

Didactic Strategy for Occupational Safety and Health in Mining Engineering students

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Introduction

Since ancient times, mining has been one of the fundamental activities for the economic and technical progress of mankind. Almost all of the material goods that man uses come from the transformation of natural products, which is why mining resources occupy a prominent place. This indicates that it is necessary for workers to be aware of the risks to which they are exposed in their jobs and to develop safe habits that tend to protect their safety and health and that of their co-workers.

However, it is not enough to require them to comply with the different standards and procedures established for the mining sector. It is necessary to work on the cognitive aspect from a pedagogical perspective that achieves a change in the attitude of the mining worker with qualitative and quantitative results so that accident prevention is a strength in them and thus avoid the consequent occupational diseases.

In this endeavor, the professional pedagogical approach of all the training activities developed and the change required in the theoretical and methodological conceptions on Occupational Safety and Health education are aspects of research interest. In this sense, Cuban Higher Education intends to contribute to the comprehensive training of professionals prepared to carry out actions that promote safety and health education and

natural resources in a harmonious way, as part of the country's economic and social development project.

In the literature consulted about Occupational Safety and Health, the following stand out: Céspedes and Martínez (2016); Gallo (2017); Román (2017a, 2017b, 2019) and the Constitution of the Republic of Cuba (2019). These researches have traditionally offered questionnaires, evaluation of working conditions and teachers' occupational health and preventive strategies, as well as duties and rights. These contributions are directed towards primary education, for the design and implementation of an occupational safety and health management system and postgraduate; however, a treatment from the pedagogical sciences aimed at Occupational Safety and Health Education is necessary for the comprehensive training of students of the Mining Engineering career.

The Cuban Standard 18000 (2005) defined it as the activity oriented to create conditions, capacities and culture so that the worker and his organization can develop the work activity efficiently and avoid events that can originate damages derived from work. That is to say, to guarantee an adequate environment with the objective of preventing and impeding the appearance of occupational diseases.

Therefore, Occupational Safety and Health ensures that workers perform their work efficiently and without risks, and prevents events that may affect their health and integrity, the entity's assets and the work environment.

In this regard, Rodríguez (2007), quoted in Guevara (2013), defined it as the systematic application of policies, procedures and management practices to analyze, assess, evaluate and prevent the different types of risks faced by the company.

Regarding its scope, the concepts of Occupational Safety and Health apply to any type of work, which includes mining. This includes the journey and the time spent going to and from the workplace as part of the working day, so that safe travel is, therefore, one of the areas that contains the subject matter in question, the object of study of this research.

The above implies achieving coherent and conscious behaviors around the understanding of environmental issues in relation to the management of natural resources, from the appropriation of a comprehensive knowledge system, and the development of general and specific skills.

Based on the above, the Mining Engineering career of the University of Moa Dr. Antonio Núñez Jiménez, should promote Occupational Safety and Health Education in

students, expressing itself in a practical, professional and integral way, which implies not only observing and implementing alternative solutions, but also contributing to transform the existing reality in the various spheres of action.

For this purpose, a factual diagnosis was made to the students of the aforementioned career, by means of which it was possible to verify that the Occupational Safety and Health Education is insufficient, which allowed the authors to specify the following problematic situation: insufficient risk perception by the students; insufficient actions in favor of the Occupational Safety and Health Education for the training of the students; and incorrect formulation and orientation of the objectives related to the Occupational Safety and Health Education, from the point of view of knowledge, skills and actions.

In this sense, the authors of this article propose to implement a didactic strategy with the objective of promoting Occupational Safety and Health Education in the students of the Mining Engineering career of the University of Moa Dr. Antonio Núñez Jiménez.

Development

Proposed teaching strategy: definition and characteristics

To achieve a better understanding of the term didactic strategy in the teaching-learning process, it is necessary to explain the concept of strategies in this research that allow the development of interdisciplinary actions. The authors Fonden (2006), Valle (2012), Fiol (2013), Rubio (2016) and García (2018), reflected in their studies that these also possess components related to each other, such as: phases or stages expressed through actions that are fulfilled to achieve the desired end, diagnosis, execution and control stand out.

According to Rubio (2016), a strategy is the sequence of stages in which a set of actions is deployed, gradually and progressively, to meet a given objective in the short, medium and long term.

According to Tebar (2003), cited in García (2018), this consists of procedures that the teaching agent uses in a reflexive and flexible way to promote the achievement of meaningful learning in students. That is, they involve the elaboration, by the teacher, of a procedure or learning system that constitutes an organized and formalized program, which is oriented to the achievement of specific objectives, previously established.

