Original article

Pedagogical model to develop technological awareness during the bachelor's degree training process

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ABSTRACT

The exponential growth of digital technological resources requires the educational system to be in constant transformation. In order to contribute to this purpose, a pedagogical model is proposed to develop technological awareness in the use of digital technological resources during the bachelor's degree training process; since, manifestations that limit their adequate use by students were observed. The application of the proposal has contributed to the conscious use of digital technological resources by future high school graduates, from the integration of the different agents and socializing agencies involved in the training process.

Keywords: Digital technological resource; Technological awareness; Baccalaureate; Pedagogical model.

Introduction

As a result of the vertiginous technological development, the educational system of any country has the responsibility to bring scientific-technological knowledge to its students, as well as to transmit it scientifically. For, as Barrios (2016) expresses, in order for a country, in the current circumstances, to be in a position to meet the fundamental needs of its population, the teaching of science and technology is a strategic imperative.

In the case of Cuba, educational policy is based on the advances in contemporary science and technology. Consequently, the demands on education increase every day and with it, the introduction of transformations to the curricula, from the incorporation of scientific-technological knowledge in all the Educational Subsystems, according to the current circumstances. Precisely, the Third Improvement of the National Education System, which is currently being developed, gives special attention to the use of digital technological resources during the pedagogical process.

The aforementioned is contextualized in that learners are able to demonstrate a "self-determined, independent and creative behavior, with the use of information and communication technologies as a means of learning and work tool" (MINED, 2017, p. 14). To meet such aspiration, it is required that, from the formative process, knowledge, skills, and moral values are transmitted, which favor the development of a scientific-technological thinking and a critical attitude to make an adequate use of digital technological resources.

In relation to the above, it is considered that the concern about the habits of use of digital technological resources of the youngest is accompanied by a low perception of the risks involved, so that most of the time, this concern does not translate into decisive actions to control these habits, from the integration of the different agents and socializing agencies involved in the training process, as required by the Third Improvement of the National Education System that is currently being developed.

As a result of the factual diagnosis and given the experience of the authors, it was found that, in the training process of the bachelor, the following manifestations associated with: use of digital technological resources indiscriminately; difficulties in the search, processing and selection of digital information and lack of criticism of inappropriate behaviors that are generated in digital environments are appreciated.

In an approach to the problem, research related to the use made by adolescents and young people of digital technological resources has been consulted, authors such as Colmenares

et al. (2017) and Del Barrio (2017), among others, address the need to involve the socializing agents involved in the training process, to perfect the use of this type of resources. Several of them recognize in their research that there is a lack of awareness of the vulnerability to the danger involved in the inappropriate use of digital technological resources.

In the international panorama, other works have carried out notorious reviews on what has been published in the field of the applications of digital technological resources to education and the effects they have caused. Among these we can highlight, the review conducted by West and Borup (2014), as well as the work of Bond et. al (2018) where almost two thousand titles and abstracts of research articles, published in the British Journal of Educational Technology (BJET) in the period from 1970 to 2018, were explored. The authors of these researches consider that it is necessary to promote appropriate behaviors for the use of such resources; however, a theoretical bias is evident from the pedagogical level, which allows regulating the behavior of learners who are trained as baccalaureate students to use digital technological resources consciously.

These arguments expose the need to solve the concrete problem of how to contribute to the improvement of the use of digital technological resources during the training process of the baccalaureate. With the purpose of offering an answer to the scientific problem, the objective was directed to offer a pedagogical model, as a proposal for the use of digital technological resources with technological awareness during the bachelor's degree training process.

Development

The article is derived from the results of the doctoral thesis in Educational Sciences of the main author. As part of the diagnosis made to the object of the research, the particularities of the current state of the use of digital technological resources during the bachelor's degree training process in the Institute of Pedagogical and Vocational Education and Training Luis Urquiza Jorge of Las Tunas are stated, and the instruments for data collection are made on this basis. Several methods and techniques of scientific

research were used: observation, survey, interview and study of the products of the pedagogical process.

The results of the empirical characterization allow to identify as a cause that generates the problem: the insufficient theoretical argumentation of the use of digital technological resources during the training process of the bachelor, in a way that allows him to integrate the school-family-community contexts, and to particularize in the development of knowledge, skills and positive attitudes associated with the use of digital technological resources, with the participation of the different agents and agencies involved in the training of the future bachelor.

