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Methodological preparation for the teaching-learning process management of the Industrial Engineering

Preparación metodológica para la dirección del proceso de enseñanza-aprendizaje en la Ingeniería Industrial

Preparação metodológica para o direcionamento do processo ensino-aprendizagem em Engenharia Industrial

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ABSTRACT

The work presents solutions alternative to the problem of the limited knowledge of the teachers of the Department of Industrial Engineering of the Faculty of Mechanical and Industrial Engineering of

the Central University "Marta Abreu" of Las Villas, regarding the direction of the teaching process- learning of Business Resource Planning systems within the subjects of the career's own curriculum. The objective is to propose a system of methodological preparation actions for teachers of the Industrial Engineering career that includes systems (ERP) as content. To respond to the problems raised in the research, the materialist dialectical method is followed with the link between qualitative and quantitative analyzes. Observations, interviews and document analysis have been applied in the stages of diagnosis, implementation and discussion of results. The main results are methodological actions within the methodological work plan that, with a systemic nature, prepare the teacher for the use of Business Resource Planning systems in the direction of the teaching-learning process. It is concluded in the research that with the application of the proposed methodological actions the theoretical and practical knowledge about Business Resource Planning systems and their inclusion in the contents of the subjects of the own curriculum are raised, an issue that contributes to offering solutions to the company from the academy.

Keywords: actions; learning; teaching; methodological preparation; Enterprise Resource Planning Systems.

RESUMEN

El trabajo presenta alternativas de solución a la problemática del limitado conocimiento de los docentes del departamento de Ingeniería Industrial de la Facultad de Ingeniería Mecánica e Industrial de la Universidad Central "Marta Abreu" de Las Villas, en cuanto a la dirección del proceso de enseñanza-aprendizaje de los sistemas de Planificación de los Recursos Empresariales dentro de las asignaturas del currículo propio de la carrera. Como

objetivo se persiguió proponer un sistema de acciones de preparación metodológica para los docentes de la carrera Ingeniería Industrial que incluye como contenido los sistemas de Planificación de los Recursos Empresariales. Para responder a la problemática planteada en la investigación se sigue el método dialéctico-materialista con la vinculación de los análisis cualitativos y cuantitativos. Se han aplicado observaciones, entrevistas y análisis de documentos en las etapas de diagnóstico, implementación y discusión de resultados. Como resultados principales se exhiben acciones metodológicas dentro del plan de trabajo metodológico que, con un carácter sistémico, preparan al profesor para el empleo de los sistemas Planificación de los Recursos Empresariales en la dirección del proceso de enseñanza-aprendizaje. Se concluye en la investigación que con la aplicación de las acciones metodológicas propuestas se elevan los conocimientos teóricos y prácticos sobre los sistemas Planificación de los Recursos Empresariales y su inclusión en los contenidos de las asignaturas del currículo propio, cuestión que contribuye a ofrecer soluciones a la empresa desde la academia.

Palabras clave: acciones; aprendizaje; enseñanza; preparación metodológica; Sistemas de Planificación de los Recursos Empresariales.

RESUMO

O trabalho apresenta soluções alternativas para o problema do conhecimento limitado dos docentes do Departamento de Engenharia Industrial da Faculdade de Engenharia Mecânica e Industrial da Universidade Central "Marta Abreu" de Las Villas, no que diz respeito à direção do processo de ensino-aprendizagem dos sistemas de Business Resource Planning nas disciplinas do próprio currículo de carreira. O objetivo foi propor um sistema de ações de

preparação metodológica para professores da carreira de Engenharia Industrial que inclua os sistemas de Planejamento de Recursos de Negócios como conteúdo. Para responder aos problemas levantados na pesquisa, segue-se o método dialéctico-materialista com a articulação entre análises qualitativas e quantitativas. As observações, entrevistas e análise documental foram aplicadas nas etapas de diagnóstico, implementação e discussão dos resultados. Como principais resultados, são expostas ações metodológicas dentro do plano de trabalho metodológico que, com um carácter sistémico, prepara o professor para a utilização dos sistemas de Business Resource Planning na direção do processo de ensino-aprendizagem. Conclui-se na pesquisa que com a aplicação das ações metodológicas propostas levantam-se os conhecimentos teóricos e práticos sobre os sistemas de Business Resource Planning e sua inserção nos conteúdos das disciplinas do próprio currículo, questão que contribui para oferecer soluções para a empresa da academia.

