on the STF to accelerate its processes and adjust them according to the current demands of social, economic, political and cultural development, in order to contribute and objectively fulfill its social mission.

General objective: aimed at enhancing the training process for local development among engineering students at the Faculty of Technical Sciences.

Specific strategic actions

In order to achieve the general objective mentioned above, strategic actions were determined to allow the coordinated direction of the training process for local development in engineering students.

1) Diagnosis of the students' training needs in relation to local development from the individual perspective of each engineering degree.

To implement the proposal, it is necessary to identify phases of the stage such as: prior knowledge of the training needs of the student of each specific engineering degree from a personal, social and professional perspective, in accordance with the professional model; establishing regularities, including the degree and the year being studied, to determine the starting level and expectations of the students as essential elements to enhance the training and development of learning for local development from the exercise of the profession.

2) Development of the methodological strategy in engineering courses, so that it contributes to the proposed objectives.

The objective of this strategic action is to establish the dimensions of the content based on the determination of the system of knowledge, skills and values that becomes an essential theoretical basis for facing problems at all levels directed towards local work.

To develop this strategic action, the following operations are proposed:

- To develop a system of knowledge that takes into account socioeconomic, didactic, pedagogical, etc. factors.
- To determine the skills to be trained (procedural) and define the value system.

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3) System of training workshops for students and training for teachers and managers of the Faculty of Technical Sciences.

The active participation of the professor as a driving force of the training process towards local development is part of the engineers' professional training process, and his systematic training is, therefore, a pre-requisite for achieving the expected results. The professor's role cannot be only that of transmitter of knowledge, but he must guide and help to build understanding and interpretation schemes that allow transforming information into knowledge.

This action aims to prepare students, teachers and managers of the Faculty of Technical Sciences, in the contents that refer to local development from the determination of the contents to be taught by the teachers, mainly by the GEDEL Study Center.

To develop this strategic action, the following operations are proposed:

- To design a workshop system aimed at training for the local development of engineering students.
- To design a training course on topics geared towards "local issues", aimed at professors and managers of the Faculty of Technical Sciences.

These specific actions will be evaluated based on the following indicators:

- Contribution of local development to the training process of engineering students.
- Scope and effectiveness of the actions proposed by the methodological plan.
- Students, teachers and managers' level of satisfaction with the workshop system and the training course for local development.

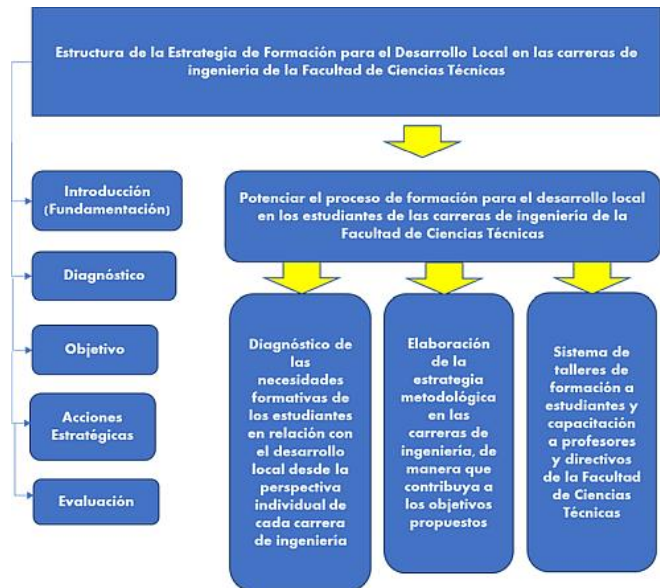


Fig. 2- Representation of the strategy
Source: own elaboration

As it can be seen in figure 2, in the strategy there is an interrelation among strategy intertwines the initial diagnostic work, the methodological work and the improvement as fundamental paths that impact the quality of the training process for local development, in the engineering courses of the Faculty of Technical Sciences, at all the levels that are reflected.

