Review article

# Information and Communications Technologies in the Teaching-Learning Process

## Las Tecnologías de la Información y las Comunicaciones en el proceso de enseñanza-aprendizaje

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**ABSTRACT**

**Introduction:** Information and communications technologies are applied as resources and tools for learning, while retaining, processing and transmitting digital information.

**Objective:** To support the use of Information and Communications Technologies in the teaching-learning process.

**Methods:** A search for scientific information was carried out on the Internet in the Department of Hospital Epidemiology of the Pediatric Hospital of Camagüey during the month of March 2024. It was structured in four stages: planning, design-management, analysis and elaboration-formalization. The analysis included 25 scientific articles and the PRISM (Preferred Reporting items for Systematic Reviews and Meta-Analysis) statement was taken into account.

**Development:** New technologies constitute a fundamental pillar in today´s modern world, since their evolution over time has favored educational systems. It is a new way of learning and teaching through channels of communication and exchange between students and teachers. They also promote interaction in a more autonomous way, improve learning and promote the acquisition of skills. With them, students can have a more leading role, to the point of becoming the architect of the educational process.

**Conclusions:** The scientific advance that society is going through implies changes in the educational activity. The diversity of scenarios, contexts and trend in education, impose new roles on the training process, which imply challenges for the professional of the future, the institutions, and the teachers in charge of their training.

**Keywords:** information technology; computer literacy; educational technology.

**RESUMEN**

**Introducción:** Las Tecnologías de la Información y las Comunicaciones se aplican como recursos y herramientas para el aprendizaje, ya que retienen, procesan y transmiten información digital.

**Objetivos:** Fundamentar la utilización de las Tecnologías de la Información y las Comunicaciones en el proceso de enseñanza-aprendizaje**.**

**Métodos:** En el Departamento de Epidemiología Hospitalaria del Hospital Pediátrico de Camagüey, se realizó una búsqueda de información científica en Internet durante el mes de marzo del 2024, estructurada en cuatro etapas: planeación, diseño-gestión, análisis y elaboración-formalización. El análisis comprendió 25 artículos científicos y se tuvo en cuenta la Declaración PRISMA.

**Desarrollo:** Las nuevas tecnologías constituyen un pilar fundamental en el mundo moderno actual, pues su evolución a través del tiempo ha favorecido a los sistemas educativos. Se trata de una nueva forma de aprender y de enseñar mediante canales de comunicación e intercambio entre estudiantes y profesores. Promueven la interacción de forma más autónoma, mejora los aprendizajes y favorece la adquisición de habilidades. Con ellas, los estudiantes pueden tener un rol más protagónico, al punto de convertirse en el propio artífice del proceso educativo.

**Conclusiones:** El avance científico por el que transita la sociedad implica cambios en la actividad educativa. La diversidad de escenarios, contextos y tendencias en la educación imponen nuevos roles al proceso formativo, los que implican retos para el profesional del futuro, de las instituciones, y de los docentes encargados de su formación.

**Palabras clave: t**ecnologías de la información; alfabetización informática; tecnología educativa.

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## Introduction

Information and Communications Technologies (ICTs) are resources, tools, equipment, computer programs, applications, networks and media that allow the compilation, processing, storage and transmission of information. They do this through voice messages, data, texts, videos and images, which are used to solve problems or make daily activities easier and adapted to the environment.[(1),(2)]

The main ICTs used in our environment include networks, devices and services. The first includes fixed and mobile telephone networks, broadband, television, and others in the home. In the latter, reference can be made to computers, smart phones and television, video game consoles, to name a few. Likewise, the services include emails, information search, cloud services, streaming, and social networks.[(3),(4)]

Several authors refer in relation to the origin of ICTs to two great advances, the telegraph and the telephone, which appeared during the 19th century.[1],[3],[5] The evolution continued with another great advance, the television, whose first broadcast was made in 1925, while color television appeared in the 1940s.[4]

During the 1960s and 1970s, the first computers were created with enormous dimensions in an experimental format. Rehearsals began on what would later become the Internet. Between 1970 and 1990, the concept of information and communications technologies emerged, which led to the integration of computing in communications with the arrival of the first computers and mobile phones.[6]