Palavras chave: Ações; Aprendendo; ensino; preparação metodológica; Sistemas de planejamento de recursos de negócios.

INTRODUCTION

In contemporary universities, as a result of the teaching-learning process, the integral formation of a pertinent professional committed from his profession with the social reality in its three dimensions: instructive, educational and developer must be achieved.

One of the more concrete examples of transformation in Cuban Higher Education is to transit through different

curricula with distinctive characteristics. In the new curriculum and teaching hours are reduced, bind and delimit materials, both basic training such as self-curriculum career, giving greater weight to the self-preparation and face to face teaching.

Then, it is transcendent to perfect the teacher's preparation for updating knowledge, skills and values, for their performance in the direction of the teaching-learning process.

The contemporary preparation of teachers in engineering careers should be aimed at reducing the gaps between academia and business "A function of the development and exploitation of computer systems, in correspondence with the modes of action demanded by society" (Barrera Jimenez, Barrera Jimenez, and Hernández Amaro, 2015, p. 3).

For Montes Miranda, Romero González and Gamboa Suarez (2017) the teacher must be "A specialized professional with good training, with the capacity and autonomy to make decisions, who acts in coordination with the teaching team and with the families" (p. 55).

At present it is common to find young faculty in universities, with little experience and little pedagogical training, so the direction of the teaching-learning process is affected.

To assume the preparation of the teacher as a priority must be based on the needs of the cloister; In addition, the preparation not should be on increasing activities but seize the opportunities updating content through scientific and technological advances and T technologies of Information and Communications (ICT), the latter according to Oms Palenque, Navarro Leyva, and Franco Luis (2018):

They have become an important and decisive means of teaching-learning so that students can learn more, train better and develop from their identification and application for the formation of knowledge, experiences, skills and habits as components of their culture, while incorporating study methods and modes of action according to the levels of independence associated with age (p. 2).

It should also be taken into account that teacher preparation must "Respond to social demands and individual needs. These demands and needs guide the apprehension of updated knowledge and the improvement of skills and values to fulfill the tasks" (Rivas Almaguer, Pérez Soria and Hernández López, 2019, p. 269) of the student body that attends the teaching - learning process. This requirement demands teachers capable of assuming any challenge, no matter how complex; comply with "The current process of improvement of Higher Education in Cuba has as one of its aspirations to achieve a graduate who has professional skills that allow him to perform with social responsibility and that promotes his education for life" (Santaya Domínguez, Breijo Worosz, and Piñero Peña, 2019, p. 55).

In Resolution 2 of 2018 in Chapter II, articles 17 and 18 on methodological work, it is defined that this is "The work that, supported by Didactics, perform the subjects involved in the teaching - learning process, in order to achieve optimal results in this process, prioritizing educational work from instruction (p. 651).

It is evident in the normative documents that methodological work is the fundamental link in the preparation

of teachers who, together with improvement, is one of the priority spaces to eliminate deficiencies that may arise in the direction of the teaching - learning process, whose main objective is the scientific - theoretical and pedagogical development of the teaching staff, with a view to optimizing the process in the different instances and levels of teaching.

Within the Department of Industrial Engineering of the Central University "Marta Abreu" of Las Villas there is evidence of the need to incorporate, to the methodological preparation of teachers, knowledge about the use and implementation of new IT solutions supported by ICT. One of the most widely used solutions is the Enterprise Resource Planning (ERP) systems. These systems are software that allows companies to control the information that is generated in each department and at each level; In other words, they are in charge of integrating all the organizational processes of the companies. Therefore, they have the possibility and scope of being integrated in a global way with the contents of the subjects and disciplines of the curriculum of the Industrial Engineering career.

The preparation of the teachers of the aforementioned career should contribute to perfect the direction of the teaching- learning process with the formation of scientific knowledge systems in the development and operationalization of technology and use the new knowledge that is generated in the business environment to an update of the career curriculum.