Fundamentals of strategy

In terms of training for local development, Higher Education has monitored the institutional processes according to which a training institution manages, operates and evaluates during this process. Macro strategies have been created at an institutional level to address the needs of local development from the CES, with ethnographic and anthropological studies that broaden the importance of the interaction between theory and practice, with contributions from knowledge situated in the work and derived to local development from the training processes of the university student. The differences between successful and unsuccessful territories are believed to be explained in the same way as other conditions, by the emergence and

enhancement of this intangible capital. The basic theoretical assumptions of DL, as set out by Arocena (2002), are based on Evolutionism (Rostow, 1963). This is a paradigm that is linked to the evolutionary process in which, in summary, it is stated that there is a positive evolutionary dynamics of DL, whereby there are natural brakes due to local traditions, but which are ultimately overcome towards positive and progressive development. Historicism proposes strategy as a key word, since contingency, the unprecedented and the novelty are based on the national profile and the specific locality. However, this model specifies that only the elites take part in the process, it is not a process guided by society. We have Structuralism, which despite having strong Marxist roots does not promote a new development model, since local actors do not play any role, and inevitably leads to underdevelopment. It is an endless circle in the same system and it is not possible to analyze development processes without involving the three dimensions highlighted by the analyzed paradigms: history (change, specificity, autonomy); the system (functioning, universality, interdependence) and the model (representations, generalization, utopia) (Gallicchio, 2002). From a methodological point of view, it has three main categories of analysis:

- Development mode: the different forms that the local socio-economic structure has taken in recent decades. How comprehensive the process has been.
- System of actors: which are the relationships and links among the governmental, business and socio-territorial subsystems.
- Cultural identity: identifying the identity traits that have an impact on development processes; just as in relation to decentralization we speak of "reinvention of politics", at the level of local development, we must speak of "reinvention of the territory".

This challenge is conceived in three dimensions:

- Knowledge aimed at renewing the paradigms and scientific disciplines involved in local development processes.
- Politics with the objective of building a collective project, which generates policies in horizontal and territorial logic (networks), rather than in the traditional vertical and sectoral logic (centralist).
- Management, taking charge of the necessary institutional adaptation of local government bodies. This work, in the particular case of training for local development, has precedents of significant importance, such as Palop (2015) and Yglesias (2017) works; with their local initiatives, which constitute mandatory consultation materials due to their enlightening nature, for the correct understanding of the training for local development that we intend to achieve in the country. Taking into account the conceptual theoretical analysis and the foundation set out above in the research, in the opinion of the authors, the training of university students for local development in engineering careers supports the need for a comprehensive, contextualized and continuous diagnosis of what this process really means and its needs, which are also changing. The support of this theoretical budget, based on the relationship between education and the transformation of society, enhances the role of the training process in which they are integrated, starting from the training for local development as a process and how this affects the professional and comprehensive training of the student, taking into account that, in the case of the engineering student, his training would be directed to work towards the local. In this research, which includes a strategy of the training process, the skills as strategies or methods of mastery also express the contents of the training, which in Cuban Higher Education professionals are structured from a broad profile model. In

our case, this work is specifically referred to students of engineering courses, since the evaluation of the impact of science and technology constitutes a strategic need, as a way to verify the development of a country, its scientific policy, as well as its management in function of society and the human beings who live in it.

Evaluating the strategy

The development of training for local development of engineering students is evaluated, taking into account the theoretical foundation expressed during the research.

In order to determine the effectiveness of the actions implemented and the transformations produced in the actors and in the dimensions to be addressed, it is essential to control the teaching process, the research and extension activity based on a systematic control and evaluation of the fulfillment of the methodological work plan; the evaluation is conceived as an intentional and systematic process to assess the functionality and effectiveness of the strategy to be implemented. All of this, taking into account the objectives and goals foreseen in terms of training for the local development of engineering students. To do this, a group of actions will be taken into account that demonstrate knowledge and know-how on the part of both students and teachers, to deduce the effectiveness and awareness of the actions implemented.

The evaluation of the general strategy involves monitoring the evolution of the results of the implementation of specific strategic actions. The partial evaluation will be carried out at the end of the semester and the final evaluation at the end of the academic year.

The self-assessment was carried out by each of the participants taking into account the results obtained during the process and the progress verified from knowledge to practice.

The hetero-evaluation will be carried out by the personnel in charge of the process, taking into account its level.

The combination of different forms of evaluation will facilitate systematic monitoring and the feedback necessary for an adequate exercise of criticism and self-criticism by those involved in the process, as well as awareness of its importance based on the achievements or failures in the process.

As part of the validation of the results obtained in this research, in accordance with the proposed strategic actions, a partial introduction into educational practice is carried out. This is carried out in two directions, one based on improving the training process for local development in students of this specific engineering, as an initial experiment, and the other aimed at improving teachers and directors of the faculty itself, in this case of the Telecommunications and Electronics Engineering degree.