Therefore, in order for these procedures to be applied in the academic environment, it is necessary for the teacher to plan and program this procedure. For this purpose, he/she must choose and perfect the techniques that he/she considers adequate and effective when it comes to achieving an effective teaching-learning process.

The strategy proposed in this research is characterized for being didactic, due to the fact that it focuses on the teaching-learning process of Safety and Health at Work. It is related to the subjects included in Study Plan E of the Mining Engineering career. In addition, it specifies the actions to be carried out by these subjects, in each academic year, so that future professionals are educated about Safety and Health at Work, which contributes to their comprehensive training.

For its elaboration, the contents of the subjects of the career were linked, this guarantees the appropriation of a necessary knowledge system by the students to face the problems related to the processes that produce chemical transformations of substances used for the extraction of the useful components of the earth's crust, the mining atmosphere, the techniques and measures of safety and hygiene at work and the protection of the environment (in its broader natural-social-productive concept), the rational exploitation of its resources and the adoption of measures that guarantee the sustainable development of the mining activity.

In the elaboration of the didactic strategy, the components of the training process were taken into account and it is structured in four fundamental stages: diagnosis, planning, execution and evaluation. This begins with the diagnosis of the students' needs, which allows the formulation of the objectives, which must be in direct correspondence with the contents of the different disciplines of the E Study Plan of the career.

The selection of the contents of Safety and Health at Work determined the use of the methods, in correspondence with the teaching means. The evaluation was carried out in accordance with the proposed objectives, the contrast between these two didactic categories propitiated, as a feedback instrument, to establish the corrections to the design of the strategy conceived for such purpose.

The general objective of the strategy is directed to the improvement of Occupational Safety and Health Education in the students of the Mining Engineering career of the University of Moa, which contributes to their integral formation.

Structure of the didactic strategy for Occupational Safety and Health Education in Mining Engineering.

Each of the stages of the didactic strategy is listed below:

Diagnostic stage: this first stage begins with the diagnosis of the current state of Occupational Safety and Health Education in the students and of the possible links between the disciplines of the Mining Engineering career, the teacher's self-preparation and familiarization with the content, continues with the methodological analysis of the class system in a methodological exchange in the subject and academic year collectives and concludes in the introductory stage.

Objectives:

- ✓ Diagnose the collaborative actions in the teaching-learning process through methodological work in the subject and academic year collectives.
- ✓ Identify the learning needs of the students of the Mining Engineering career through the diagnosis of the current state of Occupational Safety and Health Education.

This diagnosis is necessary for the improvement of the teaching-learning process from the didactic strategy, since once the inadequacies are determined, a set of actions is applied for their correction, therefore the following are proposed:

1. Actions for the diagnosis of the collaboration and establish the interrelation and mutual enrichment of the disciplines of the curriculum of the Mining Engineering career in the teaching-learning process.

- ✓ Application of surveys and interviews to students and professors of the career before the strategy was applied.
- ✓ Determination of the possible links of Occupational Safety and Health with the contents of the curriculum disciplines, from the individual and in the exchange in the subject and academic year collectives.

2. Actions for the identification of students' learning needs through the diagnosis of the current state of Occupational Safety and Health Education in the students of the Mining Engineering career.

- ✓ Diagnosis of the treatment of Occupational Safety and Health contents from the formulation and orientation of class objectives.
- ✓ Accuracy of the needs in terms of Safety and Health at Work according to the general evaluation of the individual and collective learning characteristics (levels of knowledge, skills and values) and of the possible causal factors of the detected problems.

- ✓ Assessment of the student's attitude towards learning and determination of the level of progress when receiving help from the teacher and the group.

3. Actions for familiarization with the content.

- ✓ The teacher makes an assessment of the content to be taught, the exchange of criteria is established in the subject collectives and everything related to the knowledge, skills and values that derive from the interrelation and cooperation of the disciplines on Occupational Safety and Health is presented in the academic year collective.

Planning stage: in this stage, the general and specific objectives (per academic year) of the strategy are determined, the contents are selected by subject, the methods, teaching methods, the evaluation of the subjects, the teaching tasks and the bibliography.

Objectives:

- ✓ Establish the coordination for the methodological work of the members of the interdisciplinary and academic year group.
- ✓ Determine the didactic components for the organization of the teaching-learning process.
- ✓ Elaborate the teaching tasks linked to the subjects of the curriculum.
- ✓ To prepare the teachers for the establishment of relations on Safety and Health at Work.