From 1990 to the present day, the evolution of ICTs has marked a milestone worldwide, as Internet connections are growing more and more, as well as computers becoming faster and more powerful. Mobile phones have evolved over generations with the possibility of access without limitations, through personal digital assistants or through smartphones, which marked the emergence of the digital revolution, currently developing.[7]

Given that there are almost 5 billion mobile phones around the world, the reach of ICTs is increasingly global. Countries like the United States and China dominate the market, as they present a concentrated and competitive sector. Its companies show the highest capitalization levels in the world. Other countries, such as Sweden, Singapore, Switzerland & South Korea, are also ready for cutting-edge technologies.[8],[9]

In Latin America, Brazil and Chile appear as the most developed countries, with important advances in the use of ICTs. In the Caribbean, Barbados and Saint Kitts and Nevis are the most advanced in this regard. Although Cuba is among the territories that use ICTs the least, in the last 10 years their massive use has been promoted, especially in the areas of education.[10]

The above allows the contextualization of the intention expressed in guideline 122 of the 8th Congress of the Communist Party of Cuba (PCC) related to: “Advance the computerization of the education system”. It facilitates the development of services in the use of the telematics network and educational technology in a rational manner, as well as the generation of digital and audiovisual content.[11]

The most recent experience comes from the confrontation with COVID-19, where the management of digitalized databases and the use of computer systems for government strategies was necessary. The information obtained through these resources made it possible to analyze the epidemiological situation and make timely decisions. In this way, various educational activities were carried out in all teachings with the use of technologies.[12]

In general, the introduction and use of ICTs has meant a dizzying leap in scientific and technical development. Based on the aforementioned, it was decided to carry out this review article with the objective of substantiating the use of Information and Communications Technologies in the teaching-learning process.

## Methods

A search for scientific information was carried out on the Internet during the month of March 2024. It was carried out in the Department of Hospital Epidemiology of the Pediatric Hospital of Camagüey. It was structured in four stages: planning, design-management, analysis and elaboration-formalization.

The articles were obtained from the Scopus, SciELO, DOAJ, and Latindex databases. The descriptors information technology, computer literacy, educational technology, and the logical Boolean operator OR were used. In the same way, original, review and position articles were consulted, regarding the titles and their summaries, to verify that they were in accordance with the stated objective. Once analyzed, a total of 25 articles were chosen, based on the following inclusion criteria: articles published after 2020, reviews with access to the full text, articles in Spanish and English languages, authors of different nationalities. The exclusion criteria were: articles in which there is no history of peer review. publications made on platforms other than scientific journals, duplicate articles.

The topics to be discussed were related to ICTs and education (advantages and disadvantages), ICTs and its link with higher education, medical education, as well as with COVID-19 and the role of the teacher. To prepare this review, the principles contained in the PRISM declaration were followed.[13]

## Development

### ICTs and Education: advantages and disadvantages

Starting in the 1960s, the development of computing consolidated the use of computers for educational purposes, specifically in applications such as computer-assisted teaching. In the mid-80s, experiments began with the implementation of computers in classrooms. This has generated a significant change in educational processes and methods, with the transition from the use of books and blackboards to computers, digital whiteboards and tablets, among others.[14]

Science and technology become increasingly demanding and innovative in different spheres of social life. Consequently, it is necessary for the educational community to update itself in the field of ICTs which are fundamental in the teaching-learning processes of today's society. They allow access to multiple information from one site to another, and, consequently, the development of skills and abilities of those who use them.[10],[12]

It is then specified that the creative use of ICTs is nothing more than the ingenious and own performance that each teacher has when precisely managing this technological tool in the contents and skills to be developed. The teacher must find points of union between creativity and education through alternatives, diverse, and stimulating spaces.[10]

The evolution and growth of ICTs is due above all to the large number of advantages they bring to the teaching-learning process. Among them, the broad access to information and educational resources, the development of creativity, encourages curiosity and attention, as well as developing autonomy and self-learning stand out. Likewise, it encourages psychomotor development, facilitates collaborative learning, introduces technology and prepares for the future.[15]

