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Welding skill in head position: system of actions for development

La habilidad soldar en posición sobre cabeza: sistema de acciones para su desarrollo

A capacidade de soldar em posição na cabeça: sistema de ações para o seu desenvolvimento

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ABSTRACT

At the center of the problems that are investigated in Technical and Professional Education is the development of professional skills in the process of practical teaching of welding, in the context polytechnic school-productive entity, with the purpose of competent training of the force of qualified work for its insertion in the contemporary work world. The objective of this work was to present a system of

actions for the development of the ability to weld in head position, in the first-year students of the Specialized Workers in Welding specialty, in the Primero de Mayo Polytechnic Center of Pinar del Río. The research process was carried out on a dialectical-materialistic basis and methods of the theoretical level and the empirical level were used such as historical-logical, inductive-deductive, analysis-synthesis, modeling, system approach, observation, the documentary analysis and the interview, which allowed a theoretical and practical assessment of the educational reality and the proposal of the system of actions. This result contributed to the preparation of the students to face the professional problems that demand the field of action of the specialty.

Keywords: Technical and Professional Education; skill; qualified worker; position on head; welding; action system.

RESUMEN

En el centro de las problemáticas que se investigan en la Educación Técnica y Profesional se encuentra el desarrollo de habilidades profesionales en el proceso de enseñanza práctica de soldadura, en el contexto escuela politécnica-entidad productiva, con el propósito de la formación competente de la fuerza de trabajo calificada para su inserción en el mundo laboral contemporáneo. Este trabajo tuvo como objetivo presentar un sistema de acciones para el desarrollo de la habilidad soldar en posición sobre cabeza, en los estudiantes de primer año de la especialidad Obrero Calificado en Soldadura, en el Centro Politécnico "Primero de Mayo", de Pinar del Río. El proceso investigativo se realizó sobre una base dialéctico-materialista y se emplearon métodos del nivel teórico y del nivel empírico, tales como el histórico-lógico, el inductivo-deductivo, el análisis-síntesis, la modelación, el enfoque de sistema, la observación, el análisis documental y la entrevista, que

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permitieron realizar una valoración teórico-práctica de la realidad educativa y la propuesta del sistema de acciones. Este resultado contribuyó a la preparación de los estudiantes para enfrentar los problemas profesionales que demanda el campo de acción de la especialidad.

Palabras clave: Educación Técnica y Profesional; habilidad; obrero calificado; posición sobre cabeza; soldar; sistema de acciones.

RESUMO

No centro dos problemas investigados no Ensino Técnico e Profissional está o desenvolvimento de competências profissionais no processo de ensino prático da soldadura, no contexto da Escola Politécnica - Entidade Produtora, com o objectivo da formação competente da mão-de-obra qualificada para a sua inserção no mundo laboral contemporâneo. O objectivo deste trabalho foi apresentar um sistema de acções para o desenvolvimento da capacidade de soldadura em posição na cabeça, no primeiro ano de escolaridade da especialidade de Operário Qualificado em Soldadura, no Centro Politécnico "Primer de Mayo", em Pinar del Río. O processo de investigação foi realizado numa base dialéctico-materialista e foram utilizados métodos dos níveis teórico e empírico, tais como o histórico-lógico, indutivo-dedutivo, análise-síntese, modelação, abordagem sistémica, observação, análise documental e entrevista, que permitiram uma avaliação teórico-prática da realidade educativa e da proposta do sistema de acções. Este resultado contribuiu para a preparação dos alunos para enfrentarem os problemas profissionais exigidos pelo campo de acção da especialidade.

Palavras-chave: Formação Técnica e Profissional; competência; trabalhador qualificado; posição na cabeça; soldar;

sistema de acções.

INTRODUCTION

Currently, It constitutes a fundamental purpose the training and development of skills, habits and values in students, through the educational process. It is necessary to take into account that there is a great divergence of criteria regarding the nature of these phenomena, the place they occupy in the activity and, therefore, in relation to those fundamental conditions and requirements to take into account for their training and development.

The diversity of points of view on the nature of skills is given by the multiplicity of meanings of the terms skills, habits and capacities and by the diversity of the types of activity. Professional skill is the way they work with theoretical - practical knowledge and presupposes the use of the experience gained previously, knowledge and habits without which it could not be formed. In specific professional skills, the theoretical knowledge works, above all, both in the objectives of the tasks, principles, essence, methods and procedures of teaching and education and in the methods of organizing the practical teaching process, in the knowledge which technique also apply welding.