The following aspects were taken into account for the selection of the content of the didactic strategy conceived:

- ✓ The selection of the content of the subjects of the career curriculum related to Occupational Safety and Health issues.
- ✓ The elaboration of teaching tasks for the systematization of Occupational Safety and Health knowledge.

The following actions are proposed for this planning stage:

1. Actions for the establishment of the cooperation coordinations among the members of the subject and academic year collectives through interdisciplinary methodological teaching work.

- ✓ Determination in the collective of the cooperative relationships that are established, in function of the solution of professional problems related to Safety and Health at Work in the exchange and collective reflection.
 - ✓ Establishment of cooperative relationships in the academic year collectives through interdisciplinary methodological teaching work, developing relationships between the disciplines of the specialty for the implementation of the Ergoenvironmental Training Curricular Strategy.
2. Actions for the resizing of the **didactic components** in the organization of the teaching-learning process. The interdisciplinary conception implies modifications in the didactic system of Occupational Safety and Health in a manner related to the subjects of the curriculum.
3. Actions for the preparation of teaching tasks with a developmental conception to deal in an integrated manner with the contents of Occupational Safety and Health, through the subjects of the curriculum, in the solution of professional problems.
- ✓ Elaboration of teaching tasks for students that promote education in Occupational Safety and Health, through individual and group work, in order to establish interdisciplinary relationships.
 - ✓ Definition of the objective, themes and system of actions that allow developing the teaching-learning process from an interdisciplinary approach. Selection and structuring of the contents of Occupational Safety and Health to promote its education, revealing links between the subjects involved.
4. Actions for the preparation of teachers.
- ✓ Analysis of the objectives to be met in the class system and its interdisciplinary role through methodological teaching work in the subject and academic year groups.
 - ✓ Preparation of the Mining Engineering professors who will work in the implementation of the didactic strategy, through methodological teaching workshops.
 - ✓ Preparation of the professors of the career who will work in the implementation of the didactic strategy individually and collectively, through a course of improvement on Safety and Health at Work.

Execution stage: in this stage the didactic strategy conceived in the previous stages is materialized. Therefore, in this research, the proposal complies with the theoretical assumptions referred to above and is aimed at promoting Occupational Safety and Health Education in the Mining Engineering career.

Objectives:

- ✓ To guide the methodological teaching work to be developed from the subjects of the curriculum with the contents of Occupational Safety and Health.
- ✓ To implement the development of the didactic strategy from the subjects of the curriculum to promote Occupational Safety and Health Education in the students. Para esta etapa de planificación se proponen las acciones siguientes:

1. Actions for the orientation of the methodological teaching work to be developed from the subjects of the curriculum and Occupational Safety and Health to favor the integration and relationship of knowledge, skills, methods and values.

- ✓ Analysis of the didactic components of the teaching-learning process to be fulfilled in the class system, organizational forms, as well as the role of the teacher and students in the subject and academic year collectives, with an interdisciplinary approach.
- ✓ Previous coordination with the professors of the Mining Engineering career who participate in the implementation of the strategy. For this purpose, an adequate selection of the Occupational Safety and Health contents to be dealt with in the classes is made in order to encourage the active, creative and developmental participation of students and professors in the management of knowledge and development of skills in an integral and interdisciplinary manner.
- ✓ Adjustment of the didactic strategy and its implementation for Occupational Safety and Health Education.

2. Actions for the development of teaching tasks.

- ✓ Development of teaching tasks by curriculum subjects and themes. Application by the professors of the Mining Engineering career of activities with a developmental conception, where students develop habits and skills for the prevention of work accidents and occupational diseases.
- ✓ Participation of students in the subjects of the curriculum under the guidance of the professors involved in the implementation of the strategy.

- ✓ Use of adequate instruments to monitor, improve and evaluate the teaching-learning process that contributes to the integral formation of future professionals.
- ✓ Linking interdisciplinary relationships in teamwork, with the application of teaching tasks, in a logical manner, for the improvement of Occupational Safety and Health Education in the students of the Mining Engineering career.

3. Actions for the practical and creative application of what has been learned.

- ✓ Presentation of works related to Occupational Safety and Health in seminars, workshops, Science and Technology Forum, Student Scientific Conferences to promote the exchange of experiences, knowledge and opinions on the subject in question.

Evaluation stage: this stage allows checking the degree of fulfillment of the objectives formulated in the disciplines and subjects of the career curriculum, through the assessment of the knowledge and skills that students appropriate and develop on Occupational Safety and Health. It constitutes, in turn, a way for feedback and regulation of said process.