It is also corroborated, the role played by the formation of the bachelor from the school-family-community contexts and the restricted use of the potential of the use of digital technological resources as elements to energize this process, not only through the search, discrimination, processing and exposure of information in digital format, but also as tools for communication between human beings that breaks the space-time barriers, to promote equality, integration and harmonious exchange.

The proposed solution is conceived from the modeling of the use of digital technological resources in the training process of the bachelor, aimed at promoting the development of digital skills that allow the bachelor to efficiently use digital technological resources in the school-family-community contexts.

To begin to elaborate and argue the pedagogical model of the use of digital technological resources during the bachelor's degree training process, the definition of model provided by De Armas and Valle (2011) is assumed, who refer that: "The model is an abstraction of those essential characteristics of the object under investigation, which allows describing and studying new relationships and qualities of that object of study with a view to the transformation of reality" (p.12). Once this definition is assumed, the system approach is taken as a reference for the elaboration of the pedagogical model, since it provides the general orientation for the study of phenomena as an integral reality formed by components that fulfill certain functions and maintain stable forms of interrelationships among them.

The use of digital technological resources during the training process is defined as: a process through which learners make use of digital technological resources to meet the

communication needs in the different scenarios that underlie digital environments. It requires agents and socializing agencies that consciously sensitize and provide learners with the necessary content, so that they are able to develop digital competencies, which lead them to regulate their behavior, and thus, the achievement of a digital communication with technological awareness in the training process.

The systematization of the theoretical references related to the use of digital technological resources during the training process of the bachelor, allowed to identify the essential premises, understood as postulates that constitute the synthesis of the theoretical systematization, since they constitute the basis of the model. Consequently, the following are enunciated:

- The proper and conscious use of digital technology resources is essential for the affective and cognitive digital development of the future baccalaureate.
- The training process of the bachelor is optimized with the development of awareness during the use of digital technology resources.

The essential objective of the model is the improvement of the use of digital technological resources during the bachelor's degree training process. The modeling is done through structures, relationships and components that express its relational system in an epistemic and methodological way, which make possible its operation and development in the face of variations among the relationships of its parts. Its explanation lies in the general theory of systems, addressed by Fuentes et al. (2007).

The subsystems that make up the model are related, because they respond to the need to theoretically and methodologically support the use of digital technological resources during the bachelor's degree training process, based on the relationships established between the subsystems personal spheres and socio-practical-educational environments, which result in an improvement in the use of these resources during the training of the future bachelor's degree holder.

Each subsystem is discussed below, as well as the components that integrate it and the relationships between each subsystem in a general way.

The subsystem personal spheres develops the most complex psychological formations of the personality of the future bachelor, which consciously and actively regulate his behavior, when he makes use of digital technological resources. This subsystem, besides

promoting in the future bachelor positive affective experiences that motivate them to make an adequate use of the referred resources and contribute to others to do it, will enable the acquisition of knowledge and development of skills in the students to fulfill this objective.

This subsystem has a regulating function, in correspondence with the dialectical relationship between the inducing and executing spheres of the individual's personality and its reflection in his conscience, from the modes of action. It is composed of two components, one digital affective and the other digital cognitive.

The digital affective component is in charge of reflecting, in the students, the concern for the need to make an adequate use of digital technological resources, given the consequences that their inadequate use causes. This component allows to generate in students feelings that promote a transformational action in relation to the use of digital technology resources in digital environments. The digital affective component promotes positive feelings and emotions that foster interest in learners, as well as stimulation for the execution of actions that contribute to the proper use of this type of resources. This component is in charge of making students recognize that there are difficulties in relation to the use of these resources and that they are part of the problem, but also part of the solution. The digital affective component should direct, motivate and guide the performance of students towards the proper use of digital technology resources.

Through the digital affective component, the learner should be able to understand that he/she may be in a situation of vulnerability due to the dangers that may represent the misuse of digital technological resources and reflect on the extent to which they are aware of their undesirable effects, the need for control and moderation and, accordingly, be willing to transform their behavior, through the development of digital skills that allow regulating their behavior towards the most valuable purposes.

Through this component, they acquire a strong sense of what is morally good when using digital technological resources, since it allows them to appeal to the harmonious development of human beings. Through this component, positive emotions are transmitted to the students so that the acquisition of knowledge related to digital technological resources, from the perspective of their proper use, systematically becomes a desire and pleasure for the future bachelor. The incorporation of the digital affective component is a necessary action to guarantee the effectiveness in the use of digital

technological resources, since the transmission of information is not enough for the learner to regulate his way of acting and demonstrate behaviors that are considered adequate when using the referred resources.