Technical and Vocational Education (ETP) assumes the social function of contributing to the economy of the country's skilled workforce required for its development in the various branches of production and services, in which the development of professional skills plays a decisive role.

The process of developing professional skills and, in particular, in the welding process has been examined by various researchers, including Arroyo (2015), Rodríguez & Bravo (2015), Benítez & Mena (2016), García & Vargas (2016), among others. They agree on the need of the study and organization of this process for the importance of the training of professionals in different sectors of production and services. They provide definitions of the concept of ability, aspects of its historical evolution, classification and some alternatives for its treatment; and these elements constitute premises to channel this investigation.

An exploratory study conducted to the educational practice in the first year of the specialty skilled worker in welding, from the application of an observation guide to activities of practical teaching and interview teachers of the department Welding of the Primero de Mayo Polytechnic Center, allowed to verify that the students show insecurity when executing the welding in the overhead position, they do not execute the operation in a logical order, the arcing and maintenance of the arc becomes unstable and poor quality of the welding, as well as low productive performance, among other limitations.

These difficulties denote a problematic situation in which the given contradiction is seen that, students of the skilled specialty worker in welding are not getting good results in solving professional problems containing the overhead position welding. This manifests a limited development of this skill and contrasts with the need for training in accordance with the provisions of the Professional Model of the specialty, which within its objectives demands a worker with command of overhead welding to insert and solve efficiently the tasks of

the labor world concerning their occupational profile.

This work has as objective to present a set of actions to contribute to develop the weld position on head skill, in the students of first year of the skilled worker in welding specialty, in the Polytechnic Center " Primero de Mayo in Pinar del Río .

MATERIALS AND METHODS

The study was carried out at the "Primero de Mayo" Polytechnic Center in Pinar del Río, in the period between December 2018 and December 2019. A population of 14 first-year students of the skilled worker in Welding specialty, seven professors from the teaching department and four specialist instructors from the productive entities of the territory .

The process research was conducted following the dialectic research design whose methodological basis a materialistic dialectic method and used methods of theoretical and empirical levels.

The methods of the level theoretical used were:

The historical logic: enabled the study of the theoretical conceptual framework about the process of the development of professional skills is in Technical and Vocational Education in general and in particular the ability to weld into the overhead position in the skilled worker Welding specialty, from different theoretical positions.

The inductive- Deductive: allowed the analysis of the study issue passing from the general to the particular and

the singular, determining the essential in the development of the ability to weld into overhead position in students of that specialty.

The analysis- synthesis: made it easier to identify, organize and summarize the actions to be carried out in the development of the ability to weld in an overhead position in the first year of the Specialized Worker in Welding specialty at the Polytechnic Center "Primero de Mayo".

The modeling: allowed for the abstractions and generalizations that are present in the projection of the system actions.

FOCUS system: it was applied in the integration of research results, as well as the establishment of links between s actions that make up the system, establishing their interdependence.

In empirical investigations, there were used:

The observation: it was carried out in practical teaching classes to verify the current state of the ability to weld in an overhead position in the first-year students of the worker specialty trained in Welding at the Polytechnic Center "Primero de Mayo".

Documentary analysis: the Curriculum, the programs of the subjects Technology Specialty and specialty practices, as well as lesson plans and reports of academic results were checked, allowing ascertain to what extent is given treatment professional skill welding on head.

The interview: It allowed obtaining valuable information, coming from teachers and specialist instructors, about the process of development of professional skills in the Qualified Worker of the Welding specialty.

RESULTS

In this section the results obtained are presented with the application of the methods of the theoretical and empirical levels in the research. From the theoretical study carried out, the current situation of the problem is verified; also it was found that a diversity of views on the nature of the skills is given by the multiplicity of meanings of the terms skills, habits, skills and abilities and the diversity of the types of activity.

The theoretical and methodological foundations underpinning the process of developing professional skills in the qualified worker in welding, in the workshop of the Polytechnic school and productive entity, allowed determining the logical relationships between the components involved.

