Original article

Innovation management training at the undergraduate level at the University of Granma

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ABSTRACT

Training in innovation management from the undergraduate level is a necessity for today's society. It is, therefore, a priority for university students to incorporate competencies that allow a relevant professional performance in the labor context once graduated. In view of this challenge that emanates from the functions of the university as an actor of the Management System of Government Based on Science and Innovation, a methodological proposal is made for training in innovation management from undergraduate level at the University of Granma.

Keywords: Undergraduate training; Innovation management; University students.

Introduction

The training of comprehensive, competent professionals, with innovative spirit and political and ideological firmness, committed to the Revolution, who meet the needs of graduates for the sustainable development of the country, is a strategic objective of Cuban universities. It is the essence of the aforementioned Higher Education Institutions to seek to respond with relevance to the demands of each of the territories where they are located.

Within the objectives of the sectoral project (I+D+i)¨Innovation management in universities in southeastern Cuba. Science, socio-productive practice and territorial development ¨ (2021), training in innovation management from the undergraduate level has been considered, as a key to realize the mission of the university before its functions in a System of Government Based on Science and Innovation. (Universidad de Oriente, 2021).

In this sense, actions were oriented to allow a diagnosis of the current state of the subject in the universities of southeastern Cuba and, in particular, of the University of Granma, as well as the realization of a methodological proposal for its use in the careers studied in the referred institution of Higher Education.

This article intends to socialize the results of both research tasks whose results can be perfectly generalizable to other careers and universities.

Based on the Dialectical Materialist Method, scientific research methods such as analysis and synthesis, historical-logical, induction-deduction and a system approach are assumed for the development of the research.

We worked with the careers that have greater affinity with the strategic sectors defined in the realization of the project: Food Production and Biopharmaceutical Industry, which are studied at the University of Granma (Veterinary Medicine, Agronomy, Forestry, Industrial, Economics and Accounting and Finance).

Development

I. Diagnosis of the current state of innovation management training at the undergraduate level at the University of Granma.

The diagnosis was aimed at deepening the treatment that, from the curricular and extracurricular aspects, was being given to training in innovation management in the selected careers, for which three fundamental tasks were defined:

1. Definition of indicators and measurement instruments.

2. The selection of the sample.
3. The application and analysis of the results.

The results of their materialization that constitute regularities in the careers that are part of the sample, in summary, are the following:

Base Curriculum.

- In all the careers, there is content associated with the appropriation of the scientific method expressed in at least one subject of the Main Integrative Discipline.
- There are limitations in the integration and systematization of the research skills that are the basis of the professional's mode of action.
- It is insufficient to take advantage of the potentialities of the research work as an organizational form of the teaching process.
- Weaknesses are evidenced in the articulation of the organizational forms of the teaching process, as a function of the research competence. (The class and work practice are hierarchized, to the detriment of others such as research work, self-preparation and study practice, which prevents to show in all cases the integration of the Academic-Labor-Learning-Research-Extensionist components.

Own Curriculum.

- There is no hierarchy in the mastery of the scientific method through specific subjects.
- There are subjects in the technical and economic sciences that deal with the subject from very general contents.

Optional-elective curriculum.

- There are subjects in the optional curriculum that promote scientific culture oriented toward the profession.
- The optional curriculum is oriented to complement the deficiencies in training, derived from the gaps in the basic curriculum.
- Revolutionary changes in the state of the art of the science of the profession are not addressed, which limits the capabilities to manage innovation in the base link.

- There are no specific elective subjects for the treatment of innovation-related topics.

Student Scientific Work

Among the main elements that illustrate the current situation of student scientific work are:

- Insufficient motivation and preparation of students to face scientific work.
- Limitations in individualized attention and tutoring by professors and researchers.
- Insufficient dissemination of student scientific activity.
- Little activity and prominence of the figure of the Student Assistant dedicated to research.

Methodological proposal for training in innovation management at the undergraduate level

On the basis of the detected regularities, the group of researchers made a methodological proposal aimed at achieving a contribution to innovation training from the undergraduate level, based on the fundamental normative basis of the Ministry of Higher Education and the methodological basis of the careers:

• Resolution No 47/2022. Regulations of the Methodological Teaching Work of the Ministry of Higher Education, Resolution No. 116 /18, Program of the Integrating Main Discipline as well as the Model of the Professional.