Technologies are not perfect, just as they provide multiple benefits in education, they also present some drawbacks to take into account. In this sense, distractions and lack of attention can be cited, excessive impacts reduce the development of other skills and generates the consumption of false information. Likewise, it can lead to the theft of personal data, reduces human contact and amplifies bullying.[16]

## ICTs and higher education

The digital era transforms social networks, which is why educational centers must face this challenge. In this regard, higher education is called to promote student recognition of the value and usefulness of the technological resources offered by ICTs. To give greater pedagogical and didactic usefulness to these tools, universities must carry out teacher training processes in which the development of technological competencies in teachers is guaranteed.[17]

These technological tools are essential in higher educational institutions. Their techniques allow new possibilities for teaching by opening communication channels that allow them to exchange ideas with students.[18]

The training and use of ICTs in university education help to extract the best results from each student, as they manage to foster an active attitude in each subject thanks to the new content. Tools such as virtual reality, robotics, simulations, video games, programming, among others, help learn through play.[14]

Universities must expand their educational offerings through online teaching, which promotes learning in a comfortable and economical way.[5]

In the educational field, it is about exploring, understanding and adapting the multifunctionalities that ICTs offer to improve the teaching-learning process. At present, a new term called TAC (Learning and Knowledge Technologies) is incorporated, which goes beyond learning, it is committed to exploring technological tools at the service of learning and the acquisition of knowledge.[16]

At the same time, multiple educational proposals and resources based on ICTs have increased. These include massive open online courses, seamless learning, mobile learning, learning environments, among others. This allows students and teachers to access a wealth of tools and information in all fields of education to learn, teach and share.[9]

## ICTs and COVID-19

During the COVID-19 confinement, the use of ICTs worldwide increased considerably. This situation has been taken advantage of and the advances should not be left aside, so the cognitive and instrumental implementation of these resources is urgently needed without detaching from the pedagogical purposes.[8],[14]

To carry out classes in virtual classrooms, education has had to reinvent itself, a situation faced by teachers who have seen the need and the obligation to use ICTs to teach. [19]

The universities that have not had problems in the development of virtual work are those that in their training policies had considered the use of ICTs as part of their educational model. In this framework, in order to give continuity to the teaching-educational process, teachers held conferences on different platforms, live or recorded, exams were posted on web pages, among others.[20]

Specifically, teachers have had to adapt to current conditions, where the use of ICTs has been crucial to not stop students' learning. However, knowing how to use technologies is not synonymous with knowing how to teach with them and nor does it imply an increase in the students' abilities to learn, since it is not enough to know how to use ICTs if one does not know how to teach with them in the context where students must learn.[21]

In Cuba, ICTs have allowed an important change in the educational field, since it facilitates knowledge, participatory methods, use of various educational platforms in which creative strategies are used that allow obtaining quality students. In this sense, the aim is to provide feedback to accompanied teachers on their performance through the communication area, to strengthen established professional competencies.[17]

In addition, a reflection is provided on the importance of digital technologies in students' learning with communicative expression workshops. It is stated that by updating digital tools it was possible to improve teaching-learning and maximize learning performance in graduated classrooms.[15]

## ICT's. Use and management in educational processes

The epidemiological isolation caused by COVID-19 has brought with it a series of challenges for teachers, since they have been forced to move classes from physical to virtual presence. Teachers have had to adapt to current conditions, where the use of ICTs has been crucial to not stop students' learning. However, as was said previously knowing how to use technologies is not synonymous with knowing how to teach with them and nor does it imply an increase in the students' learning capabilities (in the event that they could have access to them and use them), since it is not enough to know how to use ICTs if you do not know how to teach with them in the context where students must learn.[7]

Several authors[6],[9],[14] recommend digital tools for distance communication, dividing them into three categories, namely: chats (WhatsApp and institutional email), which allow sending and receiving messages, among other functionalities; learning management systems (Google Classroom and Edmodo), which allow teachers to organize the content of their courses, track assignments and communicate with students; and, finally, videos or videoconferences (YouTube, Google Meets, Zoom and Skype).[15]