It was considered in the analysis that the treatment of the subject of skills constitutes one of the fundamental pillars in the training of qualified workers and is related to know- how, manifested in a system of actions and operations to influence one's own environment social work, in order to acquire not only a professional qualification, but the ability to cope with a large number of planned and unplanned situations or new in his job and teamwork.

In the case of the empirical study, the observation was applied to the 14 students in the group with the aim of verifying the state of development of the ability to weld on the overhead position, in the execution of the practical welding teaching process, starting from six indicators that allowed to evaluate it on a scale of High, Medium and low.

It was considered as well, those indicators where actions developed with the characteristics described in the items (see Table 1); as Regular,

those who showed with these characteristics mentioned there are so characteristics, but were insufficient or inadequate or confusing, that do not not very clear and as Bad, those where achieve their goal. actions were not executed with the

Table 1- Indicators to evaluate the development of the ability to weld on head

Indicators	Scale		
	B	R	M
1. Interpretation of technical documentation - - Analyze the production work to be done. - - It establishes the logical actions for the solution of the professional problem.			
2. Selection of materials for welding - - Properly selects the welding materials, tools, instruments, machines and equipment to use. - - Shows ability in the use of tables, manuals and other technical documents.	-	-	-
3. Preparation of the surfaces - - Leaves surfaces and materials free of substances harmful to welding. - - Levels the edges. - - Make bevel if necessary, according to the standard.			
4. Preparation of welding machines and equipment - - Check the technical status of these. - - Connect the conductors. - - Regulates the parameters of the welding	-	-	-

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regime for this welding position.			
5. Compliance with personal safety and work environment regulations - - Personal protective equipment is adapted. - - Take care of the health of your colleagues and the environment.			
6. Execution of overhead welding - Set the welding angles. - It takes into account the effect of the transfer forces of the filler metal. - Control the established technological succession and the correct execution of work procedures. - - Shows skill on the job. - - Manifests independence in the work done. - - It makes rational use of resources, according to what is programmed. - - It complies with the established time standards for operations. - - Achieve precision and quality in the work done.	-	-	-

In table 2 results of the observation each student, following the indicators described in Table 1 are shown.

Table 2- Results of the observation of students in the practical teaching of welding.

Students	Indicators						
	one	2	3	4	5	6	7
one	R	R	G	G	R	R	G
2	B	B	R	B	B	B	B
3	B	R	G	G	R	R	R
4	R	R	G	G	R	R	R
5	R	R	G	G	R	R	G
6	B	B	R	R	R	B	R
7	R	B	B	B	B	B	B
8	B	R	B	B	B	R	B
9	R	R	G	G	R	R	R
10	R	B	B	R	B	B	B
eleven	B	B	B	R	B	B	B
12	R	R	G	G	R	R	G
13	B	R	R	R	B	R	R
14	R	R	G	R	R	R	

Once the results were determined by indicators, a general evaluation was made, from which the students were grouped into two groups: those who achieved an evaluation in which the evaluation of B predominated, not proficient, and those in which the R evaluation predominates, poorly skilled. In this regard, they evaluated unskillful students identified with numbers: 2, 7, 8, 10 and 11. As unskillful: 1, 3, 4, 5, 6, 9, 12, 13 and 14. It confirms that the development of the ability to weld on the head in the first-year students of the Skilled Worker specialty in welding is found with notable deficiencies.

Moreover, from a documentary analysis it could be seen that the formation of professional abilities is recorded in the different curricula and normative documents of specialty skilled worker in welding is insufficient, but the methodological Indications for its development are not enough, since its procedural nature and the peculiarities of the different welding positions are not recognized.

In relation to the preparation of the subject, lesson plans and reports of academic results, little systematicity and insufficient integration of the school workshop with that of the productive entity was found to carry out practical activities. It has become clear little systemic preparation classes of teaching practice and its consistency with the specialty technology, not denoting a proper planning of tasks for skill development in overhead position welding.

In the review of the planned activities and the keys and standard evaluation, it shows that these are limited to the cognitive aspect and the systematic and procedural aspects from activities practices. In addition, the methodological preparation activities to enhance the process of developing professional skills in the Qualified Welding Worker were insufficient.

As for the interview to teachers and instructor specialists, the results of this instrument confirmed, from the view of

most respondents, the process of practical teaching of welding in overhead position is being developed without following an integrator and systemic order that contains this ability. Neither has it been given attention to the development of preliminary basic skills in the school's teaching workshop, nor to the necessary familiarization with the productive entity, before starting welding activities in this position, which is the most complex.