The elements contained in Resolution No. 47/2022 Regulations of the Methodological Teaching Work of the Ministry of Higher Education, regarding the fundamental organizational forms of the teaching work in Higher Education, among which is the students' research work (article 270. 1 of chapter XI), and, in a clear way, the reference made in articles 141 to 148 of chapter III, to the essence of this organizational form of teaching work is orienting, stating that it has the purpose of "forming skills proper of technical and scientific research work, through work practice or other tasks that require the use of elements of the methodology of scientific research" (p.72), at the same time, the following are declared as fundamental types of student research work: course work, diploma work and extracurricular research work.

The indications issued by the General Director of Undergraduate Studies of the Ministry of Higher Education, Velázquez (2021), in a workshop held on November 3, 2021, with Vice Rectors in charge of the process, show the necessary articulation between the curricular and extracurricular dimensions for the formation of an innovative professional from the undergraduate level, which also constitutes the guiding basis of the proposal.

In response to the diagnosis and aligned with the regulations and guidelines stated, it is necessary to improve comprehensively the training of students in innovation management, which is achieved from the management of research work in the undergraduate, from the curricular and extracurricular dimensions.

From the curricular point of view, it is proposed to work on the consolidation of the necessary research knowledge and skills from the first year of the course. This proposal incorporates actions associated with a general and transversal component that follows a development logic for each academic year in alignment with the subjects, internships, course work, and diploma work, at the times established within the study plan. It incorporates the treatment of contents associated with the proposed subject matter from elective subjects, relevant to the careers under analysis, although they can receive enrollment from others, according to the management conception of this curriculum at the University of Granma.

In order to achieve effectiveness in the management of student scientific activity, the following requirements must be met:

- The development of a scientific method of work in students.
- The interdisciplinary and professional approach of the curriculum activities.
- The establishment of different levels of systematization of the professional mode of action in each year of the course.
- Research activity as a professional function.

It is perfectly possible to comply with these demands since we have the potentialities offered by the curricular design of all the careers, which have in their conception the Integrating Main Discipline and the subject "Research Methodology", depending on the objectives and characteristics of each one. Therefore, the conception and location of this subject should be improved in order to ensure that research work is developed from the first year. The subject that gives introduction to the career, which, in a general sense, is

located in the first year, it is pertinent to take advantage of it and, from its content, to intend the research training.

The necessary evaluations should be made on the treatment of research work, with emphasis on project management and innovation from the subjects in each academic year and what they, from their content system, can contribute to its improvement, since all the subjects of the curriculum have the potential to develop skills in this direction and provide the necessary tools for it.

The **Course Work** is part of the curricular conception of the Student Scientific Work and includes its realization associated or not to the evaluation of the subjects. Coursework linked to the evaluation of a subject constitutes one of the types of final evaluation. In this case, the student, through the solution of problems or professional tasks, must be able to deepen, broaden, consolidate and generalize knowledge; these may be integrative and interdisciplinary works, taking into account that the solution of the problem posed implies the interaction of knowledge. As a final subject evaluation, the degree of fulfillment by each student of the objectives proposed for this type of work is checked, depending on whether it is associated with those formulated in the subjects, disciplines or academic year in question, so that they contribute to evaluate the degree of fulfillment of the general objectives proposed, which will serve as a complement for the awarding of the final grade. Orienting it to the proposal of concrete solutions to existing problems defined in the bank of problems of the institutions is a way of contributing to the formative purposes related to innovation management.

Something similar can occur in the course work not associated to subjects. The possibility that this can be oriented from the first years with a systematic control of its progress by the year group and the assigned tutor, and that its evaluation is carried out at the end of the 3rd academic year, allows checking the level of development of the research skills achieved in the period. Its organization and execution is individual, students must demonstrate competences to deepen, broaden, consolidate and generalize the knowledge achieved; apply, with independence and creativity, the techniques and methods acquired in other organizational forms of the teaching-educational process and develop the methods of scientific work. It is essential that this work be oriented to the solution of a problem that manifests itself in productive or sociocultural practice.

The **extra-class work** occupies an important space in the partial evaluation of the subjects of the curriculum to check the achievement of partial objectives of one or several topics, it gives the possibility to each student to apply the knowledge acquired in

the search for solutions to problems posed from the content, so as to generate a space for research appropriate to the level of development of the skills of the year, this type of work should be integrative, can be oriented in different ways, which should be discussed and approved in the collective of the year. Its use for the development of students in innovation management should be used with greater intentionality.

Recognizing the **Diploma Paper** as the fundamental form of study culmination is a priority in the implementation of the Student Scientific Work in each career, therefore, it should be oriented from the first years, and its articulation with the other types of research work of the students in order to achieve coherence and take advantage of each result that the student achieves during the career.

