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The development of professional skills for the Personal Software Process

El desarrollo de habilidades profesionales para el Proceso de Software Personal

O desenvolvimento de habilidades professionais para o Processo de Software Pessoal

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ABSTRACT

Currently, the construction of software systems is an activity that demands a significant number of human resources. Most applications are built by development teams, where individually, each technician usually produces a series of small components that are assembled to produce a functional software system, hence the objective of this article is to reflect on the elements involved in the process of developing professional skills for the Personal Software Process with a collaborative approach in the training of the Informatics technician. The historical-logical method, systematization, inductive-deductive, generalization and documentary analysis were used in its elaboration. As a main result, a theoretical analysis was obtained on the subject that can serve as the basis for various investigations related to the training of the computer technician and concluded with the need to weigh collaborative learning as a fundamental organizational form in the training of professional skills for the Personal Software Process.

Keywords: Personal Software Process; Computer Projects; professional skills; collaborative learning.

RESUMEN

En la actualidad, la construcción de sistemas de software es una actividad que demanda de un importante número de recursos humanos. La mayoría de las aplicaciones se construye por equipos de desarrollo donde, de manera individual, cada técnico suele producir una serie de componentes pequeños que son ensamblados para producir un sistema de software funcional, de ahí que el objetivo de este artículo es reflexionar sobre los elementos que intervienen en el proceso de desarrollo de habilidades profesionales para el Proceso de Software Personal, con un enfoque colaborativo en la formación del Técnico Medio en Informática. Se emplearon en su elaboración el método histórico-lógico, la sistematización, el inductivo-deductivo, la generalización y el análisis documental. Se obtuvo, como principal resultado, un análisis teórico sobre la temática que puede servir de fundamento a diversas investigaciones relacionadas con la formación del Técnico Medio en Informática y se concluyó con la necesidad de ponderar el aprendizaje colaborativo como forma organizativa fundamental en la formación de habilidades profesionales para el Proceso de Software Personal.

Palabras clave: Proceso de Software Personal; Proyectos Informáticos; habilidades profesionales; aprendizaje colaborativo.

RESUMO
Atualmente, a construção de sistemas de software é uma atividade que exige um número significativo de recursos humanos. A maioria das aplicações são construídas por equipas de desenvolvimento onde, individualmente, cada técnico produz normalmente uma série de pequenos componentes que são instalados para produzir um sistema de software funcional. Assim, o objectivo deste artigo é refletir sobre os elementos envolvidos no processo de desenvolvimento de competências profissionais para o Processo de Software Pessoal, com uma abordagem colaborativa para a formação do Técnico Informático Médio. Na sua elaboração foram utilizados o método histórico-lógico, sistematização, indutivo-dedutivo generalização e análise documental. O principal resultado foi uma análise teórica sobre o tema que pode ser utilizada como base para várias investigações relacionadas com a formação do Técnico Informático Médio e concluiu com a necessidade de considerar a aprendizagem colaborativa como uma forma organizacional fundamental na formação de competências profissionais para o Processo do Software Pessoal.

Palavras-chave: Processo de Software Pessoal; Projetos Informáticos; Competências profissionais; Aprendizagem colaborativa.

INTRODUCTION

Every day there is a stronger demand for the training of professionals capable not only of efficiently solving the problems of professional practice, but also, fundamentally, of achieving ethical-responsible performance.

Citizen responsibility and social commitment as values associated with professional performance and, therefore, linked to professional competence, constitute the center of attention in Technical and Professional Education (ETP), which takes place in the polytechnic centers where it is studied the Computer Science specialty, which are primary agents in the computerization process of current Cuban society.

Computing is a science that is increasingly associated with how much human process is carried out. For the country, its intelligent, creative and ethical use can contribute significantly to socio-economic development, raising living standards and the quality of the services provided to the people (Díaz-Canel, 2019).