The previous evaluations denote the need for change in the perceived situation and, in this sense, a system of actions is presented for the development of the ability to weld in an overhead position, in the first-year students of the Skilled Worker specialty in Welding, at the "Primero de Mayo" Polytechnic Center in Pinar del Río.

It is important to take into account for the development of this skill the following aspects:

- Organize the welding process so that the actions and operations of each activity are systematized.
- Orient the generalizing ability (essential or guiding), in this case welding in the overhead position.
- Guarantee the fully active, conscious character of the learning process, gradually and organized in the solution of the professional problems of the specialty.
- Know the actions and operations that the student will carry out in the solution of the professional problem that is presented to him.
- Structure actions and operations so that they are sufficient, varied, differentiated and contextualized to the workplace, that is,

in the school workshop or in the productive entity.

- Establish the invariants of the ability to ensure ways of acting ways of the students.
- Establish one appropriate communication in the process and evaluate the mastery of skill from the determination of the indicators set out in the key and standard assessment.

Thus, through the direct observation of the actions developed by the students in the practice activities in the schoolwork shops or productive entity, it was achieved or determine which were the professional skills that conciliate better the knowledge within the practices and to verify with this the process of their training and development in the jobs that are available to them, related to welding in the overhead position.

This analysis was done in the classroom, in the workshop school or productive entity, where the students performed practical activities, paying attention to the development of classes that were performed in a theoretically and practical way. The development achieved by each student in the solution of the proposed professional problems was taken into account.

To the planning of the methodological procedure in stages for the formation and development of the ability to weld in an overhead position, significant importance is assigned; In this sense, the following were taken into account:

Stage 1. Planning and organization of the set of actions and projection of the execution of the remaining stages.

- Review of the professional model and the specialty study program.

- Determination of essential actions for the formation of the ability to weld in overhead position and what the underlying transactions.

- Analysis of the current development conditions required in the student by the established plan, which generally leads to the determination of the functional invariants.

- Order of skills, actions and operations to be ascending from the simplest to the most complex.

Step 2. Familiarization with the process of developing the ability to weld in an overhead position.

The student should be able to achieve a initial approach to the theoretical and practical knowledge, to the actions and operations that make up this skill and its link with the professional profile. In this way, he appropriates the field of action of the specialty, which allows him to master the theoretical, procedural and ethical aspects related to ability.

It must be able to identify methods, working means, procedures and related techniques with the overhead welding position.

Stage 3. Training in the execution of the ability to weld in an overhead position through training. Direct interaction between the teacher, the specialist-instructor and the student.

- At this stage it should guide the student on by which to perform action and fit the corresponding objective and to achieve this.

- Promote the role of motivation and awareness: the presence of these factors facilitate the acquisition of executions, they are essential elements in their training.

- The student, under the guidance and support levels of the teacher, of the specialist-instructor and other more able students, do practical activities to master the skill; Initially he repeats the actions and then he goes on to exercitation in an individual way.

Stage 4. Execution on an independent way of the ability to solve professional problems in the workshop of the school or the productive entity, according to planning. For this, the following will be taken into account:

- Organize and guarantee the conditions for the successful execution by the students.

- Achieve the independent performance of the students, prepare them so that they can independently and creatively solve professional problems.

Then a proposal of actions and operations associated with the development of the skill welding in overhead position is presented.

a) Action: muscle control (keep the pulse).

Operations:

- Hold the electrode holder by raising the arm above the head for five minutes at intervals.

- Move the electrode holder, in the aforementioned position, at a constant speed, from right to left or vice versa, depending on the right hand.

b) Action: set the welding angles.

Operations:

- Identify reference surfaces.

- Place the electrode at an angle of 85° to 90° with respect to the axis of the weld bead to be deposited and 45° with respect to the faces of the surface to be welded.

c) Action: proceed with welding.

Operations:

Step 1. The first thing you should do is make sure that each cable is connected in place. The electrode connector cable, usually, is located on the left side of the welding machine, while the mass or land is located to the right side (going in front of the machine).

Observation: the verification of the technical state of the equipment before starting to weld is essential.

Step 2. Adjust the intensity of current as the thickness of the work piece and the diameter of the electrode. This is calculated according to the expressions seen in the Welding Technology course. If you have obtained a converter or rectifier welding current type selected and polarity that is needed. How to select these parameters is explained below.