The second component of the subsystem: personal spheres is the digital cognitive, which will allow the learner to create a mental representation of the digital technological resources in general, mainly integrated by concepts, categories, theories, data and characteristics of these resources and their form of use, which must be preserved in thought as a mechanism of action.

This component ensures the formation in the learner of a perception of digital technological resources, which is structured in thought in the form of representations and abstractions. The level of information provided by this component, which should be characterized by its scientificity, relevance and timeliness, should be considered key to subsequently activate the personal norms that regulate the conduct of learners towards an appropriate use of digital technology resources.

This component equips the learner with a knowledge system that enables him/her to interact appropriately with digital technological resources in the digital environments in which he/she interacts. The referred knowledge is evidenced not only in that the learner is able to know the information or have it available, but also includes the ability to re-signify, recreate or transform that information individually or collectively to achieve the proposed objectives, based on previous knowledge.

This component also fosters the development of skills for interaction in digital environments. These represent the level of mastery that learners have in the use of these resources; their development requires knowledge and practical systematization. Through this component, the learner will assimilate, preserve, use, transfer and objectify digital knowledge.

In addition, through this component, the learner must be able to internalize and demonstrate a volitional, moral, aesthetic and emotional education, in relation to the use of digital technological resources. It includes moral and ethical standards, preferences and needs in aesthetic appreciation, emotionality and motivations.

This component equips the learner with the necessary values to eliminate or reduce inappropriate behaviors when using digital technology resources in digital environments.

This requires the mastery of behaviors that counteract or favor the appropriate use of digital technology resources during the training process of the bachelor.

Between the digital affective and digital cognitive components there are relations of coordination and reciprocal complementarity, because at the same time that the learner experiences the need to make an adequate use of these resources, he/she is provided with the contents that will allow him/her to fulfill this objective. In other words, one component nurtures the other and vice versa. Both are necessary and complementary with the purpose of adapting, contextualizing and improving the use of digital technological resources by students who are trained as baccalaureate graduates.

In relation to the above, the unity of the affective and the cognitive, with a high level of integrity, is an essential and basic principle of personality. From the unity of both, the most complex psychological formations of the personality are developed, which consciously regulate their behavior, for the purposes of this research in relation to the use that the future bachelor makes of digital technological resources.

The relationship of the components that make up the subsystem personal spheres will enable the future bachelor to be able to condition his actions, through a regulation of his behavior, so as to enable the inclination towards the realization of those actions of more value both individually and socially and to enter into a value conflict, every time he is going to make a decision that affects his behavior or that of others, when he uses digital technological resources.

The second subsystem of the model is: socio-practical-educational environments, which is composed of the components: socio-digital environments and digital communication. This subsystem is aimed at achieving an educational integration and coherence among the agents and agencies involved in the training process of the bachelor, so as to enable an adequate use of digital technological resources in the different scenarios in which digital environments appear; say school, family and community, through the use of different digital communication codes. This subsystem has a procedural function.

The first component socio-digital environments is defined as those social environments in which the training process of the bachelor develops and in which digital environments underlie. This component will make it possible to match, in the same direction, or at least achieve an approach of the system of influences that, related to the use of digital

technological resources, the learner receives. It is in charge of achieving a correspondence between the digital contents that the future bachelor receives through the different agents and socializing agencies.

This component allows perfecting the pedagogical practice to adapt it to the current technological context and that the educational institution, in integration with other agents and socializing agencies, acts as a lighthouse that guides learners towards an education that contributes to the proper use of digital technology resources and thus achieve to eliminate, or at least reduce the negative consequences arising from the inappropriate use that learners make in the different scenarios in which digital environments appear.

Through this component, the family and social institutions and organizations of the community, through networking, become active members of the school educational community, thus eliminating the isolated participation of these agents and socializing agencies for the sake of an informational approach that favors the training of students towards the proper use of digital technology resources.

The above idea is based on the fact that learners use digital technological resources in other social environments, sometimes much more massively than in the educational institution. And, what is more serious, this information is not integrated or used by them. Hence, this component enables to redefine the role of agents and agencies involved in the training process of the bachelor, to contribute in an integrated way to the proper use of digital technology resources in digital environments.