It is evident that the preparation of teachers of the career Industrial Engineering in the direction of the teaching-learning directly affects students where ERP systems and T IC as

the content of the preparation of teachers, in conjunction with the system approach of the ERP, contributes to the process of training and skills development, the teachers self - improvement and their transfer to improve the curriculum of the career Industrial Engineering.

By the application of various empirical methods with late diagnosis and the interview with the head of the department of Industrial Engineering at the University Central "Marta Abreu" of Las Villas, the survey teachers of the department and conducting class observations it was found:

- The non - inclusion of systems planning of the Enterprise Resource (ERP) as the content of the subjects of the own curriculum that is taught in the career.
- The priorities of the methodology work in the career lack of an interdisciplinary approach to systems of ERP, so the training of the future professional response is insufficient.
- Not accepting extra courses to prepare teachers in different subjects very necessary for the development of the process of teaching and learning.

Given the above considerations it is propose a system of actions of methodological preparation for teachers of the career Industrial Engineering in the direction of the process of teaching learning Systems Business Planning (ERP) supported by computer.

MATERIALS AND METHODS

The investigation took place in the career Industrial Engineering of the Industrial and Mechanical Faculty of the Central University "Marta Abreu" of Las Villas.

The population was integrated by 39 teachers directly involved in the training of undergraduate in that university; all of them were teachers of the department of Industrial Engineering that impart subjects of the curriculum of the career.

A sample of eleven professors was intentionally selected taking into account as inclusion criteria: willingness to collaborate, that they belong to one of the groups of the subjects of the Industrial Engineering curriculum and that all the disciplinary groups of the own curriculum are represented. Of these eleven teachers, four belonged to the collective of Logistics I, the second group comprised of other three professors belonged to the group of the subject Human Resources Management and four teachers to the group of the Business Information Model, in order to test knowledge of these on ERP systems, the treatment given to interdisciplinary and current trends in implementation. It was also applied an interview with the head of the department of Industrial Engineering to identify gaps and potentials in the direction of the methodological work of the department; in addition, the analysis of documents such as the methodological work plan and the lesson plans of the teachers who made up the sample. The teacher survey was used to verify their knowledge of the content related to ERP systems and their link to the teaching - learning process.

The methods of the theoretical level used were: Historical and logical analysis, for the determination of the historical background on the implementation

of ERP systems within the process of teaching and learning, with the use of technologies and systemic-structural for the conformation of the system of methodological actions proposed according to their level of hierarchy and subordination.

The mathematical method used was the percentage analysis for the quantitative assessment of the results of the observations to classes in the needs determination stage, as well as for the processing of the data provided by the surveys carried out to the teachers who made up the sample.

RESULTS

To achieve an appropriate methodological preparation in the faculty of Industrial Engineering who teach subjects of its own curriculum, it must consider the possibilities of ICT and the Information Management and Knowledge (GIC) in their production and services processes, with the corresponding added value in their results. It should also consider the relationships between systems (software) supported by ICT within the teaching preparation and their impact on the formation of future graduates, as it is shown in Figure 1.



Fig. 1 - Relationship between the components: training, ICT, ERP systems and teacher preparation

The scheme presented shows the integration of some components such

as training, ICT, ERP systems such as ICT and teacher preparation within the Industrial Engineering career, taking into account a systemic configuration and its dialectical relationships. All are influenced by the performance of subjects, so they have a personal charge.

It should be noted that among the main strengths of ERP systems there is the interdisciplinary nature and high involvement as contents of the disciplines of Industrial Engineering.

Determination of needs

After the documentary analysis of methodological work plans of the Department of Industrial Engineering courses 2017-2018 and 2018-2019 it can highlight it have been taken into account the fundamental aspects that have characterized the process of teaching and learning for training of the professionals, and the results achieved during the previous courses, as well as the composition of the faculty. In the 2019-2020 academic years, Plan E is applied, which implies the reduction of teaching hours to achieve a four-year career.

In the analyzed document (methodological work plan of the Industrial Engineering department) it is stated that the pedagogical group has the mission of improving the teaching work of the department based on a conception of a solid methodological work aimed at the priorities declared in the course, so that quality is guaranteed in the training process of the future Industrial Engineer. The foregoing indicates that the mission is accurately oriented towards raising the professionalism of the graduate.