Step 3. Adapt to personal protective equipment.

Step 4. Prepare the surfaces to be welded. Remove dirt that may damage the quality of the weld with the wire brush or other appropriate means.

Step 5. Start the power supply.

Step 6. Fatten the arc, following the methods set tip or scratching the electrode surface to be welded.

Step 7. Separate the electrode, at the length of the arc, corresponding to the diameter of the electrode and advanced

to a constant speed, keeping the angles pre established.

Step 8. Clean the slag with a pickaxe.

Step 9. Perform the final check on the weld. Here a general check will be made of everything, the materials, the equipment and the quality of the welded joint.

As stated in step 2, it is important to consider what type of current to use and why. In this sense, the following methodological recommendations for the use of current types are stated.

Alternate Current (CA): This type of current will allow to use more power and achieve greater temperature and current magnitudes rather high, its counterpart is that the arc is turned off and on with almost the duplicate as often, and it makes it unstable, which results in joints, usually of a lower quality.

Direct Current (DC): This type of current will generate electric arcs much more stable, so the unions made will be of higher quality; However, the magnitude of the current will not be so high.

In addition to the current type selected in the presence of welding machines mentioned above, it is important to consider the type of polarity, which is responsible for regulating the distribution of the heat emitted by the electric arc. It is clarified that in the case of the Welding Transformer the polarity cannot be established, because the alternate current that it receives from the high voltage network is the same that is supplied to the output circuit. Two types are manifested:

Direct Polarity (It is produced connecting the cable of the holder electrode to the negative pole (-) of the source of welding and the ground wire to the positive pole (+) of

the source) this type of polarity is used when you want to maximize the fusion of the electrode; It is used when the material is thick, since what is sought here is to maximize penetration.

Inverse Polarity (It is achieved by connecting the power the holder electrode at the positive pole (+) of the source of welding and the ground wire to the negative pole (-) of the source): is used in thick materials having a lower penetration. It is also recommended for metals and alloys with low point of merge.

It is noteworthy that the control occurs throughout the entire implementation, from orientation to the achievement of systematization, overlooking to gradually improve results. At first, the teacher should help the student, but it is very important that they also provide the possibilities for self-control and to develop the weld.

The evaluation of the process will be carried out by observing the teacher and / or the specialist - instructor based on the guide, based on the evaluation code and standard.

DISCUSSION

Currently there are various definitions of the concept **skill**; one of the main is indicating the dictionary of the Royal Spanish Academy which states that ability comes from the lat *habilitas* - *ATIS* , is the ability, willingness and ability to execute something that a person performs with grace and skill (Royal Academy It is p ANOLA, 2014) .

García & Vargas (2016) state that, "ability is the domain of a complex system of actions necessary for the appropriate regulation of the activity.

Knowledge only is not the most important; it is even more valuable than knowledge skills show through "(p.6).

The study of how to develop skills in students is of extraordinary importance in the modern world and constitutes a fairly general problem, despite the fact that several researchers on the subject have proposed methodologies for these purposes, which include certain short and medium term.

In them different points of view are appreciated when dealing with the subject, but also coincident elements are identified when it comes to expressing the actions ; for example, determine the professional tasks, the system of knowledge that is the basis for the formation and development of skills and the methods that make it possible to activate this process; to plan, organize and carry out the teaching - learning process ; initially diagnose the development achieved by students and the state of the teaching-learning process carried out ; direct the learning of the students with an instructional-educational style, which implies an orientation, direction and adequate control of the process and evaluate the development of the ability from indicators that allow determining the level of development reached.

In practice melding teaching, traditional models have emerged. The activity focuses, fundamentally, on the teacher's presentation on the subject in question, moving to a demonstration of the operation if the necessary material basis for study is available, if it does not remain on the theoretical level; Subsequently, the student is the one who demonstrates and thus enters the exercise if the means for practice are available as previously indicated.

In this type of teaching is denoted Asystematicity and certain academicism is denoted because

it always takes into account the stage of the production entity, or a coherent set of actions for treatment, which causes limitations in the development of professional skills in the melding.

