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TECHNOLOGY IN THE CLASSROOM: THE EVOLUTION OF ICT IN EDUCATION

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Abstract:
Information and Communication technologies (ICTs) have greatly influenced modern education, gradually becoming a crucial aspect of teaching and learning. Despite the widespread use of ICT in classrooms worldwide, its role in education is only one facet of its broader history and development. From early communication systems to the digital age, this article explores and examines these technologies and technological tools, following their development up to the digital age. This article aims to shed light on the history of ICT, defining the term and examining its key components, such as telecommunications and computing. It then moves on to the historical progression of ICT, highlighting key milestones such as the invention of the telegraph and telephone, the rise of radio and television, and the digital revolution that introduced computers, the internet, and then artificial intelligence. Each technological advancement has played an important role in reshaping how information is created, sorted, and shared, ultimately influencing various sectors, including business, healthcare and education. By analyzing the history of ICT, this article provides insight into how technological progress has driven global connectivity and communication. Additionally, it also reflects on the rapid pace at which innovation is progressing, as well as the challenges associated with technological advancements, including issues of accessibility and digital divide in many parts of the world. Understanding the historical contest of ICT allows for a deeper understanding of its present role and future possibilities it could provide in an increasingly interconnected world.

Keywords: academic experiences, in-person learning, online learning, transition

1. ICT as A Practical Educational Tool

In recent years, Information Communication Technology (ICT) has become a necessary educational strategy used by educators on a global level to "*facilitate teaching processes*."

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Though it has been widely adopted, ICT has often been introduced as an extracurricular tool or as a platform to serve as an aid for some teachers. However, after the spread of COVID-19, all countries —developed and developing alike— have realized the importance of educational technologies in ensuring students' distance learning and enabling them to complete their academic curricula while staying home during quarantine.

Over the past years, various educational reforms worldwide have emphasized the integration of ICT in education, particularly in higher education. Many international organizations and governments have published strategic visions for ICT reforms, highlighting education as a gateway to social and personal development, as well as the facilitation of community dialogue that strengthens relationships between institutions and their communities. These reforms aim to create fairness, equality of opportunity, and quality education for all.

To achieve such objectives, governments and institutions globally have focused on several key themes that secure a well-built and effective use of ICT, such as digital education, governance, private sector involvement, e-learning platforms, and accessibility. Many national and international initiatives, such as UNESCO's ICT Competency Framework for Teachers, the European Commission's Digital Education Action Plan, and similar strategies in various regions, have played a role in shaping the global approach to ICT in education.

Throughout this article, the objective is to explore the history of Information Communication Technology (ICT), examining what it is and how it has developed over the years. The discussion will trace the evolution of ICT in education, highlighting key milestones in its integration into teaching and learning.

2. ICT in the Globalization Era

The interest of this article is to tackle the relevant literature concerning ICT use and integration, and to study its historical development and evolution as a teaching tool in order to come up with a clear and general definition of ICT within education.

Undoubtedly, in our globalized era, ICT's global use is contributing to overcoming territorial and geographical boundaries between countries, their exchanging educational strategies and their people's easy acting and transacting. The integration of ICT in all various fields (economic, social, industrial, cultural, educational, etc.) has led to the necessity to date and update the knowledge acquired but also to be able to access, analyze, filter and select the array of information, news and messages received on a daily basis.

Besides, to survive in a competitive digital world the two perquisites' requirements have become first to make informed decisions, and second to go hand in hand with the fast rate of change and evolution, because surprisingly it is the first time in the history of humanity that what is learnt today is old fashioned tomorrow. It has, therefore, become crystal clear that nowadays knowledge by itself is not sufficient, and in order to be…

> *"…productive contributors to society in our 21st century, you need to be able to quickly learn the core content of a field of knowledge while also mastering a broad portfolio of essentials in learning, innovation, technology, and careers skills needed for work and life."*

Moreover, it has become crucial to equip the young generation with the most recently invented tools and created skills to become informed, knowledgeable, active and responsible global citizens ready to meet the challenges of the 21st century, an era when…

> *"…technology lies at the heart of the globalization process, affecting education, work and culture."*

Accordingly, in Digital and Media Literacy: A Plan of Action, Renee Hobbs, a media literacy pioneer, professor and founder of the Media Education Lab at Temple University, defines the essential competencies of digital literacy not only for finding and assessing information and sharing messages but also for taking action. He also argues that using ICT has become a must to form an effective, selective, digitally literate generation with…

> *"…the ability to access, analyze and engage in critical thinking about the array of the messages they receive and send in order to make informed decisions about the everyday issues they face".*