Objectives:

- ✓ To evaluate changes in teachers and students of the career during the implementation of the didactic strategy.
- ✓ To evaluate the results of the effectiveness of the methodological actions developed in the proposed strategy for the improvement of Occupational Safety and Health Education.

The following actions are proposed at this evaluation stage:

1. Verification of the application of the methodological guidelines contained in the strategy through interviews and conversations with the professors of the career, as well as visits to classes.
2. Systematic evaluation of the students' performance during the teaching-learning process.
3. Enrichment of the elaborated strategy, based on the criteria and opinions derived from its implementation.
4. Readjustment and control necessary for the redesign of the methodological teaching work proposed to improve the teaching tasks.

5. Analysis in the subject and academic year collectives of the individual and group changes in the improvement of Occupational Safety and Health Education after the implementation of the strategy.

Therefore, taking into account the elements considered above, the following is proposed as a graphic representation (Figure 1) of the didactic strategy for Occupational Safety and Health Education for students of Mining Engineering at the University of Moa.:

Source: self elaboration

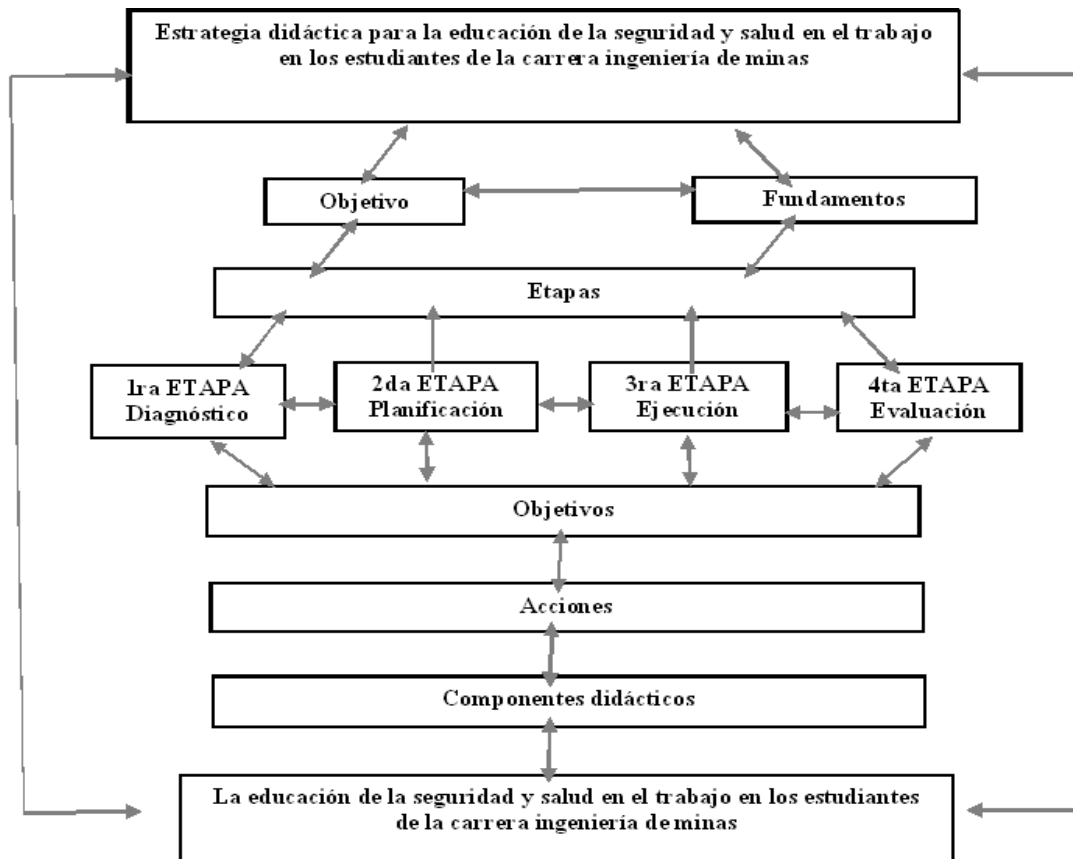


Figure 1. Didactic strategy for Occupational Safety and Health Education in Mining Engineering students.

Conclusions

The theoretical elements referred to constitute the basis on which this research is based, and the argument of the need to promote Occupational Safety and Health Education in

the students of the Mining Engineering career, through the different disciplines of the curriculum.

With the application of the didactic strategy, it became evident that it constitutes an alternative to promote Occupational Safety and Health Education in the students.

The results obtained bring about the transformation of the educational practice in the training of students of the Mining Engineering career, by means of the didactic strategy proposed to promote Safety and Health Education at Work.