For the development of the ability to weld in an overhead position in the first-year students of the specialty Qualified Worker in Welding, in the Polytechnic Center "Primero de Mayo" in Pinar del Río, it is necessary to take into account the opportunities offered by the productive entities, possessing the most renewed technical - material base. It is there where the real professional problems that the future professional of the referred specialty must solve are present. This question is addressed in this new proposal.

Education and the world of work must not be separated, as it has happened for a long time; for this reason, actions are currently being carried out to promote the integration of educational institutions with productive ones in the training process of students, for the formation of professional skills demanded by the worker model that society requires.

Mena, JA, Aguilar & Mena, JL (2019) highlight the need for training and the development of practical activities in labor entities, under the direction of the school, which implies the development of professional skills .

This idea, supported by the aforementioned researchers, refutes the purely academic training of the professionals that prevailed in previous periods; those theories posed that technical education of young people is achieved with the structuring of processes and pedagogically well thought over selected contents from the school .

The didactic foundation of the training and development of professional skills in the welding technique is highly complex because social, personal and technical factors interact in this process that is planned in advance but is modified in its development by the participant subjects and by influencing external factors.

Technical ability refers to the ability to use technical tools or procedures in a specialized field; it is the possession of knowledge and skills in activities involving methods, processes and procedures. Therefore, it implies the skillful use of specific instruments and techniques (Arroyo, 2015).

All skill has a structure of actions, operations and components, and these must be mastered by the student manifesting the action knowledge, the skill has already acquired. Skills can be formed and developed on the basis of the subject's experience, knowledge and habits, so knowledge and skill have a consistent relationship.

Knowledge is a basic premise for skill development. Knowing is mastering the content; This happens when it is interesting for the student and imply to operate with it, use it, add it to the processes of the activity that is conducted: In this study the overhead position welding.

Through the activity, the students, as subject relate to the object and other subjects and transform them in correspondence with the object and the level of motivation feels by this.

For Oviedo & González (2016), "the structure of an activity serves as the foundation for the structure of skills, which are, knowledge (as an epistemological basis), actions and operations (as executing components) and the motives and

objectives (as inducing components)
" (p.252).

Welding, in different positions, becomes in an activity containing the above - described components. These positions refer exclusively to the position of the welding shaft in different levels to be welded. Basically, there are four positions of welding and all require knowledge and mastery of the welder for the execution of a welded joint.

In the execution of welding, parts that cannot be placed in a comfortable position appears, preferably horizontally. According to the reference plane, the following four welding positions were established:

- Welding in a flat position.
- Welding in horizontal position on vertical plane.
- Welding in vertical position.
- Welding in position on head.

It should be pointed out that in overhead welding the forces involved in transferring the filler metal through the arc act negatively; with greater incidence the force of gravity, which causes the detachment of molten metal, which tends to fall on the operator, as well as the emanation of metal vapors, fumes and other elements made up of nanoparticles. This requires extreme personal security measures to minimize the harmful effect on health.

According to Blamey, Mosquera & Díaz (2016) " All these nanoparticles, due to their size and morphology, have their main route of entry through inhalation, entering the respiratory tract, and that due to diffusion or the action of macrophages, would have the capacity of reaching neurons and affecting the

central and peripheral nervous systems " (p.28).

In addition, the use of suitable filler materials reduces splashing and smoke emissions. In this regard, it is appreciated that Oñoz, Rodriguez & Fadruga (2017), has analyzed the selection electrode. Puello, León, Gómez, Muñoz & Blanco (2018) they refer to the affections of heavy fumes from welding tasks on the operator's health.

The analyzes carried out in the present investigation allowed us to conclude that an adequate system of actions allows projecting, organizing, executing and evaluating the development of the ability to weld in an overhead position, in a way that contributes to the training of a competent professional and in tune with the demands of the established professional model.

With the system of shares contributed to the practical teaching of welding, both in the workshop of the polytechnic center and the productive entity from the integrated elements, highlighting the methodological suggestions are provided for the development of the referred ability.

The scientific novelty of a proposed outcome was evidenced, given in the elements that from the theoretical, practical and technical point of view integrate it and that reinforced the related knowledge to the topic under investigation, in students, teachers and specialists instructors of the productive entities.

The research topic is relevant and current, as it responds to one of the pressing problems of the ETP: training and development of professional skills in the various specialties of this education, taking into account the implementation of joint actions,

polytechnic center production - entity, as part of the current transformations.

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