Among the main problems to be solved, it was found that a more active and leading participation of the students in the teaching - learning process should be achieved, based on a correct

orientation of the teacher and continue working on the integration of knowledge to starting from the methodological work within the disciplines, between disciplines and in the subject and academic year groups.

The methodological line of work of the department expressed the improvement of the preparation of the cloister to guarantee the quality of the direction of the teaching-learning process, with emphasis on the active participation of students in the process, education from instruction, use of computer resources, the application of curricular strategies and the coherent operation of the base link aimed at the comprehensive training of students.

For the improvement of the methodological work of the Department of Industrial Engineering, the following needs were raised:

- Promote the contents of the teaching-methodological work with the use of computer resources in the teaching-learning process.
- Promote the treatment of computer resources as contents of Industrial Engineering.
- Develop methodological strategies for the improvement of the direction of the teaching-learning process.

It was found that the teachers preparation in the direction of the process of teaching and learning of the ERP systems corresponded directly with the overall objective of the methodological work plan of the Department of Industrial Engineering, declared as: perfect methodological preparation teachers to raise the quality of the teaching -learning process, leading to a better performance in the comprehensive training of the professional in Higher Education.

In class observations it was found that in 85 % of these was not worked ERP systems; the remaining 15 % of the classes observed include subjects that are taxed at the group of Business Informatics, discipline which is evidenced by its content, higher potentialities for working with ERP systems.

In the interview with the Head of department it could confirm that there are shortcomings to achieve greater integration between subjects. Insufficiencies to determine how each subject contributes to the objectives of the year and career are also detected.

The results of the survey of teachers who integrated the sample show that one of the teachers fulfill at 100 % with the planning, execution and control of the process of teaching - learning of the ERP systems within their subject. The remaining ten teachers have difficulties mainly with the choice of subject content and its relationship with ERP systems, with 18.3 % evaluated as good. There were also difficulties when performing teaching tasks to develop the content of the subject in connection with ERP systems, in accordance with the Organizational forms of learning (FOE), with 22.3 % well.

As a result of diagnosing the need for preparation of the teacher it was determined to address the teaching - learning of ERP systems in the career Industrial Engineering, so a system of methodological actions, corresponding to the needs detected and adjusted to the resolutions that govern the methodological work plan for teaching at the higher level in Cuba were designed.

Proposal for methodological actions

The proposal for a system of actions is aimed at satisfying the aforementioned

needs of teachers with the incorporation of new content. That proposal has as a characteristic that it will work first with the teachers of the department and then is directed to groups of subjects of the own curriculum within the curriculum mesh of the career Industrial Engineering.

Generally, it will start working with all teachers in the teaching collective of the Department of Industrial Engineering and a group of activities will be directed towards them. These activities make references to the properties, characteristics, importance of implementing an ERP system, advantages, as well as the interdisciplinary nature of the same in the Industrial Engineering career

Subsequently, it will work with the disciplines of Economy and Direction of the Process, Human Factor Engineering, process Management and Supply Chains. It should be noted that the Business Informatics group must play a supervisory role in the planning, execution and control of the development of the proposal, due to its experience in the treatment of content related to ERP systems.

Organizational levels for the development of methodological actions

- Teaching Department level
- Discipline Collective Level
- Collective level of subject

Next, the disciplines of the own curriculum with the subjects that integrate them are presented.

Business Informatics

- Business Information Modeling
- Development of IT Solutions

Economics and Process Management

- Business Management
- Economic and Commercial Management

Process Management and Supply Chains

- Logistics I and II
- Operations Administration I and II

Industrial Engineering Project

- Industrial Engineering Projects (PIII)
- Industrial Engineering Projects (PIV)

Methodological actions will run after planning and have as taxonomy: type, objectives and methodological conceptual problem solving.

The first activity is the realization of a teaching - methodological meeting with all the department pedagogical collective, to substantiate from the theoretical and methodological conceptual problems related to the direction of the teaching-learning process of ERP systems.

It is proposed as title of the methodological activity: The teaching-learning process of the skill "manage ERP systems."