Regarding the latter, reference is made to video as an excellent means of generating interest in students and videoconferences, for their part, enable greater interaction with the student body. Additionally, certain criteria of good practices for having a successful class are explained and encourage teachers to investigate and test the tools before extending their use to the home.[16]

Possessing tools to teach through ICTs does not guarantee student learning. It is suggested that there are difficulties that are due to different factors, such as design errors in the materials used or the lack of pedagogical and computer preparation on the part of the teachers. There are also limitations related to the application of ICTs in teaching processes, basically regarding the availability of adequate resources to establish an appropriate and efficient technological platform.[18],[21]

There is no clear evidence of a positive impact of technologies on learning. This is because, on various occasions, the results in research products are contradictory and obtained in specific circumstances, so a generalization could not be made. On the other hand, university students give ICTs significant importance from the point of view of entertainment and access to information, but they do not value them to the same extent as effective and useful tools in their academic training as future teachers.[17]

An effect related to the use of ICTs indicates that the concept of "technostress" corresponds to one of the negative psychosocial effects of their use, warning that exposure to these technologies influences the psychosocial well-being of the person, both positively and negatively.[19]

Students continue to see the interaction produced in person as an advantage, unlike that which occurs through ICTs. Furthermore, it is possible to assume that students find it more comfortable not having to adapt to new technological resources, due to the time and effort that this entails.[4],[7],[9]

It is important to mention that there are large technological gaps in the access and use of ICTs, with high levels of inequality between socioeconomic segments, age groups, educated and illiterate people. The above would constitute one of the great disadvantages of the development of ICTs.[10],[12]

In addition, there are also disadvantages related to the lack of privacy, possible fraud, social isolation, among other phenomena, due to the misuse that can be given to the technology. Likewise, it is necessary to consider the statements of the European Commission, which warns of the danger of overvaluing the potential of ICTs as agents of innovation and recommends readjusting people's expectations about what they can achieve with these technologies.[17],[18],[21]

## ICTs and the role of the teacher

Several authors refer to the fact that ICTs have not been given sufficient priority in Latin America, since there is an under use of these technologies in the region, especially within the classroom. Although there are many reasons that contribute to this trend, the most significant is that teachers do not have good training in the use of ICT for pedagogical purposes.[22]

Teaching processes should lead to serious reflection by teachers on the importance of knowing the appropriate use that should be given to ICTs to achieve their integration into education. That is, a change must be generated regarding the conception of the use of ICTs in terms of what and why to use them.[23]

The proposed standards were organized according to three different didactic approaches: basic notion of ICTs, deepening of knowledge and knowledge management. These guidelines aimed to develop the ICTs competencies of teachers,

from simple daily use and management, to their use to launch and evaluate projects with remote and permanent work groups.[21]

Without a doubt, it is necessary for teachers to know and use ICTs, which, especially in the current situation, are increasingly requested by schools. It is important to allow those who do not have ICTs skills the possibility of acquiring them and that those who already have them can reinforce them.[24]

In this paradigm of digital transformation, educational services and teachers must adapt, improve their knowledge and skills to face this reality. Likewise, they must make their knowledge available to the educational system and implement it, either as a support instrument, or as a complement to ordinary education, to improve the efficiency and effectiveness of the educational system, key in this digital era for the development of the society of the future.[22]

Now, this scenario, which, although it may represent a weakness in having to break the teaching digital divide, is offered as an opportunity in the educational field, for teachers and students.[25]

## Conclusions

The scientific advance that society is going through implies changes in educational activity. The diversity of scenarios, contexts and trends in education impose new roles on the training process, which imply challenges for the professional of the future, the institutions, and the teachers in charge of their training.