In this sense, it goes through a complex process of transformations, in order to achieve a greater correspondence with the current demands and perspectives of the national economy, whose livelihoods are found in the guidelines approved in the VII Congress of the Communist Party of Cuba in April 2017.

These transformations are aimed at achieving quality vocational training for students, in correspondence with the current demands of each profession, in order to become protagonists of the country's economic and social development.

With the creation of the specialty Technical Middle Computer in the ETP, it has contributed to the training of the workforce to meet these changing demands of society. Where necessary than the Process of Teaching - learning (PEA) is guaranteed from the methodological to the

technical professional. One of the subjects that contribute to the training of this computer specialist, with the demands that society intends in the professional model, is the Computer Projects subject, in which the professional skills related to the Personal Software Process are formed (PSP).

Professional skills acquire extraordinary relevance in any professional training process, which, linked to the motivational and axiological development of the student, fosters the successful performance that is aspired to.

In this sense, the researcher Hernández (2014) affirms: "professional skills are the essence of professional performance, (…) in the complex mission of guaranteeing the training of young people with sufficient qualifications and skills, they acquire an extraordinary relevance" (p.23).

In the re-dimensioning, which in the economic order the Cuban society tries to achieve, in correspondence with the conditions and needs that production, services and new organizational forms require, it is imperative to give treatment to professional skills.

Thus, education received by the Technical Middle Computer during its formative process, in close connection with the instruction, it has to achieve an indissoluble link between the facts of everyday life, the events of the classroom and demonstrations of their professional work for which it is prepared.

However, it is not possible to achieve this purpose if there is a separation between school, social life and work, so the polytechnic center, in close connection with each work entity with which the student is related, must teach not only knowledge, but must make the student learn the "know - how" and

"how," which linked to "know how to be" put to emphasize the close relationship between study and work.

Several authors, including Corona and Fonseca (2009), Hernández (2014), González and Vega (2015), Benítez and Mena (2016), coincide in pointing to professional skills as a cardinal component in the professional training of graduates of the ETP.

In relation to the PSP, the theoretical positions of Humphrey (2001), Linares *et al.* (2016) and León, Alea and Gato (2019); where they bring the need for the use of professional skills for the PSP in software development.

In the participation of students in development projects, it is still not possible to apply a group of skills very inherent to the PSP, such as: managing time and schedules; plan work and time; estimate times, sizes and resources; summarize timing data; record time, job and defect data, in order to improve their processes and achieve quality products.

In the pedagogical practice, it has been verified, through the use of research methods such as observation and survey, the existence of insufficiencies in the development of these skills, which limits their application in work planning and brings with it unreal data, problems in the development of projects and limitations in the development of other teaching activities, since the projects are developed in parallel with other activities of the PEA.

Although the PSP is treated in bibliographies as a computer process, it involves the Process of teaching-Learning of the subject Computer Projects; hence the need for the formation from a more holistic approach is evidenced, considering the role of the

group and the company's workforce in professional training, so we consider the collaborative approach as a feasible model.

Given this growing need in the specialty of Computer Science, the authors of this article consider it appropriate that its aim is to reflect on the elements involved in the process of developing professional skills Process Personal Software in the formation of the Middle Technical in Computing.

The dialectical - materialistic method is assumed as the foundation of the investigation, which allows clarifying factors that intervene in the development of professional skills for the PSP and made possible the use of a system of methods such as: the historical - logical, the systematization, the inductive - deductive, generalization and documentary analysis.

DEVELOPMENT

The evolution that the concept of Teaching-Learning Process (PEA) has had, demonstrates the process nature of the phenomenon of teaching and learning; from identification as a teaching process with a strong emphasis on the central role of the teacher as a transmitter of knowledge, to the most current conceptions in which the Teaching-Learning Process is conceived as an integrated whole in which it is highlighted the leading role of the student (Addine, González and Recarey, 2002, p.20).