This activity makes possible the analysis, discussion and decision making about ERP systems and how perfect the management of the teaching - learning process.

Methodological objective: Analyze the direction of the teaching - learning of ERP systems to make decisions regarding the treatment of the contents of the Industrial Engineering curriculum E.

Taking as starting point arrangements of the methodological

meeting it should be prepared methodology classes for the preparation of the teacher in the direction of the teaching - learning of ERP systems, using manual developed by the ERP according to the ERP system used as a teaching means for self- preparation. Methodological classes are proposed according to the needs of preparation of teachers and the achievements and difficulties encountered during the implementation of actions.

The second activity is the realization of an instructive methodological class for the pedagogical groups of the subjects of the Industrial Engineering curriculum.

In instructional methodology class, teachers will be oriented how electing an ERP system, arguing on procedures and techniques available in the literature used for this operation can occur.

In this activity it will argue and analyze how the process to select ERP system making comparisons between packages ERP type will be. Selection methodologies will be applied, implemented system valuation will be performed in Cuba and the world as successful cases, Architecture system analysis for the feasibility and applicability of the solution will be made.

The title of the methodological instructive class will be: "Enterprise Resource Planning Systems (ERP). The selection process".

The methodological problem to solve will focus on: How to select an ERP system that fits the contents, the objectives of the year, career goals and the self - learning process, under the concept of the new curriculum E?

As methodological objective it is set: Select ERP systems which, through concrete examples fit the infrastructure

and the objectives of the year, career and self - learning process under the concept of the new curriculum E.

The third activity is the realization of an instructional methodology class for all the pedagogical collective of the Department of Industrial Engineering, except teachers service with their respective subjects, whose will be: "Planning Systems of Enterprise Resource (ERP). Its interdisciplinary nature in the Industrial Engineering career".

The methodological problem to solve will be raised as follows: How to insert the contents relating to the management of ERP systems to self - curriculum subjects?

The methodological Objective is: relate the ERP systems with the contents of the subjects of the curriculum itself.

This activity will demonstrate the parameterization of a ERP system in response to the interdisciplinary nature of ERP systems .Specific configurations of the system in response to the organizational structure to be used (structure organizational of Cuban enterprises) will be exemplified and they will be personalized with the aim of adapting the workings of the system to the peculiarities of business processes of each organization and establishing roles for users.

The fourth activity is the realization of another methodological demonstration class for the whole group teaching the discipline Industrial Engineering Projects of the Industrial Engineering department. In this class, the considerations of the particularities of the subjects that make up this group are taken into account.

The methodological problem to solve materializes in: How to integrate

into practical solutions such ERP taking into account the objectives of the integrative discipline Industrial Engineering Projects I and II?

Methodological Objective is: demonstrate, through concrete examples, how to characterize the solution of an ERP system implemented in the company under study discipline Industrial Engineering Projects.

In the development of the demonstrative methodological class, examples will be given for the characterization of a solution of an ERP system implemented in the company under study. The processes of selection, implementation, operation and management of ERP systems, with application of work procedures of the industrial engineer production processes and services, its elements and interrelationships will be systematized.

The solutions implemented in companies object of the practice, stating the practical knowledge of the processes in the business environment and Cuban institutions taking into account the compliance with existing standards and best national and international practices will be characterized.

The fifth activity is the realization of the second demonstrative methodological class for the entire pedagogical group of the Economics and Process Management discipline of the Industrial Engineering department. In this class, the considerations of the particularities of the subjects that make up this group are taken into account.

The methodological problem to solve will be: How to develop practical activities from the subjects of the Economy and discipline process with the implementation of an ERP system that meets the objectives of the discipline?

It will be raised as methodological objective: To demonstrate, through concrete examples, in the discipline Economy and Management of the Direction Process the teaching - learning of the ERP systems in the new conception of the curriculum E.

In the development of the demonstrative methodological class, it will be possible to show that the contents of the basic subjects of this discipline have a high implication with ERP systems.