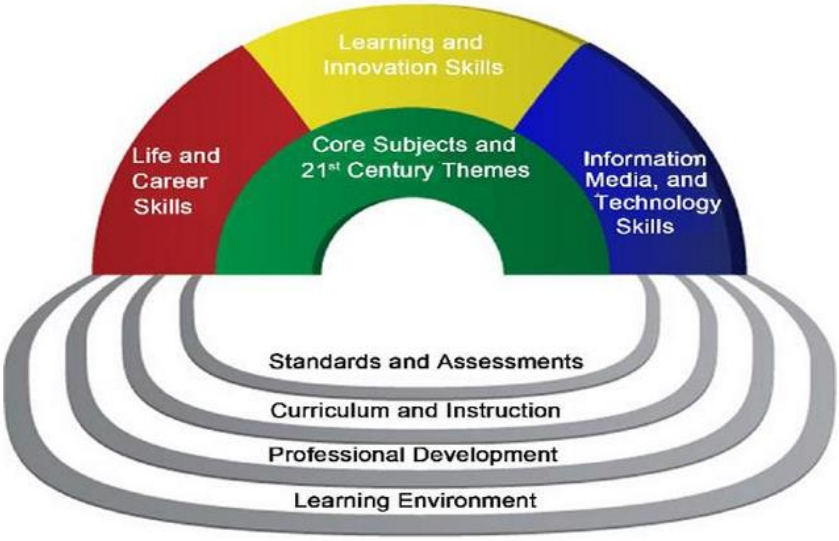

Figure 1: The Framework for 21st Century Learning.[16]

As highlighted by the afore-mentioned Figure 1, students nowadays have new skills to master, new capacities to develop and new knowledge to gain in order to meet the challenges of the global world. The frame revolves around three skills: Life and Career Skills, learning and innovation Skills and Information, media and Technology Skills, which are considered the standards of education and the key to success for students in

the 21st century. Overall, the frame highlights the fact that digital literacy is a requirement to survive in the fiercely competitive global world.

3. ICT within Education

Thanks to ICT, students can nowadays use internet references and gather data from various books, journals and articles. Hence, since its adoption by many educational institutions over the past two or three decades, ICT has been an important contributor to education and providing easy access to learning in many developing countries. Thus,

> *"…in Education, ICT can be referred to as the use of different types of educational technologies as mediators … which have been employed in the teaching environment for many different purposes."*

As a result of the exigencies of our globalized era, many educational systems do not perceive integrating ICT into their curricula as a choice but rather as a must in order to be part and parcel of the global community. It is clear and evident that the integration of new technologies has become essential in the educational field to enhance the teaching/learning process in and outside the classroom. Besides, the use of educational technologies creates an appropriate environment for students to achieve their full potential, and their learning is no longer limited by space or time. Because it combines the small classroom context and the unlimited space and time of cyberspace, students have the opportunity to enrich their knowledge and expand their research at their own pace and time schedule. Accordingly,

> *"The internet is an endless source of activity and information. The information they can find on the web is extremely rich and varied, and dissolves the walls of the classroom. The possibilities are limitless."*

Regarding the classroom context, teachers play a crucial role in integrating ICT in their courses, enhancing the teaching/learning process. When it comes to English language teaching, technology has empowered students to become more involved in the learning process. They are no longer passive recipients of the knowledge but active participants having a word to say and background knowledge to share. The following Frame highlights the roles that the teachers and students play in an educational environment where technologies are used. The teaching/learning process is no longer a unidirectional process with the teacher spoon-feeding the students, but rather a two-way process and a give-and-take transaction with the students as major shareholders in the learning capital.

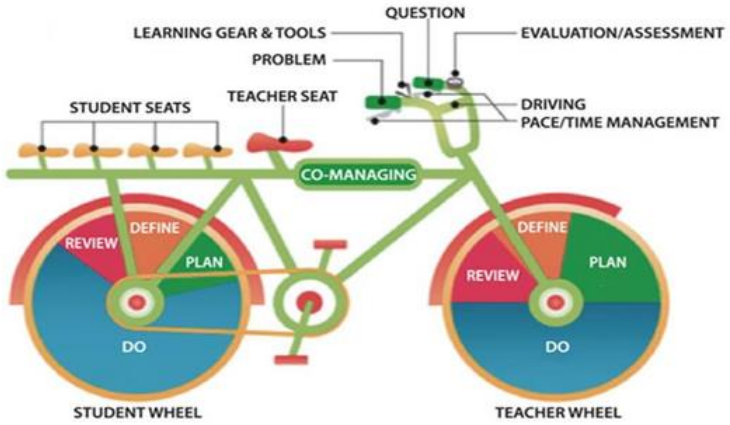

Figure 2: The Project Learning's Bicycle Model.[19]

The teacher and the students set new objectives to attain when they are equipped with new tools (ICT) that they can both master. Indeed, the objectives are no more to cover a program and teach content but more than that to prepare the future generation to the real world because, according to Eisner, "*life is a multimedia event and the meaning that we secure from life are not simply contained in the text; they yield their content through a wide variety of form*".

