EduSol
Vol. 23. Número Especial
ISSN: 1729-8091
(http://edusol.cug.co.cu)

Implementación del Modelo de Educación a Distancia en la carrera de Ingeniería en Procesos Agroindustriales

Implementation of the Distance Education Model in the career of Engineering in Agroindustrial Processes

Gemma Domínguez Calvo
Annia García Pereira
Alexis Torres Alonso
Universidad Agraria de La Habana "Fructuoso Rodríguez Pérez", Cuba.
ORCID: https://orcid.org/0000-0001-5591-1387
https://orcid.org/0000-0002-3420-1113
https://orcid.org/0000-0002-3043-901X
Correo electrónico(s):
gemma@unah.edu.cu
anigarpe75@gmail.com
alexist@gmail.com

Recibido: 20 de febrero de 2023
Aceptado: 23 de noviembre de 2023

RESUMEN: La presente investigación tiene como objetivo diseñar una estrategia metodológica para la implementación del modelo de educación a distancia de la educación superior cubana en la Carrera de Ingeniería en Procesos Agroindustriales de la Universidad Agraria de La Habana. Para ello, fueron empleados métodos teóricos apoyados en un conjunto de métodos y técnicas del nivel empírico. Los resultados obtenidos permitieron constatar el valor teórico, metodológico y práctico de la propuesta, así como la conveniencia y potencialidades para su total implementación.

Palabras clave: Educación a distancia; Sistemas abiertos de aprendizaje; Estudios a distancia; Educación distribuida.

ABSTRACT: The objective of this research is to design a methodological strategy for the implementation of the distance education model of Cuban higher education in the Agroindustrial Process Engineering Career at Agrarian University of Havana. For this, theoretical methods supported by a set of methods and techniques of the empirical level were used. The results obtained allowed us to verify the theoretical, methodological and practical value of the proposal, as well as the convenience and potential for its full implementation.

Keywords: Distance education; Open learning systems; Distance study; Distributed education.

Introduction

Providing quality education is one of the goals explicitly stated in the 2030 Agenda. Currently, it is necessary to take as a starting point the predominance of a growing use of information and management systems based on the use of Information and Communication Technologies (ICT); this has led in the last two decades to a change in the conception, organization and operation of teaching processes, with a trend towards the virtualization of these processes (Báez Pérez & Clunie Beaufond, 2019; Cuetos Revuelta et al., 2020; Figallo, 2020; García Aretio, 2020).

Cuba, for its part, in recent years has introduced important transformations regarding the virtualization of higher education, in 2016 a new model for distance education in higher education was approved (MES, 2016). This model is based on philosophical, psychological, technological and psycho-pedagogical principles (which encompasses elements of traditional and emerging pedagogy); it has as principles that it is developed under a high convergence and technological integration, that interaction and communication between all actors in the process is encouraged and that it is developed under conditions of flexibility (curricular, technological, temporal space and organizational); In addition, it highlights four components to consider for its implementation: Pedagogical, Technological, Organizational and Human Resources.(MES, 2016)

The authors of this research after conducting the analysis of the Model characterize it as bimodal, flexible, based on an intensive use of ICT, which favors mediated didactic dialogue, with prevalence of multidirectional communication and focused on the student's autonomous learning.

On the other hand, the mission of Agricultural Sciences is to contribute to the food sovereignty of nations, but even access to higher education in these careers remains limited, according to data published in the 2019 Cuban Statistical Yearbook in Chapter 8 on education (ONEI, 2020), only 4% of students enrolled in the period between 2014 and 2020 correspond to agricultural sciences, so it is part of the national policy to promote all modes of study for this type of careers.

As a way of addressing the problems described above, the Agrarian University of Havana (UNAH) is designated by the Ministry of Higher Education to implement the distance education model in the Agroindustrial Process Engineering (IPAI) career, as a pilot experience, to be applied for the first time in the country in a technical career of agricultural profile, a task for which there was no scientifically based theoretical and methodological conception for its implementation that also responded to the particularities of the model itself and of this career in the pedagogical, technological and normative areas.