Within the subject Human Resources Management it is aimed the development of operation and management processes of ERP systems making inputs, outputs, storage and updating of information through specific modules such as HHRR. It will be worked Thematic such as:

- Selection of personnel
- Survey processing in the company
- Absence Management
- Allocation staff demand
- The evaluation
- Analysis and description of jobs

In the subject of Economy and Financial Management, it will be worked topics such as:

- Operations finances, and Economy and Marketing

This course will develop operation and management processes of the ERP systems making inputs, outputs, storage and updating of information through specific modules to perform financial analyzes in real time. You can configure the account structure and automate recurring periodic actions, also maintain a collection and payment management, as well as budget monitoring. In addition, all the necessary processes are contemplated for their adaptation to the accounting standards that allow financial

and accounting management to comply with the tax obligations of the companies. All these operations are carried out closely with other disciplines such as Electronic Commerce, Logistics and Marketing.

The sixth activity is the realization of another demonstrative methodological class for the entire pedagogical group of the Process Management and Supply Chain discipline of the Industrial Engineering department. In this class, the considerations of the particularities of the subjects that make up this group are taken into account.

Methodological problem to solve will be directed to: How to develop practical activities from the subjects of the discipline Management Supply Chain Process and the implementation of an ERP system that meets the objectives of the discipline?

As methodological objective will arise: demonstrate, through example, treating of the subject content of discipline Management Process and Supply Chain through ERP systems in the new conception of the curriculum E.

In the development of the demonstrative methodological class as a model teaching activity, contents related to the determination of the optimal inventory policy will be worked on, corresponding to the maximum utility and minimum cost models for perishable products, the establishment of the ABC classification method, the quantity Joint Replenishment Order Form as a way to perform inventory management for multiple items at the same time.

In this demonstrative methodological activity, it is oriented the development processes operation and management of the ERP systems making inputs, outputs, storage and updating of information through specific modules inventory management system to become familiar with the

particularities of design, based on practical experiences and research work carried out in this area.

The seventh activity will consist of conducting an educational - methodology workshop for teachers, where topics such as: The ERP systems in Cuba and the world, possible proposals for solutions such ERP that architecture fit of Cuban enterprises, possible strategies and methods for the inclusion of ERP systems in the subjects will be addressed.

It will pursue the following objectives: debate on ERP systems implementation in Cuba, success stories, alternative solutions for the architecture of Cuban companies and possible strategies for including them as content of the subjects of the curriculum the Industrial Engineering career.

The starting point of the workshop will be the particular experiences of past activities addressing questions, presentations and case studies resolutions where ERP have been implemented. It will provide teachers levels of aid to promote the maximum development of individual potential and channel it toward constructive change. The knowledge will be elaborated together; it will part from the knowledge practice (nothing will be rejected, because everything will be used in the learning process).

Activities led by the facilitator will be done, in conjunction with the group of Computer Business. Guidance will be offered to the teacher to consult bibliographic and virtual references and user manuals for the different modules of the ERP system, which pay directly to the groups of the subjects of the Industrial Engineering curriculum.

Techniques as: brainstorming; discussion; question induction; Collaborative learning; Peer teaching: instruction conducted by the teachers

themselves; independent learning; self-appraisal; review will be used. There will be a reflection about the contents worked, expectations fulfilling and assess the degree of satisfaction of the workshop developed; it will be valued appropriation of knowledge throughout the development of the workshop. There will be an estimated time of two hours.

DISCUSSION

In the design of the methodological actions system for the management of the process of teaching learning of the Planning Resources Company systems (ERP) is was considered rules set forth by the Resolution 2/2018, taking as reference notes related to the methodological work:

It is the work (...) carried out by the teachers who make up this group with the purpose of guaranteeing, prior to teaching work, the planning and organization of the main elements that, supported by didactics, ensure their efficient and effective development. Its content is oriented towards the construction of the didactics of the subject, relying on the experiences that are accumulating as a result of the systematic methodological work that is developed and the achievements that are achieved in the pedagogical research carried out for this purpose (p 654).

Other investigative postulates taken as a reference in the research are those

of García Batista (2002), who states that:

The methodological work is the system of activities that is permanently executed with and by the teachers at the different levels of education to guarantee the transformations aimed at the efficient execution of the educational teaching process, and that, in combination with the different forms of professional and postgraduate improvement, that allow to reach the suitability of the cadres and the teaching staff. It is designed in each school in correspondence with the diagnosis made (p. 275).