This component enables the establishment of an integration that leads to a dialogue to avoid, as far as possible, discrepancies that could disorient learners and reduce the artificial division as to what corresponds to each one. For, when the potentialities of one are hierarchized, the process is incomplete and is one of the causes that currently causes the inadequate use of digital technology resources by future high school graduates.

Although there are several types of digital environments, this component should be able to address the educational, cultural and entertainment ones, since they are the ones in which the students who are being trained as high school graduates interact in the different scenarios in which they are educated. This component will provide a clear exposition of the potentialities and an intentional approach to the limitations of these digital environments.

This component allows the learner who is being trained as a bachelor to know and overcome the difficulties arising from an indiscriminate use of this type of environments, to perform a constant self-monitoring and self-evaluation of his performance, with a high self-critical character. It provides them with a general idea of the ways in which they are going to use them, so that they can take advantage of their benefits and reduce the risks when interacting with them.

This component also contributes to prepare the agents involved in the training process of the bachelor, to integrate them in the common goal of improving the behavior of students in terms of the use of digital technology resources. For which it is required that they master, at least elementarily, the educational tools that contribute to the referred objective. This component enables the development of integrated actions to ensure the collective solution to the needs of the pedagogical process carried out in the educational institution, in the case of this research, in relation to the use of digital technological resources.

The second component of this subsystem is digital communication. This is defined as a form of communication focused on the digital environment, because it is a process that enables the exchange of digital information with and through digital technological resources. This component must be able to demonstrate that communication in the digital environments that underlie the different social environments is not unique, but multiple. The modes of communication range from online interactivity to the active selection and creative construction of information, through the use of digital technological resources with which the future bachelor interacts.

Through this component, students who are trained as baccalaureate students become generators of information to communicate it in digital environments. For which they require the development of skills that make them not only receivers and decoders of information, but also generators of information for others. This component must be able to provide the digital communicative codes necessary for effective communication in digital environments. In addition, it should provide an intentional approach to the forms of digital communication, taking into account the time of interaction with digital technological resources (synchronous or asynchronous communication) and the channels used to transmit information, as well as the scenarios in which digital communication takes place.

In relation to the above, the learner must demonstrate skills that enable assertive communication in small time intervals, since the time lapses that pass between the construction of the statement and the response to it, without any alteration in the process, are relatively short, as in that which takes place at different times between the sender and the receiver.

In addition, through digital communication, the learner must be able to select information available in the digital environments with which he/she interacts; for this, he/she must put into practice skills that enable him/her to adequately search, select and use the information that is really useful, so that he/she takes into account criteria such as: timeliness, relevance and scientificity. That is to say, to select relevant information among the vast amount of existing information to avoid saturation and the consequent cognitive overload.

Through this component, the learner should obtain the benefit of a more effective communication, because it provides the integration and combined use of various resources: text, image, video, animation, graphics, audio or combination of different codes, and offers more practical and effective variants of communication of information and ideas, than those obtained with the usual use of communication based on verbal language.

Digital communication provides the future bachelor with the necessary communicative codes to make effective communication in the different scenarios in which digital environments appear: school, family and community. Understanding the communicative codes of digital environments and using them efficiently to communicate is the fundamental objective of the presence of this component in the model, which encourages the learner to be able to participate in virtual communities, filter and classify information on the web according to their interests to create and edit digital content appropriately.

Through this component, the learner, as a user of digital environments demonstrates: courtesy, discretion, expressive formality and ethics. In addition, he/she manifests communication patterns that preserve the good image of the participants in the dialogic interaction and favor their understanding.

Between the components digital environments and digital communication there are relations of coordination and reciprocal complementarity, because to interact properly in the different scenarios that underlie the digital environments, communicative codes are

required, different in each of them: school, family, community, and at the same time, these agents and socializing agencies are required to equip the learner with the necessary tools to make digital communication effective.

The personal spheres and the socio-practical-educational environments establish functional relationships of coordination, which allow the formation of new features that particularize the modeling process. They are:

- Regulated digital behavior: is the result of the materialization of the appropriate use of digital technological resources, as a result of experiencing feelings of interest to transform, in a positive way, the use made of these resources. This will enable the development of digital competencies, which will be evidenced in their mode of action, and will enable to regulate their behavior towards appropriate behaviors when using these resources.
- Digital socialization: is manifested when the future bachelor is able to share experiences, experiences and knowledge with other users of digital technology resources in the family, school and community from an assertive digital communication that is based on codes for each scenario.