Thus, the objective of this work is to design a methodological strategy for the implementation of the distance education model of Cuban higher education in the Agroindustrial Processes Engineering Career of the Agrarian University of Havana, under a theoretical conception in correspondence with the particularities of this model and the career.

Development

The theoretical inquiries carried out by means of the historical-logical and inductive-deductive methods and documentary analysis allowed the authors to characterize the model as described above, to periodize the development of distance education based on its forms of communication and the use of technological means, as well as the theoretical and structural bases that support the designed strategy.

Distance education periodization.

The evolution of distance education has been influenced by the development of the technological means used for communication and that define interaction, leading to three generations being recognized by the means used for such purposes: the first called "Epistolary communication or correspondence", followed by "Multimedia Teaching" and finally the third known as "Telematic Teaching" or "Tele-Informative Paradigm" (Vourikari et al., 2016; Cuetos Revuelta et al., 2020). However, it is important to clarify that the aforementioned generations are not framed in closed periods of time or place since, when a new one appears, it coexists with the existing one, due to the fact that the technological resources used as a means of teaching, communication and interaction vary according to the real possibilities of institutions, teachers and students.

The authors of this paper agree with what was raised by Báez Pérez & Clunie Beaufond, (2019) when they assure that the technologies used in this last era, are assuming a real revolution in the field of education by considering that mobile technologies have redrawn the educational landscape, providing not only mobility but also connectivity, ubiquity and permanence, allowing individuals to learn wherever they are and to count on the components of their social environment, thus making it possible to declare the emergence of a new generation of distance education permeated by the possibilities offered by mobile devices.

Methodological strategy for the implementation as distance education model of Cuban higher education in the Agroindustrial Processes Engineering Career of the Agrarian University of Havana.

The design of the methodological strategy proposed as a scientific result of the educational research, takes into consideration the following aspects cited by Lombillo, (2012)

- ✓ A conception with a systemic approach, in which coordination relations predominate, although relations of subordination and dependence are also present, with a structure based on phases related to diagnostic, planning, instrumentation and control actions.
- ✓ A dialectical character that is given by the search for qualitative change that will occur in the object, by the constant adjustments and readjustments that its actions may undergo and by the articulation between objectives and methodology, because they are not static, rigid, but flexible, susceptible to change, modification and adaptation of their scope, by the nature of the problems to be solved.

On the other hand, the definition of methodological strategy given by Armas, et al. (2003: 45-46) and assumed by Lombillo (2011: 85-86) is assumed as: "the projection of a system of methodological actions, which allows the transformation of the direction of the teaching-learning process; for the achievement of the determined objectives, in a specific time". From which the authors of the research define the methodological strategy for the implementation of the Model in the IPAI career as the set of actions and operations that, regulated by certain guiding requirements and structured according to the components declared in the model itself, explain how to proceed to implement the modality in a technical career of agricultural profile with the use of ICT.

For the design of the strategy, we start by establishing the Guiding Requirements (five in total), which are precepts and guidelines that constitute transversal axes and theoretical foundations for all the components that comprise it, and are presented below.

Correspondence between the pedagogical, methodological, technological and management foundations for the development of a teaching-learning process based on the intensive use of technologies.

This requirement establishes the unity that must exist between technological development and its integration in the training process of the professional under pedagogical and methodological supports, where technology must be at the service of pedagogical practices as a fundamental

characteristic for the implementation of the model; without ignoring the university management systems for the organization and control of students with part of the organizational component. The implementation of the model does not only mean guaranteeing the availability of technological resources that allow communication between the different actors, but it must also be characterized by student-centered, flexible, interactive and cooperative learning.

Correspondence between technological integration, interaction and communication, with curricular, technological, spatial, temporal and organizational flexibility.