This action is carried out with the purpose of verifying the functionality of the strategy, so the partial introduction of this strategy into practice is carried out, in accordance with its implementation with the following actions of the proposed strategy:

- Training course aimed at teachers and managers of the Telecommunications and Electronics Engineering program on topics related to "the local" (first semester, 2021-2022 academic year).
- Workshop system aimed at training for local development, for students of the Telecommunications and Electronics Engineering degree (second semester, 2021-2022 academic year).

The training course for teachers of the course in question is applied earlier, for an adequate logic in the acquisition of the contents and knowledge; in the case of students, they will be better supported by a more successful intervention of the teacher in the subject of training for local

development based on their knowledge in the training course they received previously.

Following the improvement actions, the participants were offered the data collection method: in-depth sessions that allowed to verify the incidence of these, in such a way that the contents related to training for local development were systematized with a systemic and contextualized character; with this, also the need for its improvement from a perspective in favor of the integrality in the functioning of the processes, both university and social, that occur in the environment.

Results of the in-depth sessions. Criteria provided

Students show a greater understanding and motivation of what local development means and the importance it has for their professional training and their role in society.

Teachers achieve a greater understanding and involvement in working "on the local level" from the first years of their studies, explaining, directing and encouraging students as the articulating axis, in order to participate in science and technology forums and scientific events in general; always keeping in mind that their contributions have a strong sense of social and local development, which favors the quality, efficiency, relevance and effectiveness of this important process.

There is a growing awareness among management of directing the work of the faculty from a scientific and technological perspective with a strong foundation towards "the local" and this is also the case with those responsible for processes (PPAA, department heads) in the area, in favor of the integrality in the functioning of the processes of the faculty and the university.

DISCUSSION

It is necessary to emphasize the mechanisms and instruments created by the Ministry of Higher Education and the "Hermanos Saíz Montes de Oca" University of Pinar del Rio to guarantee, promote and to encourage the correct planning of local development strategies from the training processes of the careers studied there, and due to the strategic importance that this relevant process has at the country level for the improvement of our society from the university as the center of social, cultural, economic and all kinds of policies.

Although the concept is not very current and has been criticized for its broad scope (Muñoz *et al.*, 2007), it is quite close to the multilateral and comprehensive nature of local development. It identifies four dimensions that are embodied in the socio-human, economic-productive, socio-cultural and environmental aspects; also including indicators such as territoriality, population, sustainability, education, culture, health, collaboration, and its implementation through public or governmental policies.

In Cuba, research on local development and training is still not abundant, despite the need to continue advancing in this regard. Authors such as (Martinez, 2022) have studied the impact of university education from the sociodemographic aspect as a way to diagnose to a certain extent their permanence and success at the university. This, without delving into how beneficial it would be to include work towards the local from training for greater permanence not only in the university but also in the community itself, in order to solve the problems that concern it and, at the same time, to create a sense of permanence. Others, such as González *et al.* (2019), have analyzed the evolution of the concept of development and its relationship with training from university extension, highlighting that the strengthening of the capacities of the population in the territories and its impact on local development have a strategic role in the process of updating the Cuban economic and social model, with a marked economic vision of

the process; although the proposals related to research skills and knowledge management are recognized and highlighted. Thus, from the training processes, the educational environment (university), the organizational environment (workplace where the student interacts as a professional) and the community environment (community) emerge scenarios whose spheres of action of the engineering student are seen from the point of view of the socioeconomic structures themselves, the introduction of innovations, both in the productive business base and in the institutional one, which is what we work on next. That is why there must be unity between the teaching received and the activity as a concrete expression of the engineer's work towards the local, which turns it into a constant and dynamic source of development learning and enhances local development as an outlet to achieve the resolution of problems at all levels of its performance in an efficient manner. We can add to this criterion what was expressed by Guzón (2002, p. 67), when he refers that the above must "...start from an elaborate strategic projection and a plan that will change and evolve with the practice of the managers themselves. But this development is not totally independent, but it must remain interconnected with the environment and form part of the logic of national development."