One of the characterizations of the PEA is raised by Silvestre Zilberstein (2000), who considers that "The PEA is the pathway mediating essential for the appropriation of knowledge, skills, habits, rules of relationship, behavior and values bequeathed by humanity,

which are expressed in the teaching content, in close connection with the rest of the teaching and extra-teaching activities carried out by the students" (p.16).

Rico (2004), states:

> The teaching-learning process has historically been characterized in different ways, ranging from its identification as a teaching process, with a strong emphasis on the central role of the teacher as a transmitter of knowledge, to the most current conceptions in which the teaching - learning process as an integrated whole, in which the leading role of the student is highlighted. In this last approach, the integration of the cognitive and the affective, of the instructive and the educational, as essential psychological and pedagogical requirements, is revealed as a determining characteristic (p. 50).

The problem raised by this author has been decisive in the characteristics of the direction of the Teaching-Learning Process from its comprehensiveness and the role of students in the different educational subsystems of the country, always with the ultimate goal of achieving comprehensive training.

For its part, Bermudez and Perez (2004) define the process of teaching and learning as "Process interaction between teacher and students in which the teacher directs learning through proper activity and communication, facilitating the appropriation of the historical-social experience and the growth of the students and the group, in

a process of personal and collective construction" (p. 47).

From its unique approach to learning, the Teaching-Learning Process is characterized from a conception which highlights the interaction between teacher and student, the direction through the activity and communication, typical of the approach historic and cultural of Vygotsky (1987) and followers, and introduces terms such as facilitation, student and group growth, and personal and collective construction.

On the other hand, when the student role is considered in terms of "personal and collective construction", it goes beyond the role of the student in the accomplishment of the task, it includes their participation in the decisions that are made to plan, execute and control the Teaching-Learning Process (PEA).

Addin (2004) exp RESA ideas that typify the PEA as:

- It is complex, multifactorial, with multiple interactions, where the conditions are definitely those that favor or hinder the process itself and the result.
- It must be studied and investigated from its projective dimension, which includes its design, execution, evaluation and guides its results to the personal and social, starting from a diagnosed present to a desirable future, where the multilateralism of interrelationships must be recognized, as well as the heterogeneity Participation.
- It is specified in a created situation, so that the student learns to learn. They constitute a dialectical process where situations for the subject appropriates the tools that allow operate with reality and face the world with a scientific personalized and creative attitude.

- It is communicative in its essence, considering that all the educational influences, which are generated in it from the human relationships established in the process of joint activity, occur in situations of communication.

In the context of Technical and Professional Education (ETP), Abreu and Soler (2015), based on the research carried out in the Model Project of the Polytechnic Institute of Informatics (MIPI), by Bermúdez, Pérez, Armas and Menéndez (2009), define the Teaching-Learning Process of ETP as:

> Cooperation process between the educator and the students through which learning is directed, facilitating the individual and collective construction of the profession's contents, in the context of the Polytechnic School-Labor Entity-Community relationship to enhance personal and group growth based on the requirements of the Professional Model (p. 43).

The previous definition responds to the needs of this teaching. It emphasizes aspects such as individualization and cooperation of the protagonists, which are requirements for ownership of the contents of the profession in the context of the - Polytechnic school-Labor entity-Community relationship, and enhances personal and group growth, that constitutes educational demand in vocational training.

In the case of the Computer Science specialty, the Teaching-Learning Process is defined by Serrano (2017) as "A process of cooperation between the teacher and the students through which the learning of computer content is directed, and the individual and collective construction of those useful contents for

the profession, in the context of the annexed school-classroom integration is facilitated " (p.52).

In agreement with the author, it is a cooperative process for learning computer content, but there are limitations in the definition, as the relationship should not be reduced to the attached classroom. The integration of the polytechnic center is with the entire labor entity, where the system of educational influences is exercised by specialists-instructors, managers and other workers in general.