This requirement considers the integration of different technological tools that allow new ways of accessing, generating and transmitting information and knowledge, under a flexible curriculum capable of being executed with an interaction and communication that responds to the previously established organizational forms, eliminating the space-time barriers between the teacher and the student, by promoting the exchange of information and cooperative work, allowing the student to establish his own learning path.

Correspondence between high availability, ubiquity, reusability and interoperability of digital educational resources for the development of a teaching process based on the intensive use of technologies.

This requirement refers to the characteristics of digital educational resources used in virtual learning environments. These resources must always be available and accessible to many people simultaneously in different spaces. While ubiquity represents the mobility of technological resources that allows access to digital educational resources from any place and device, allowing people to learn at any time and in any place. Reusability allows that digital educational resources can be grouped, ungrouped, reused quickly and easily and can be assembled; while interoperability allows flexibility in accessing digital educational resources through different interfaces, protocols, interconnections, exchange, security services and data transfer between different computer systems.

Correspondence between digital and pedagogical competences of teachers for the development of the teaching-learning process based on the intensive use of technologies.

This requirement expresses the unity between the new role of the teacher as a mediator in a virtual teaching and learning environment (VLEE) and the need to combine technological and pedagogical skills in the production of educational resources and courses within the virtual environment.

Unity between the digital competencies of support staff and the way the training process of IPAI professionals is managed.

The use of technology occupies a preponderant place in training support processes and therefore is inherent to the managers of the process (those who plan, organize, administer and control the processes) as their functions are often carried out in a virtual environment. For this reason, it is essential to train digital competencies not only in teachers and students, but also in managers who are key actors in the transformation and gradual assimilation of these new approaches (Camacho Marín et al., 2020; Pozú-Franco et al., 2021).

1. The concreteness of the guiding requirements expressed above, are particularly specified in the conceptual and operational axes, however, in order to make their implementation feasible, it is necessary to establish the following Premises:

2. Existence of an institutional policy for the implementation of the Cuban distance education model with the intensive use of ICT, reflected in the strategic planning of the institution.

3. Existence of a technological infrastructure that provides support for the storage and distribution of educational resources, interaction and communication, as well as technological convergence and integration, through an interactive platform, social library and repositories of learning objects, which provide flexibility, interoperability and high availability of knowledge. In addition to favoring the development of substantive and management processes among all the actors involved in training.

4. Availability of human capital with competencies to perform all the roles defined in the Model together with those who perform coordination and advisory functions during the implementation process, being an element that favors the processes of management, design, production and use of digital resources in the training process of the professional.

Conceptual axis

The conceptual axis enabled the establishment of the basic concepts that support the methodological strategy and with it the definition of the principles that characterize it, by integrating the fundamentals of distance education, particularly those related to the Distance Education Model of the MES, the authors define that the strategy has a systemic, integral, harmonic and contextual character. Based on the psychological postulates of the historical-cultural approach and the staged formation of mental actions with the use of mediating instruments (tools and signs) developed by Vigotsky, the Theory of Cognitive Flexibility and Connectivism, as well as, the

Theory of Learning Objects (TOA)(Lombillo, 2012), Theory of Personal Learning Environments (PLE) and the Theory of Open Content. All this results in the statement of the principles.

The principle of flexibility is analyzed from the systems approach as the ability of the system to adapt to a new situation, to offer a quick response to the changing needs of the environment (MES, 2016). The principle is assumed from the curricular, technological, organizational and from a spatial-temporal analysis.

The principle of interoperability is assumed for the development of computer procedures that facilitate the use of an information management process in which the heterogeneity of the systems and applications used is admissible, without hindering the reuse of information. The use of distributed programming principles and the development of components capable of managing data within an application without the need to modify the application code.

Collaboration Principle is based on the use of tools, data models and computer resources that allow the sharing of distributed information, as well as the collective participation in the production of contents (collaborative work), with the use of organizational and technological alternatives that allow achieving adequate levels of cooperation among all the parties that make up the information management system for the production of contents.