Technology has made it possible to bring the outside world into the classroom and create a virtual learning setting for students to enhance their language skills, communication competence, cultural knowledge and last but not least to become independent learners. Hence, technology…

> *"…not only motivates learning, it builds self-esteem, can provide immediate feedback, can provide learning beyond drill and practice, and it can address various learning styles as well as help build learner strategies."*

Within this educational environment, the teacher becomes a knowledge facilitator and monitor rather than a knowledge provider. Aware of the need to supplement the traditional "Chalk and Talk" methods and resources of teaching, and work on new and innovative approaches to meet the new demands of the 21st century.

4. The Definition of ICT

Information Communication Technology, also referred to as ICT, can be defined in different ways; for instance, it is referred to as "*the study of the technology used to handle information and aid communication*", and as new technologies emerge, its definitions expand and become up to date. They keep changing to account for the various technologies that emerge over the years, although the general idea is the same, as it is clear from the definition by UNESCO, which states that:

> *"Information and Communication Technologies (ICTs) refer to all technologies used to communicate, create, manage, access, gather, and distribute information. These include computer hardware and software, the Internet, telephone, television, radio, and audio-visual equipment."*

In addition, for Gholami, Information Communication Technologies (ICT) is a term that comes from two different concepts: "Communication Technology" and "Information Technology". By molding all these definitions with one another, the whole concept of "ICTs" is highlighted, based on their being tools that can be both communicative and informative. A broad and common example of this technology would be the new computers and mobile phones, but ICTs are not limited to these two devices, as the list of ICT tools is exhaustive and continues to grow over time. For another observer, while Information technology makes up part of ICT, information systems do not, so

> *"Information technology (IT) can be defined as computing and telecommunications technologies that provide automatic means of handling information. IT is therefore taken here to represent equipment: both the tangible hardware and the intangible software. A computer linked to other computers on a local area network represents one example of IT."*

He goes on arguing that,

> *"Information systems (IS) can be defined as systems of human and technical components that accept, store, process, output and transmit information. They may be based on any combination of human endeavors, paper-based methods and IT. A financial information system of staff and computers that gathers data and processes it into reports used for managerial decision making represents one example of an IS."*

Although some literature keeps using IT and IS interchangeably, IT and IS are not exactly the same, as information technology makes up part of information systems: Information technology can be perceived as a subset of information systems but not the other way around, because Information technology only involves the technology components, whereas information systems involve the people and processes as well.

Regarding the "*technological*" aspect of ICT, Galbraith highlights that it is "*the systematic application of scientific and other organized knowledge to practical tasks*", and Grübler argues that it "*consists of manufactured objects like tools and containers*", and "*their purpose is either to enhance human capabilities or to enable humans to perform tasks they could not perform otherwise*", stressing the fact that technology is a means to solve human problems.

Because such arguments are related to the concept that educational technology and instructional technology can be interchangeable though they are different in some aspects, K. Sharma pinpoints that educational technology refers to "*the development of a set of system methods and practical knowledge of designing, operating and testing schools as*

educational system", in other words, it is the effective use of technological tools in the learning process, similarly to Kumar who defines educational technology as follows:

> *"Educational technology is a systematic way of designing, implementing and evaluating the total process of learning and teaching in terms of specific objectives, based on research in human learning and communication and employing a combination of human and non-human resources to bring about more effective instruction."*

Moreover, among the more up-to-date definitions, one views that educational technology "*as a concept*" concerns "*an array of tools, such as media, machines and networking hardware, as well as considering theoretical perspectives for their effective application*"; being thus, is a multifaceted concept that mainly focuses on learning and facilitating this learning, while another considers it as the technology field that revolves around the creation of meaningful resources for learning.

Accordingly, in *Instructional Technology*, Seels and Richey define instructional technology as "*the theory and practice of design, development, utilization, management and evaluation of processes and resources for learning*". Besides, the Association for Educational Communications and Technology (AECT) denotes instructional technology as "*the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning"*. So, in 1969, the Commission on Instructional Technology defined instructional technology as,

> *"A systematic way of designing, carrying out, and evaluating the total process of learning and teaching in terms of specific objectives, based on research in human learning and communication, and employing a combination of human and nonhuman resources to bring about more effective instruction."*

In addition, instructional technology is defined as "*the ability to share information using media-based technology (audio, text, video, image, etc.) to facilitate enhanced interaction between educators and targeted learners*", as is the case with information systems and information technology. In contrast, educational technology can cover up instructional technology, and the reverse is impossible.