The Computer Projects subject, located from the first to the third year of the Computer science specialty, has a theoretical-practical
character; pursues, simultaneously , the systematization of principles and concepts of work with computing and analysis and problem solving, which is taxed both the development of thought and competent training the future Technical Middle Computer.

Among its
main objectives is the contributing to the development of logical thinking and planning activities that are used to perform a software, so that the future graduates make an efficient and professional use of the information technology, as well as enhancing creativity, reasoning ability and independence at work, from the creation of algorithms and problem solving through the accurate representation of structured models in the software development process (León, 2015, p. 5).

In the investigations of the authors Carrizo and Alfaro (2018) several characteristics are observed that are attributed to the project and that account for new elements that enrich its definition; Among them, the following are mentioned: the project starts from a problem, it implies a work that integrates a system of tasks in an action plan, it has defined certain objectives and purposes,

it is framed over a period of time, it takes into account the Material and human resources for its execution, it is integrative and interdisciplinary, conducive to search and research in the school, and requires its evaluation once completed.

The definition provided by Pérez (2016) is assumed, who defines as a computer project:

> The form of organization of the process of training the average computer technician that contributes to the training of his professional skills, through which the student, in a defined space- time rela tionship, and with certain resources (human and material) required, performs automated information processing through professional tasks supported by the use of computer technologies, which allow them to obtain a product, or the provision of a service of social need and utility (p.41).

This definition reveals the following characteristic features:

- Part of recognizing the computer project as a form of organization, which is streamlined and carried out by means of the Teaching-Learning Process, which guides the logic of its treatment (design, organization and execution). Although it is the author's criteria that it must also include control and evaluation.
- It takes into account the space and time of completion, as well as the human and material resources required for its implementation.

- It systematizes the training approach based on professional skills, as a more inclusive vision.

By participating in software development projects, students receive the new content that is essential for their realization. In addition, the computer project is an application that links people, *hardware* equipment, *software,* research and training, focused on obtaining one or more desirable results on an information system.

The activities to be carried out by the student and the scope of the project will be determined by the system of objectives and skills of the Computer Project subject and the other technical subjects according to the year in which they are.

According to León (2015):

> The teaching- learning process of Computer Projects involves the Comprehensive General Teacher as coordinator of the training processes of its students, project teachers, who generally act as project leaders, teachers of technical and basic subjects which find their intervention in the projects based on their needs and at the time of the production cycle that requires their participation and the teachers of the general training subjects as carriers of integral culture (p. 48).

The specialist- instructor of the labor entity participates as an advisor on the subject or as leader of the projects established with his labor entity.

During the Process of teaching -learning of the subject in different years of study, students develop a group of professional skills that increase their complexity gradually, from professional problems in the treatment of content, allowing to obtain quality products within certain time frames. Among these professional skills we find those related to the content titled Personal Software Process.

The PSP was created and defined by Watts Humphrey of the *Software Engineering Institute* at *C arnegie Mellon University,* as a "self - improvement process designed to help control, manage, and improve the way you work. It is structured by tools and procedures to develop high-quality software" (Humphrey, 2001, p.30).

In the Cuban educational context, specifically in the formation of the Technical Middle Computer, " it has been introduced in the curriculum as a set of disciplined practices for management of software and improve personal productivity, development tasks and maintenance of computer systems" (León, 2015, p. 33).

Among its main principles are:

- Each technician is different; to be more efficient, you must plan your work based on data from your own professional career.
- To genuinely improve their work, technicians must use well-defined and quantified personal processes.
- To obtain quality products, the technician must take personal responsibility for the quality of his products. Good products are not obtained by chance, but as a result of a positive effort to do quality work.
- The sooner defects are detected and corrected the less effort will be required.
- It is more effective to avoid defects than to detect and correct

them. Working well is always the fastest and cheapest way to work.

- The technician must plan the work, strive to comply with the planning, strive for the best quality products and this in the context of a process of continuous improvement.