Methodological Axis

This axis constitutes the connection between the conceptual and operational axes and makes the methodological recommendations that guide the institution in the process of implementing the model, specifically in the four components (pedagogical, technological, organizational and human resources components).

Pedagogical Component. The study plan must be flexible, to allow students to select what, how and when to study according to their potential, interests and learning environment, with a curricular design that contemplates the three scenarios stated in the Model.

- ✓ The analytical programs of the subjects in turn must have: Concrete methodological indications indicating the methods, organizational forms, means and technological tools to be used according to the scenario, as well as defining the type of communication to be used (synchronous or asynchronous) in the proposed activities and the number of face-to-face activities to be carried out (if necessary). The educational resources should be mostly elaborated in hypermedia language with high availability, reusability, flexibility, scalability

and easy socialization, and the evaluation system should be continuous, personalized and participative, encouraging theoretical-reflective and practical-active activities.

- ✓ The design of the courses should be visually homogeneous with pre-established templates in all the subjects and general aspects that facilitate the students' understanding and assimilation of the contents through an adequate orientation, which should be carried out through the student's guide with a friendly language and without didactic-pedagogical technicalities but that allows the teacher to model the learning orientation. In addition, it is necessary the use of an integrated and progressive media system so that contents reach the student in different formats according to the scenario where he/she is and an evaluation system that responds to the proposed methodological indications.

Technological Component. takes into account the maximum possible reuse of all teaching and non-teaching information that facilitates the design and production of content for the teaching and learning process, being essential to achieve: differentiated computerized treatment of content as a learning object, the ability to interact with non-teaching information management systems, high level of use of standard data structures with a systemic approach, where user profiles can be generated according to the various user roles.

Organizational and Human Resources Components.

The implementation of the modality should constitute an institutional policy reflected in its strategic planning and where the operating manuals and procedures for its development are established. It is essential to have a student management system that allows the teaching secretary to control students, a teacher support center for the creation of educational resources and a technological infra structure that guarantees the production, reproduction and distribution of educational resources, in correspondence with the demand. In addition, it is essential to implement a continuous and contextualized training strategy for teachers and support staff, designed for their development, through the production-training process, with a system of consultation and training on technological, pedagogical and organizational elements.

Operational Axis

This operational axis defines four stages (Diagnosis, Planning, Implementation and Evaluation), with their respective objectives, actions and procedures.

In the Diagnostic stage, the national and institutional environment of the essential elements of each of the previously stated components is analyzed in order to obtain information on the methodological bases, regulations, norms, procedures and the training system necessary to guarantee implementation. During planning, the strategic, management, pedagogical, methodological and technological guidelines of the different organizational instances are established for the implementation of the model in accordance with the guiding ideas, premises, principles and indications issued in the methodological axis and the findings detected during the diagnosis. Subsequently, during implementation, the multidisciplinary team implements the strategic, organizational, pedagogical-methodological and technological guidelines of the different organizational instances for the implementation of the Model and fine-tunes the processes and services designed in the previous stage, to ensure the interoperability of the tools and that the platform and the content repository work properly.

The evaluation is characterized by a rigorous supervision process through which the coordinating team and the designated teachers, together with the IT team, closely monitor the results obtained in the distance education process. At this stage, computer processes are used to support the quality control of the contents.

Partial validation of the proposed methodological strategy

Once the theoretical positions were assumed and the methodological strategy was designed by the authors of the research, we proceeded to the implementation and evaluation of the feasibility through its partial validation, for which we applied the method of subjective-based forecasts based on the consultation of experts through the Delphi Method in 2 rounds, the results obtained were contrasted with the Concordance Coefficient (Anochi) and the consultation of users was carried out through the Iadov technique.

The group of experts was made up of a total of 23 professionals from the National Distance Education Group, the National Distance Education Center of the UCI, the Center for Higher Agricultural Education Studies, the Faculty of Technical Sciences of the UNAH, the University of Manabí, the Directorates of Professional Training and Informatization of the UNAH and the National Career Commission of IPAI. Of these, 20 have a Doctorate Degree in Sciences (10 in Educational Sciences, five in Pedagogical Sciences and five in Technical Sciences) and three have a Master's Degree in Education; 16 are Full Professors, four are Assistant Professors and the

remaining three are Assistant Professors dedicated to educational technology and an average of 25 years of experience in Higher Education.