Taking into account the essential criteria of the consulted literature that make up the state of the art, for the conception of the methodological work, it is necessary:

- Determine priorities starting from the most general to the most specific.
- Consider the differentiated and specific nature of the content, depending on the problems and needs of each instance and group of teachers.
- To base the rational combination of sociological, philosophical, political, scientific-theoretical and pedagogical elements in the content of the work.
- Determine the conception of the systemic character, taking into account the guiding function of the objectives, by linking different organizational levels and types of activities.

In methodological work, it is necessary to attend to two fundamental directions

based on content and objectives: teaching-methodological work and scientific-methodological work.

The teaching-methodological work guarantees the improvement of the teaching-educational activity through the use of the most up-to-date contents of the pedagogical sciences and the corresponding particular sciences.

On the other hand, research has been analyzed in which ERP systems were included within the content of subjects in careers related to companies. This research highlights the great importance attached to it, by graduates, to ERP systems for the professional performance. Scholars like Hawking and Stein (2003) of Victoria University of Technology, Melbourne, in Australia, do an inquiry into the personnel handling information within

organizations. Meanwhile, Boyle and Strong (2006), University of Antigonish, Canada, conducted a study where skills on theoretical knowledge of ERP, skills about business functions and skills about teamwork were evaluated. These investigations are confined to the business environment rather than the teacher, so they do not report aspects of the preparation of the teacher in charge of the training of engineering careers. No solutions are offered that appeal to methodological work and the realization of actions that conform to the contents of the Industrial Engineering career with an organized and systemic sequence to prepare the teacher with a non-pedagogical career profile.

On teacher preparation in the Cuban context, as fundamental antecedents authors such as: Horruitiner (2011); Sierra, Castellanos and García (2013); Castañeda (2013) and Borges (2019) pose, from a global context, the preparation needs of university teachers (graduates of non-

pedagogical careers), who have deficiencies in pedagogical preparation and, in particular, with regard to the training and development of skills from their psychological and pedagogical sustenance through a didactics adjusted to the demands that it imposes on their training and the even more rigorous nature in the case of plan E; to be new, different and changes that Traverse the whole process of formation of the professional.

Among the main limitations found in the literature studied, it emphasizes that systems actions or activities of preparation of teachers on current systems for managing information only found in self-preparation.

The conception of ERP systems is only conceived as business software; therefore, in the curricula of careers related to the contents of these systems are treated by the Business Informatics Discipline.

During the research process on the subject, it has been found shortcomings in the management of the teaching-learning process of the ERP systems on teachers of the department of Industrial Engineering at the Central University "Marta Abreu" of Las Villas.

The proposal of one set of actions has the novelty that works for the first time methodological preparation for the direction of the teaching-learning systems Planning Enterprise Resource Management (ERP), within the subjects of the own curriculum the Industrial Engineering degree at the "Marta Abreu" Central University of Las Villas . The foregoing reinforces the idea that many of the answers that should be given to the problems that arise in the company must arise in the houses of higher studies. Consequently, it coincides with what was raised by Díaz- Canel (2019), who asserts that "an important part of the solutions can be

obtained from research and knowledge that is made from universities" (p. 2).

Implicitly, the dimensions of planning, execution and control are taken into account for the design of the actions for the direction of the teaching - learning process of ERP systems as contents of the disciplines of the curriculum of Industrial Engineering, as required by said process, with an interdisciplinary character within the study plan E.

The requirement to prepare teachers needs all the theoretical and methodological foundations necessary for, from their work, to be able to perfect the direction of the teaching- learning process of ERP systems in the Industrial Engineering career.

With the proposed methodological actions, theoretical and practical knowledge about ERP systems and their inclusion in the contents of the subjects of their own curriculum are raised, an issue that contributes to offering solutions to the company from the academy, in correspondence with the identified needs.

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Authors' contribution:

Michel García Pérez: conception of the idea, general advice on the topic addressed, coordinator of authorship, literature search and review, preparation of instruments, application of instruments, compilation of information resulting from the applied instruments, statistical analysis, preparation of tables, graphs and images, preparation of database, review and final version of the article, correction of the article, revision of the applied bibliographic norm.

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