The fundamental objective of the PSP is to strengthen the skills related to the software development process; it is a powerful tool that we can use to manage work, assess talent, and measure product quality. PSP is not a magical answer to all software design problems, but it can help you to identify where and how you can improve.

According to Arriagat (2018):

> PSP defines how to carry out the work in accordance with a series of rules and with a series of metrics and with a series of specific practices, which allow to have a personal history of each of the team members, allowing the Each team member's work is auditable and that we can determine to what extent each person is accurate or not in their approach to work plans, in the effort they will have to dedicate to a specific activity and finally in the quality of the work expected from this person (p. 3).

The author does not agree with the aforementioned, since the development of professional skills for the PSP goes beyond the mere definition of tasks and roles, insofar as it goes to functions and social assignments and makes it easier for the individual to know the objectives and what it expected from him.

To ensure that students carry out a correct development of professional skills in the PSP, it is necessary to take into account the main trends in their teaching-learning.

Despite the fact that the PSP is treated in the bibliographies as a computer process, it is part of the Teaching-Learning process of the Computer Projects subject; hence the need for its training from a more comprehensive approach is evident.

According to Alonso *et al.* (2017), after analyzing different investigations, they conclude that "(…) it seems sufficiently proven that students learn more effectively when taught with their predominant learning styles. Learning does not take place in a vacuum, but through the contextual strategies and mediations that the teacher uses in his teaching process" (p.6).

Currently, educational systems are betting on new methodologies, new approaches that significantly enhance the open construction of knowledge. "This methodological innovation is mainly represented by collaborative learning, which offers both teachers and students the possibility of interacting more directly, understanding and becoming involved in learning processes " (Revelo, 2018, p. 122).

On the one hand, the teacher becomes a teacher-tutor, whose functions are to inform, guide, guide and train in order to provide resources to their students and promote the development of skills. On the other, the student exchanges information, reasoning and points of view to promote feedback among group members (Salinas, 2018, p. 94).

Collaborative learning is a concept that defines a highly current theoretical and research area with a strong identity. Although the subject of intellectual cooperation has a long

tradition in the field of research in psychology and education, often associated with the idea of group or team work, only in the 1980s, and especially in the 1990s, the issue gains new momentum, giving rise to the epistemic field recognized as collaborative learning (De la Fuente, 2017).

In the neo-Vygotskian approach to collaborative learning, the value of the socio-communicative experience lies not only in access to a plurality of perspectives, but in the benefits of social coordination itself: levels of aid, reciprocal stimulation, the extension of the field of action or representation, the complementation of roles and the inter-subject control of contributions and activity.

The relationship between professional skill development and collaborative learning is practically direct. Tobón (2016) approaches collaborative work and its objectives from the perspective of socioformation, where the educational context is the main part of their concern and that individuals are formed through the execution of projects and participate in the solution of relevant problems of the environment to achieve personal recreation.

Making a proposal of the characteristics that must be included to develop competences from the collaborative approach, Tobón (2016) states that those who use this teaching-learning strategy must have a common goal, an action design, create synergy in their work, to act meta cognition in interaction with an assertive communication and, above all, with personal responsibility.

Currently, the construction of computer applications must respond to very complex and critical requirements. Software products must be built from the Computer Projects subject, by students organized in work teams. It is difficult to think that a single student can develop a complex system that responds in terms of quality and time.

It is for this reason that collaborative learning is an excellent tool to facilitate the learning of students in the Personal Software Process, since it relates the need they have to learn to work as a team for their competent professional performance, as well as providing them with a tool that enhances learning.

CONCLUSIONS

To achieve the effectiveness in the formation of the Technical Middle Computer, it is necessary a formative Teaching Leaning Process of the subject Computer projects where extols collaborative learning as a fundamental way in the formation of professional skills for Personal Software Process.

The Technical Middle Computer will be more relevant to the extent that interact to achieve an integrated process: the polytechnic and labor entities involved in software development as guiding element in the process of computerization of society.

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