The analysis of the existing relationships between the subsystems of the pedagogical model on the use of digital technological resources during the bachelor's degree training process, with respect to the new essential features expressed, allows asserting that a development of the technological awareness of the bachelor's degree has been achieved, as a quality resulting from the pedagogical model. It is defined as: the result of a formative process, planned and intentional, as a result of social, technological and contextual demands, which evidences the formation and development of digital competences in the students who are formed as bachelors, which they will put into practice during the communicative process and will allow, through a critical and reflective analysis, to regulate and direct their behavior towards the most valuable purposes, both individually and socially, when using digital technological resources in the different social environments in which digital environments underlie.

The pedagogical model of the use of digital technological resources during the training process of the bachelor, has a dialectical character, and the elements that compose it are structured in a system, a condition that admits the feedback between the subsystems and components that becomes a continuous development in which prevails a system of

knowledge associated to the use of the referred resources, which correctly integrated, favor the development of the technological conscience of the future bachelor. (See figure 1)

Fuente: Elaboración propia

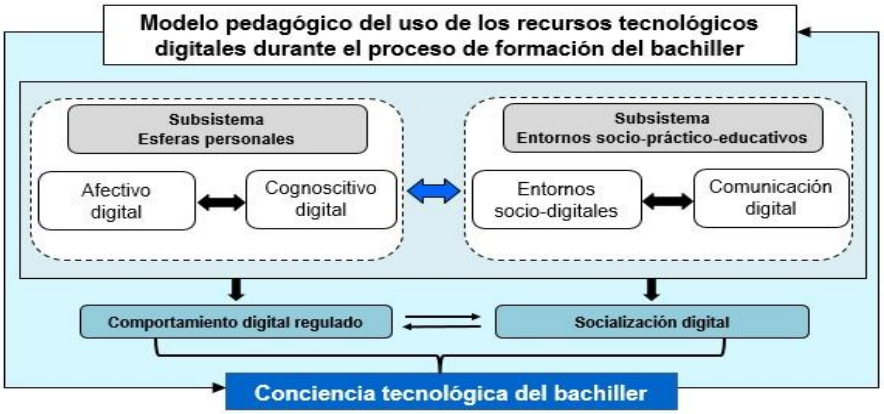

Figure 1. Graphical representation of the pedagogical model of the use of digital technology resources during the bachelor's degree training process.

The logic of scientific verification that is assumed considers the realization of workshops of critical opinion and collective construction, with the objective of socializing the pedagogical model, which contribute to promote the exchange of ideas, the critical and reflexive evaluation and the improvement of the proposal through the contribution of recommendations. For the development of these workshops, the methodology developed by Cortina (2005) was used.

A total of three workshops were planned and carried out: the first one was developed with the participation of the teachers of the Computer Science Department of the Institute of Pedagogical and Vocational Education and Training Luis Urquiza Jorge; the second one with teachers of the remaining subjects of the faculty where the experience is developed and the psychopedagogist of the center; and the third workshop was carried out with the members of the Research Project: Contextualization of the professionalization of the teacher at the Institute of Pedagogical and Vocational Education and Training Luis Urquiza Jorge. The assessment derived from the workshops demonstrated the feasibility and viability of the proposal. Currently, the proposed model is being put into practice through a pedagogical strategy. On the other hand, through the use of the Living Pedagogical Experience, a method proposed by Arteaga (2002), its relevance has been

proven. Thus, the use of digital technological resources is perfected through the integration of social agents and agencies involved in the training process of the bachelor, from achieving that students demonstrate a regulated digital behavior and a digital socialization, which result in a development of technological awareness of the future bachelor.

Conclusions

The real existing state of the problem addressed, made possible the elaboration of the pedagogical model for the use of digital technological resources. It is based on the establishment of a system of interdependent and complementary relationships between the subsystems of personal spheres and socio-practical-educational environments, as well as the components that form them, from which the development of the technological awareness of the bachelor results as a new quality. In the validation, the model of the use of technological resources during the bachelor's degree training process was the object of analysis and reflection by a group of education professionals with vast experience in the subject, which made it possible to recognize its novelty and pertinence and to achieve its improvement. Currently, the model is implemented in educational practice through a pedagogical strategy.