In the first of the rounds, the selected experts declared that, of the 43 elements put to their consideration, 39 were very adequate (90.7%), three quite adequate (7%) and one adequate (2.3%) with a calculated value of the Concordance Coefficient equal to 0.61 interpreted as Acceptable.

From the theoretical-methodological block, nine of the experts suggested making modifications to the Guiding Ideas, as well as in some elements of the Methodological Axis, specifically in the Pedagogical and Organizational Components; while 10 experts suggested making modifications in the operational block in the strategy rationale and in the methodological design of the course for the implementation of the AoD model. These suggestions made by the experts were valued and influenced the final redesign.

The second round made it possible to verify the stability of criteria of the group of experts with respect to the elements put to their consideration. In this case, they had the opportunity to contrast their own opinions with the average of the results obtained during the first round; on this occasion, 100% agreement was obtained from the experts in the elements evaluated (Very Adequate), with an Acceptable Concordance Coefficient (0.63). Finally, the experts who had suggested modifications were satisfied with the changes introduced, and therefore considered the methodological strategy to be highly useful. This information was contrasted with the data obtained by applying the Iadov Technique as an indirect way to study satisfaction.

Within the framework of this research, 22 of the professors who make up the teaching staff were defined as users of the proposed methodology. The technique made it possible to obtain a group satisfaction index (ISG) by associating the different levels of satisfaction of the respondents with a numerical scale ranging from +1 to - 1, as follows:

Table 1 Results of the IADOV technique

Scale	Meaning	Individual satisfaction
+ 1	Maximum satisfaction (A)	7
+ 0,5	More satisfied than dissatisfied (B)	10
0	Undefined and contradictory (C)	1
0,5	More unsatisfied than satisfied (D)	1
-1	Maximum dissatisfaction (E)	0

Source: Self elaboration

Using expression 1, the Group Satisfaction Index (ISG) was determined, obtaining a value of 0.65, which is reprented graphically in Figure 2. This indicates that there is satisfaction and recognition of the usefulness of the methodology by the evaluation group.

$$ISG = \frac{A(+1)+B(+0.5)+C(+0)+D(-0.5)+E(-1)}{N} \qquad (1)$$

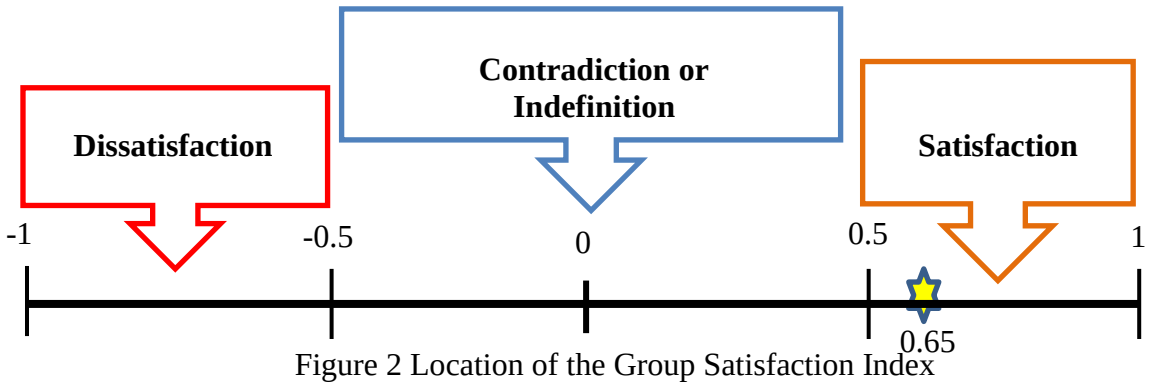

Figure 2 Location of the Group Satisfaction Index

Source: Self elaboration

Based on the results obtained from the partial evaluation made by the experts, it is possible to qualify as Very Adequate the methodological strategy proposed for the implementation of the MES distance education model in the IPAI program, which is also confirmed by a high level of satisfaction on the part of the users, as expressed in the results of the group satisfaction coefficient.