In order to address the formative research strategy of each career, it is necessary to define the skills to be developed in each of the years, aligned with the objectives of these and, therefore, coherent with the contents worked on in the subjects, the organizational forms and the forms of evaluation. In this sense, a proposal is made that contemplates the main ideas worked from the Vice Rector's Offices that attend to the undergraduate and graduate processes:

For the first year:

Skills: observe, identify, summarize, record, record, inquire, gather information, communicate

Proposals for action

- Familiarization with the research process.
- Observation of the possible problems with the help and guidance of the tutor.
- Identify the existence of the problem.
- Collect information.
- Organize the bibliography.
- Explore the reality object of research.
- Elaborate content and bibliographic cards.
- Elaborate summaries with the information gathered.
- To elaborate papers after orientation.
- Communicate orally the results of their research activity during the year.

For the second year:

Skills: observe, summarize, inquire, question, communicate, design, diagnose, characterize, appraise.

Proposals for actions

- Diagnose the object of research.
- Elaborate the diagnostic instruments.
- Evaluate the results of the diagnosis, once it has been applied.
- Determine the research problem.
- Select the methods to be applied in the research.
- Characterize the stages of the research process.
- Design the research process (elaborate the theoretical and methodological design).
- Evaluate the dynamics of the research process.
- Communicate the results of the research process.

For the third year:

Skills: questioning, communicating, designing, characterizing, assessing, hypothesizing, theorizing, critiquing, demonstrating.

Proposals for action:

- Execute the tasks proposed in search of the solution to the scientific problem.
- Critical appraisal of the literature consulted in the development of the research.
- Interpret the information obtained and process the data obtained.
- Elaborate hypotheses.
- Characterize the research process in general.
- Evaluate the results.
- Demonstrate theoretical and practical mastery of the proposed solution.
- Demonstrate the effectiveness of the proposal in the solution of the scientific problem.
- Elaborate the research report.
- Communicate the results of the research process.

For the fourth year:

Skills: questioning, communicating, designing, characterizing, assessing, hypothesizing, theorizing, critiquing, modeling, demonstrating.

- Model a proposed solution to the problem.
- Evaluate the results of the introduction in practice.

- Verify the veracity of the hypothesis.
- Demonstrate theoretical and practical mastery of the proposed solution.
- Demonstrate the effectiveness of the proposed solution to the scientific problem.
- Elaborate the research report.
- Communicate the results of the research process.

The proposal includes three **elective subjects** that address the knowledge identified in the initial diagnosis of the Project as necessary to mitigate the identified barriers.

- Subject 1. Innovation Environment /Hours (30 H)

General objective: to provide students with the basic knowledge to interpret, study, understand and explain the conceptual and legal foundations of innovation and the management of this process.

Knowledge system:

Basic concepts: reflections on science, technology and society. Concept of science. Concept of technology. Impact of science and technology on the development of society. New knowledge economy. Comparison between the old and the new knowledge economy.

Innovation fundamentals: conceptualization of innovation. Global references. National references. Classification of innovation.

Legal framework of innovation in Cuba: Legal basis of science and technology. Decree Law of Science and Technology. Intellectual Property regulations. Public policy in science and technology, at national, provincial and municipal levels.

The importance of technological innovation: innovation ecosystems in the world and in Cuba. Triple/Quadruple Helix. The innovation process.

Subject 2. Knowledge, technology and innovation management /Hours (30 H)

General objective: to train students in skills that will allow them to propose knowledge management and innovation systems through the evaluation of productive vocations and mega trends, the use of technological surveillance and foresight tools to improve organizational innovative capacity.

Knowledge system: concepts of innovation and knowledge management: a) Research b) Technological development c) Innovation d) Knowledge management, importance, application and relationship of innovation and knowledge management with technological projects and business development.

Technological innovation, types of innovation and its characteristics, importance of innovation culture. Concept and characteristics of innovative companies.

Knowledge management models, their structure and application. Knowledge management system characteristics.

Innovation process and innovation models. Key activities of innovation processes.

Concepts, characteristics and importance of: a) Technology watch b) Technology foresight c) Benchmarking (with focus on technology).

Process of organization of technology watch systems. Technology foresight methodology, Benchmarking methodology in the technological innovation strategy.

Intellectual and industrial property, its elements, importance, characteristics and application.

Technology transfer process and its importance. Elements of a technology transfer contract.

Concepts of megatrends and technological structures. Main technological megatrends.