5. The History of ICT

Technology has been part of the world for a long time. After the announcement of the first computer in the world in 1946, education started shifting towards the use of technology in the education sector. Before dealing with technology within education itself, a brief history of how ICT evolved throughout the years will be given in this section.

5.1 The Four Major Revolutions

According to Kaino, ICT witnessed four major revolutions, and they include:

5.1.1 The First Revolution

Paper instruction was still the norm during that period. Students would rely on the teacher as the one and only means of information available. This teaching is what is known as the "traditional teaching method", where students acquire knowledge directly from the teacher, and reproduce it as it is later on.

5.1.2 The Second Revolution

It is also known as the "*communications revolution*", which was accompanied by a major increase in the use of computers and technological tools for educational purposes. This was made feasible starting from 1970 with the Altair, and was soon followed by Apple Computer, Inc.'s, the Tandy Radio Shack, and the Commodore Business Machines Personal Electronic Transactor (PET) in 1977. However, it was viewed negatively in the educational sector because parents and some educators viewed it as a barrier to students' creativity and knowledge acquisition.

5.1.3 The Third Revolution

For Kaino, the integration of telecommunications and microelectronic technology in computing, the era of "information technology" (IT) was born, as a result of the computers that became commonly used within education to provide a more diverse and entertaining method of teaching and learning.

5.1.4 The Fourth Revolution

The fourth revolution, which started with IT becoming "Information Communication Technology" (ICT), is still evolving. This revolution has mainly been affected by the birth of globalization, which led to its widespread adoption all over the world at a fast pace, as globalization has turned the world into a small village where people can act and transact freely, thanks to ICTs. Indeed, ICTs have destroyed the geographical barriers and boundaries between countries and changed the world into a small village.

Nowadays, education is mainly affected by technology. Whether in the classroom or at home, students can use computers to further increase their knowledge, communicate virtually with teachers, or discuss assignments with peers, and "*students can now learn while on campus or outside, benefiting more distant learning students worldwide*".

5.2 The Four Major Eras

Educational technology has seen major advancements throughout the years, with earlier technologies shaping it into what we know today. In total, educational technology went through four major eras:

5.2.1 The Pre-Microcomputer Era

The first ever computer to be used for education purposes was in the 1950s, to teach MIT pilots using flight simulators. Later on, computers started to be used more within the classroom, and mostly within the mathematical sector, by teaching binary arithmetic to elementary students in 1959. The emergence of Computer-assisted instruction (CAI) in

the early 1970s heavily affected universities with the introduction of mainframe systems for programming and shared utilities, where students would develop their software programming and benefit from the computer-assisted instruction. This CAI kept being used in schools only for a short period of time, as it started declining with the emergence of the computer literacy movement in the mid-1970s.

5.2.2 The Microcomputer Era

In the late 1970s, new technologies emerged, such as microcomputers, which were introduced to students by the teachers. It was during this period that the Altair, Apple Computer Inc., the Tandy Radio Shack, and the Commodore Business Machines Personal Electronic Transactor (PET) were introduced, and the notion of personal computers emerged. Parallel with this growth in computer usage by the public, the education context kept shaping, improving and attempting to integrate these devices in its curriculum.

5.2.3 The Internet Era

An important constituent of ICT is the internet, which was introduced through "World Wide Web" (WWW) in 1993; then became a part of not only schools and corporations, but households as well. Throughout the 1990s and early 2000s, the world witnessed a large use of the internet, which gave opportunities for online schooling to significantly increase. In this context, Roblyer argues that:

> "*Distance learning became a much more accessible option for higher education and even K-12. Virtual schools made up of online courses for high school students are being developed. The internet becomes a valuable tool for connectivity and research, and teachers work to develop ways to integrate the global access into their classrooms."*

5.2.4 The Mobile Technologies Era

By the early 2000s, social networking started gaining more popularity; as a result of the introduction of smartphones and tablets, which allowed people to be connected anywhere and everywhere 24/7. These new technologies, which kept on changing over the years, also led to many changes in the education sector, with the introduction of the E-book, "Kindle" by Amazon in 2007, followed by the iPad, which was the first handheld computer, also introduced by Apple in 2010. Such new technologies made the students gradually shift towards the screens rather than paper.

> *"Social networking sites and crowd-sourced sites like Wikipedia offer information and connectivity like never before, and technology is everywhere, as is the need for technological fluency."*

Conflict of Interest Statement

The authors declare no conflicts of interest.

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