Conclusions

The design of the methodological strategy based on the theoretical and methodological references consulted comprises: general objective, five guiding requirements, three premises and three axes: the conceptual, which covers the theoretical foundations on which the proposal is established and declares its principles; the methodological, a connection between the conceptual and operational axis that proposes a group of recommendations to guide the work of the institution and all the actors involved in the training process, according to the role they play; and the operational, composed of four stages structured in: objectives, actions and procedures. The systemic conception of the proposal and the relationships among its components and with the environment, allow the articulation and implementation of the result.

The theoretical assessment and the empirical exploration of the feasibility determined in its partial implementation using the consultation to experts and the users' criteria, allowed confirming the

theoretical, methodological and practical value of the proposed methodological strategy, as well as the convenience and potentialities for its full implementation at the Agrarian University of Havana.

Bibliographic references

Báez Pérez, C. I., & Clunie Beaufond, C. E. (2019). Una mirada a la Educación Ubicua. *Revista Iberoamericana de Educación a Distancia*, *22*(1), 326–344. http://dx.doi.org/10.5944/ried.22.1.22422

Camacho Marín, R., Rivas Vallejo, C., Gaspar Castro, M., & Quiñonez Mendoza, C. (2020). Innovación y tecnología educativa en el contexto actual latinoamericano / Innovation and Educational Technology in the current Latin American contex. *Revista de Las Ciencias Sociales*, *Vol. 25*.(Número especial), 260-272.

Cuetos Revuelta, M. J., Grijalbo Fernández, L., Argüeso Vaca, E., Escamilla Gómez, V., & Ballesteros Gómez, R. (2020). Potencialidades de las TIC y su papel fomentando la creatividad: percepciones del profesorado. *RIED. Revista Iberoamericana de Educación a Distancia, 23*(2). https://doi.org/10.5944/ried.23.2.26247

European Commission. (2020). Digital Education Action Plan 2021-2027. *European Commission*, *20*. https://ec.europa.eu/education/sites/default/files/document-library-docs/deap-communication-sept2020_en.pdf

Figallo R., F. (2020). Después de la educación presencial, ¿qué? *Revista de Educación Superior En América Latina*, *8*. https://doi.org/10.14482/esal.8.371.35

García Aretio, L. (2020). Los saberes y competencias docentes en educación a distancia y digital. Una reflexión para la formación. *RIED. Revista Iberoamericana de Educación a Distancia (2020), 23*(2).

Lombillo, I. (2012). *Estrategia metodológica para el uso integrado y progresivo de los medios de enseñanza por docentes de la Universidad Agraria de La Habana*. Universidad Agraria de La Habana.

MES. (2016). *MODELO DE EDUCACIÓN A DISTANCIA DE LA EDUCACIÓN SUPERIOR CUBANA.* http://moodle.uho.edu.cu/plugingfile.php/32522/mod_resource/content/1/mModelo de Educación a Distancia.pdf

ONEI. (2020). *ANUARIO ESTADÍSTICO DE CUBA 2019.*

Pitch Herrera, B., & Benitez Cárdenas, F. (2018). Transformaciones del modelo de educación a distancia en la educación superior cubana. Primeros resultados y retos (2015-2017). *Congreso Universidad, 7*(4). http://revista.congresouniversidad.cu/index.php/rcu/article/view/1060

Pozú-Franco, J., Fernández-Otoya, F. A., & Muñoz-Guevara, L. (2021). Valoración de las competencias digitales en docentes universitarios. *Revista Psicológica Herediana*, *13*(1). https://doi.org/10.20453/rph.v13i1.3850