## References

1. Cardozo Gavilán MS. Uso de las TIC en el proceso de enseñanza-aprendizaje en estudiantes del primer y segundo ciclo de la educación escolar básica. Ciencia Latina [Internet]. 2022 [citado 21 de marzo de 2024];6(6):8354-71. Disponible en: https://ciencialatina.org/index.php/cienciala/article/view/4002

2. Poveda Pineda DF, Cifuentes Medina JE. Incorporación de las tecnologías de información y comunicación (TIC) durante el proceso de aprendizaje en la educación superior. Form Univ [Internet]. 2020 [citado 21 de marzo de 2024];13(6):95-104. Disponible en: http://www.scielo.cl/scielo.php?script=sci_arttext&pid=S0718-50062020000600095&lng=es&tlng=en

3. Sánchez Rojo A, Martín Lucas J. Educación y TIC: Entre medios y fines. Una reflexión post-crítica. Educ Soc [Internet]. 2021 [citado 21 de marzo de 2024];42(1):421-36. Disponible en: https://www.scielo.br/j/es/a/dvqVBqSLbL3BXxt93LMnDhd/?lang=es&format=html#

4. Paladines Enriquez NR. Implementación efectiva de las TIC en l educación para mejorar el aprendizaje: una revisión sistemática. Ciencia Latina [Internet]. 2023 [citado 21 de marzo de 2024];7(1):5788-804. Disponible en: https://ciencialatina.org/index.php/cienciala/article/view/4862

5. Aguaded I, Ortiz Sobrino MA. La educación en clave audiovisual y multipantalla. RIED [Internet]. 2022 [citado 21 de marzo de 2024];25(1):31-9. Disponible en: https://revistas.uned.es/index.php/ried/article/view/31454
6. Rodríguez Ravelo E. ICT and self-management of knowledge in Higher Education. Universidad y Sociedad [Internet]. 2022 [citado 21 de marzo de 2024];14(6):222-35. Disponible en: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S2218-36202022000600222&lng=es&tlng=en
7. Guevara Bazán IA, Martínez Cortés J, Landa Alemán AA. La adaptación a la tecnología en la educación: una situación emergente. Revista RedCA [Internet]. 2020 [citado 21 de marzo de 2024];3(8):49-61. Disponible en: https://revistaredca.uaemex.mx/article/view/15462
8. Ferrer Dávalos RM. Adopción e impacto de las TIC en la gestión de microempresas. Rev cient cienc soc [Internet]. 2021 [citado 21 de marzo de 2024];3(1):49-68. Disponible en: http://scielo.iics.una.py/scielo.php?script=sci_arttext&pid=S2708-04122021000100049&lng=en&nrm=iso
9. Giler Valverde GP, Melo Hanna GE, Quimi Franco WP. Efecto de las Tics sobre el desarrollo económico. RECIAMUC [Internet]. 2022 [citado 21 de marzo de 2024];6(1):159-72. Disponible en: https://reciamuc.com/index.php/RECIAMUC/article/view/774
10. Quilia Valerio JVM, Alfaro Mendoza JA, Riveros Avila MA. Impacto de las TIC en educación básica en América Latina. Rev Mendive [Internet]. 2023 [citado 21 de marzo de 2024];21(3):e3291. Disponible en: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1815-76962023000300026&lng=es&tlng=es
11. Vela Valdés J. El 8vo. Congreso del Partido Comunista de Cuba y la Salud Pública. Rev Cubana Salud Pública [Internet]. 2021 [citado 21 de marzo de 2024];47(3):e3285. Disponible en: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0864-34662021000300001&lng=es
12. Jiménez Franco L. Alternativas tecnológicas para enfrentar la COVID-19 en Cuba. Revista Cubana de Información en Ciencias de la Salud [Internet]. 2022 [citado 21 de marzo de 2024];33(1):[aprox. 14 p.]. Disponible en: https://acimed.sld.cu/index.php/acimed/article/view/2034
13. Matthew JP, Joanne E, McKenzie PM, Bossuyt IB, Tammy C, Hoffmann CD, et al. Declaración PRISMA 2020: una guía actualizada para la publicación de revisiones sistemáticas. Rev Esp Cardiol. 2021;74(9):790-9. DOI: https://doi.org/10.1016/j.recesp.2021.06.016
14. Gallo Macias GG, Cañas Suárez AJ, Campi Mayorca JA. Aplicaciones de las TIC en la educación. RECIAMUC [Internet]. 2021 [citado 21 de marzo de 2024];5(2):45-56. Disponible en: https://reciamuc.com/index.php/RECIAMUC/article/view/644
15. Parra Bernal l, Rengifo Rodríguez K. Prácticas pedagógicas innovadoras mediadas por las TIC. Educación [Internet]. 2021 [citado 21 de marzo de 2024];30(59):237-54. Disponible en: http://www.scielo.org.pe/scielo.php?script=sci_arttext&pid=S1019-94032021000200237&lng=es&nrm=iso
16. Peñafiel Rodríguez W. Educación y Tecnología y competencias TIC. Revista de Disfunción cultural y científica de la Universidad La Salle en Bolivia [Internet]. 2020 [citado 21 de marzo de 2024];19(1):19(19):11-4. Disponible en:

https://www.scielo.org.bo/scielo.php?script=sci_arttext&pid=S2071-081X20200002&lng=es&tlng=es
17. Luzbet Gómez FR, Laurencio Leyva A. La virtualización como alternativa para la educación de posgrado. Rev Cubana Edu Super [Internet]. 2020 [citado 21 de marzo de 2024];39(3):e17. Disponible en: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0257-43142020000300017&lng=es&tlng=es
18. Vargas Murillo G. Estrategias educativas y tecnología digital en el proceso enseñanza aprendizaje. Cuad Hosp Clín [Internet]. 2022 [citado 21 de marzo de 2024];61(1):114-29. Disponible en: http://www.scielo.org.bo/scielo.php?script=sci_arttext&pid=S1652-67762020000100010&lng=es&tlng=es
19. Alcívar Cedeño LE. Las TIC y su aporte en el proceso enseñanza y aprendizaje en los estudiantes. Cienc educ [Internet]. 2022 [citado 21 de marzo de 2024];3(7):28-40. Disponible en: https://www.cienciayeducacion.com/index.php/journal/article/view/147
20. Valero Cedeño NJ, Castillo Matute AL, Rodríguez Pincay R, Padilla Hidalgo M, Cabrera Hernández. Retos de la educación virtual en el proceso enseñanza aprendizaje durante la pandemia de la Covid-19. DC [Internet]. 2020 [citado 21 de marzo de 2024];6(4):1201-20. Disponible en: https://dominiodelasciencias.com/ojs/index.php/es/article/view/1530
21. Alvarado Rodas HR. Competencias digitales en el proceso de enseñanza-aprendizaje del docente y estudiante. Rev Gua Edu Sup [Internet]. 2020 [citado 21 de marzo de 2024];3(2):12-23. Disponible en: https://www.revistages.com/index.php/revista/article/view/28
22. Urday Cáceres JR, Deroncele Acosta A. Enseñanza-aprendizaje significativo en un entorno educativo virtual. Conrado [Internet]. 2022 [citado 21 de marzo de 2024];18(86):322-31. Disponible en: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1990-86442022000300322&lng=es&tlng=pt
23. Arriaga Delgado W, Bautista Gonzáles JK, Montenegro Camacho L. ICT and its support in university education in time of pandemic: a facto-theoretical foundation. Conrado [Internet]. 2022 [citado 21 de marzo de 2024];17(78):201-6. Disponible en: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1990-86442021000100201&lng=es&tlng=en
24. Alvarado Chávez TS, Velez Alban RV, Benavides Naranjo RA, Andrade Macías JB. Las TICS como herramientas en la formación del pre y posgrado de la Facultad de Ciencias Médicas de la UEES. RECIAMUC [Internet]. 2020 [citado 21 de marzo de 2024];4(1):277-95. Disponible en: https://reciamuc.com/index.php/RECIAMUC/article/view/763
25. García Cedeño J. Aplicación de las TIC en el Doctorado en Ciencias de la Educación Médica. SERIE [Internet]. 2022 [citado 21 de marzo de 2024];14(2):148-59. Disponible en: https://publicaciones.uci.cu/index.php/serie/article/view/750

## Conflict of interests

The authors declare that does not exist an interest conflict.

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