In Velázquez (2023) analysis of the development of education in Cuba after 1959, the process of educational training in the country and its evolution towards a cutting-edge training are broadly reflected, based on the absorption of foreign and local educational models that include work towards the local, not only from the medical sciences, which constitutes its area of expertise, but also from Higher Education in the Cuban university. As we can see, there is not much agreement regarding the terminology and unity of criteria between the authors, but there is regarding the functions to be assumed in local development as a process, so local development is assumed as a necessary element in the training of professionals in engineering careers and this process is tempered to the modes of action of the same from the need for:

- Assume local development as a dynamic and systemic process that visualizes engineering courses and their contents from the subject and disciplines, so that they are strengthened from the academic, labor and research perspectives.
- In terms of the curriculum, local development is assumed in engineering courses as a means to enrich and improve the quality of life of the community, the municipality and the province from respectful proposals, valuing the diversity of situations that would be addressed in a problem bank and that would make possible the analysis of the complexity of the territory from mini-laboratories, which would look inside and outside our institution.

It is important to note that the purpose of education for local development entails the need for a new development model based on knowledge from education, since it is the teacher's task to provide students with local skills; so that they develop in social contexts determined by problems to be solved, related to development (Luna-Nemecio, 2019).

It is agreed that it is not correct to identify development only with economic growth, since the latter is a necessary but not sufficient condition for the former to materialize. Development, after all, "is a process that generates social well-being. A process that involves the expansion of productive, sociocultural and political capabilities and opportunities of society itself." These authors agree that local development is based on the identification and use of the endogenous resources and potential of a space. Also, they do not only consider the economic aspect to successfully carry out a local project or undertaking.

In summary, the training process for local development of the Faculty of Technical Sciences has made significant progress since the implementation of the strategy, which has

allowed a leap forward in some indicators that were slowing down the process. Such is the fact of seeing local development only as a process that leads to economic results, a greater awareness of its importance as a result of the training process and, therefore, of the graduate's comprehensive training.

The training process for local development has been interesting in the sense that, although the strategy initially had engineering courses as its background, the first course in the TCF that has its own local development project is the Bachelor Degree in Labor Education, with objectives that include environmental education, communication, coexistence and the use of ICT and it contributes mainly to homes for the elderly, daycare centers and homes for children without parental care.

However, their involvement in some courses of the Faculty of Technical Sciences is still low (9). There remains a group of courses that, despite their particularities, have made more discrete progress.

Training for local development cannot be seen exclusively from an economic perspective; however, what distinguishes the social aspect of this process from the merely economic aspect has to do with the political, social and technological aspects of a society, which are often so interrelated that it is difficult to study them separately.

In this order, the contextualization of training for local development in Higher Education students is only effective if it contributes to truly improving the community and local work actions are implemented (Hernández, 2019).

Training for local development is a feature to be included in university educational models, so it is essential that HEIs move from traditional teaching to training with a greater connection to the real problems that arise in different social, organizational and local scenarios.

Training for development at the university should stop focusing on learning content and evaluating it and should be oriented towards local development through the search, understanding, analysis and application of scientific and technological knowledge. This implies that training should start from the beginning of careers in all the spaces for this, in the localities to avoid the isolation of the student from the context, to work on the problems that he needs and learn to take a sense of belonging to his profession, his locality and thus avoid him going to practice in places far from local needs.

This is why, training should not be viewed only from the perspective of training technical skills, since as an educational resource it also has a role in social construction by influencing the models and types of society to be built from their relationships with the context and their inclusion in territorial development plans.

Training is, therefore, considered an essential component of local development, since it provides people with the skills and knowledge necessary to contribute to the growth and progress of their community, and as they develop, so do the opportunities for training, creating a cycle of continuous growth and learning.

This is why, it is also important that the professionals who are responsible for directing these processes be creative in innovation and knowledge management. But they must also interact with other important and decision-making figures in the environment who see the university not only as a center for producing knowledge but also as one that helps to solve local problems.

The path to local development in Cuba is conceived by educational institutions as part of the preparation of future professionals, considering that they are relevant to achieving this. This requires knowledge, scientific, technological and innovative capabilities. The Higher Education system is capable of playing a

relevant role in addressing the needs of development.

Adequate training for local development from the university is synonymous with developing professionals with skills that are up to par with today's world.

The training strategy for local development for engineering students was defined through three specific strategic actions, aimed at strengthening this process in the Faculty of Technical Sciences, from a systemic perspective: one aimed at improving students' knowledge of the subject and the other at improving teachers and managers' knowledge in the area. The consultation with experts confirmed the validity and relevance of the strategy adopted and demonstrated its contribution to improving the training process for local development.

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