- Subject 3. Creativity and innovation for sustainable development /Hours (30 H)

General objective: to form in students a system of scientific-technical knowledge and skills that will enable them, through technological and innovation management, to contribute to competitiveness in the business sector and sustainable development.

Knowledge system: building sustainable development in favorable environments for creativity and innovation: regional integration, national innovation systems and competitiveness. Public innovation policies as instruments of economic, social and sustainable development. Policy instruments.

Sábato's triangle as an engine of territorial development. Strategies for linking actors to stimulate innovation. New forms of cooperation between public and private actors. University-business-government linkages: characteristics and actions for promotion and development. Reflections on institutional innovation.

Knowledge, talent and intellectual capital as a tool for innovation. Knowledge management: approaches, methodologies and cases. Strategies and organization for knowledge management. Intellectual capital and talent management in organizations. Indicators of knowledge, intellectual capital and talent management.

Technological management for sustainable development. Alternative technologies and energies. Technology transfer. New technologies in conservation and environmental

protection. Environmental, social and cultural aspects of technological innovation. Technology for social, urban and environmental management.

Innovation management in companies. Organizational innovation culture, technological culture. Processes of organizational learning and creation and accumulation of capabilities for innovation management in the company. Innovation management in MSMEs: adaptation of global tools and development of specific tools for innovation. Successful cases of innovation in organizations, innovation governance.

I+D+i project management.

Technology management in new organizational models. New economic actors. Support mechanisms for the creation of innovative companies. I+D results and creation of technology-based companies; methodologies and experiences. Information and communication technologies as support for innovation.

Tools to support I+D+i management. Scientific and technological foresight, technological information, forecasting tools, technology maps. Technological monitoring and competitive intelligence. Evaluation of I+D+i activities. Methodologies and experiences. International cooperation in I+D+i: opportunities and challenges for management.

Another element to consider in the work of the Student Scientific Groups (GCE) as one of the ways to implement the strategy of formative research, its necessary linkage to the project, orients it to research that allows addressing a practical problem and the introduction of its results in order to solve them. It is formed at the beginning of the second year of the career, so the work of the first year group is fundamental in terms of orientation, execution and control of the research work and the management of the department and study centers in each of the disciplines they direct; this group can be enriched or renewed in the following years if necessary.

The organization and control of the research activities developed by the different Student Scientific Groups and the selection of the students that integrate them are carried out taking into account:

- The result of the integral diagnosis.
- The research performance demonstrated, according to the objectives of the year.
- Motivation and interest shown in research and the search for solutions to the problems they face.

The incorporation to the GCE has to become a stimulus, a recognition to those students who stand out in the scientific work, they conform the quarry for the management of talented students and for the accomplishment of the exams of prize, it allows to manage the quarry of students to opt for prize to the scientific merit, therefore, its conformation must be prioritized in each career, this requires a systematic, differentiated and oriented attention to this end.

The CGEs are formed according to the lines of research approved by the faculty, although some may be created to incorporate students from various careers and areas of knowledge in order to provide an interdisciplinary approach to the problems posed. The members respond to the specific cognitive interests and research skills demonstrated by the students during their studies. In the management of the student scientific activity it is necessary to consider the existence of a competent tutorial activity.

The **student assistants** (AA) are students of high teaching achievement, previously selected in the careers, both in the central headquarters and in the municipal and branch university centers. They should distinguish these students, faster assimilation rhythms, favorable aptitudes for learning one or more disciplines of the study plan and for scientific research.

The selection of the AA is a process that begins in the 1st year with the diagnosis of the development that the students are reaching and they can be chosen preferably at the end of the first year; at the end of the process, the dean officially approves the students that integrate the AA movement. Once selected, they can direct their preparation to achieve their training as teachers, or to scientific-technical work, according to institutional needs, and with the aptitudes and motivations that the student possesses.

It is necessary to strengthen the figure of the **AA dedicated to research**, from the incorporation of projects, scientific publications together with their tutors, as well as their stimulation in the participation in the events convened at different levels and that will pay the Scientific Merit Award, in correspondence with Res. No. 116 - 2018 of the MES.

Conclusions

The diagnosis made to determine the current state of innovation management training at the undergraduate level at the University of Granma revealed that there are deficiencies in the correlation of the different organizational forms of the teaching process in terms of research competence.

The formation of research skills should be considered under an integrating approach of the curricular and extracurricular, starting from the incorporation of students to I+D+i projects, directing the tasks towards the bank of territorial problems. It is important to prioritize the research method in the teaching and learning process in order to achieve cognitive independence, scientific production and its orientation towards innovation, all of the above in line with the professional's modes of action.