Notes for a historical-epistemological approach to information and communication technologies

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Abstract: In this article, the author presents an analysis of the most recent information and communication technologies (ICT) and their influence on society. These ICT are constantly evolving, as they are designed, manufactured, and marketed continuously, creating pressure among consumers for the latest innovations and advances available in the market. Of note is the growing role these tools are playing in the educational arena, particularly at the primary level, where students learn about internet search, email, laptops, tablets, and other digital devices. This generation of students is commonly referred to as the "digital generation." It is claimed that while children are taught to use these devices, they lack the technical knowledge to fully understand them. The intention of this study is to conduct a comprehensive analysis of this phenomenon from various perspectives, including the impact of ICT on society and its implications for academic education. To achieve this goal, the topic will be divided into several sub-themes that will be integrated in a cohesive way.

Keywords: Information and communication technologies, digital generation, network connection, E-learning

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Notas para un enfoque histórico – epistemológico de las tecnologías de la información y la comunicación

Resumen: En este artículo, el autor presenta un análisis de las tecnologías de la información y la comunicación (TIC) más recientes y su influencia en la sociedad. Estas TIC están en constante evolución, debido a que se diseñan, fabrican y comercializan de forma continua, lo que genera presión entre los consumidores por obtener las innovaciones y los avances más recientes disponibles en el mercado. Cabe destacar el papel cada vez mayor que estas herramientas están desempeñando en el ámbito educativo, particularmente en el nivel primario, donde los estudiantes aprenden sobre la búsqueda en Internet, el correo electrónico, las computadoras portátiles, las tabletas y otros dispositivos digitales. Esta generación de estudiantes se conoce comúnmente como la «generación digital». Se afirma que, si bien a los niños se les enseña a usar estos dispositivos, carecen de los conocimientos técnicos necesarios para comprenderlos plenamente. La intención de este estudio es realizar un análisis exhaustivo de este fenómeno desde varias perspectivas, incluido el impacto de las TIC en la sociedad y sus implicaciones para la educación académica. Para lograr este objetivo, el tema se dividirá en varios subtemas que se integrarán de forma cohesionada.

Palabras clave: Tecnologías de la información y la comunicación, generación digital, conexión en red, E-learning.

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INTRODUCTION

Since T. S. Kuhn is usually spoken of "Scientific Revolution", since the formulation of the theory of relativity by A.Einstein (1879 – 1955), there was a radicalconception about the origin, structure, andevolution of the universe. This should also be referred to by W. Heisenberg (1901 – 1976), with his publication on matrix mechanics and his "UncertaintyPrinciple". Then, E. Schrödinger, will present his proposal of wave mechanics. These new conceptions opened the possibility of manipulating matter at the submicroscopic level, atoms directly, which culminated in the design and manufacture of calculation machines. (The structure of scientific revolutions, 1972)

The need to explain the so-called "scientific revolution" of the early twentieth century,was what drove the new epistemological approaches to science, that is, Physics, and at the head of them is that of K. Popper(1962), with its replacement of theories and its crucial experiments. Later, with the criticisms he made of this epistemologist,his professor, I. Lakatos turned to the concept of "research programs", to explain from these the developmentof scientific knowledge. It should be mentioned that epistemological analyses deal exclusively with Physics; since Galileo (1564 – 1642), science hasbeen linked to the need for the design and construction of instruments. (1983)

It should also be said that some historiansdo not share Kuhn's concept of scientific revolution, it has been understood that this occurs when a new theory proposes adifferent view of the world or the universe and is accepted after certain years by thespecialist community and is converted into an object of teaching. The literature review conducted allows us to affirm that the concept of "Technological Revolution" has not been proposed, although since the mastery and conservation of fire, ceramics, metallurgy, written language, and others, these have changed the way of living and the rhythm of life of humanity. As not to consider thesteam engine of J. Watt (1736 – 1819), preceded by the atmospheric machineof T. Savery (1650 – 1715), displacedby that of T. Newcomen (1663 – 1729), of whose technical and technological analysis, Watt designed the machine that consecrated it. (Bowler, 2007).

In 1803, R. Trevithick (1771 – 1833), designed the mechanism to be taken up again in 1829 by G. Stephenson (1781–1848), to build the steam locomotive, whose speed was only 48 km/h and, with it, to start the business of transporting passengers and goods by train. Robert Fulton (1765 – 1815), in 1806, adapted the steam engine, to develop the first ship powered by paddle wheel, which, of course, also transformed river transport. These innovations would end when, in Italy, physicists E. Barsanti (1821 – 1864) and A. Matteuchi (1808 – 1889), in 1854, invented the first internal explosion engine, although there is an extensive list earlier of characters who contributed significantly to this invention.

Despite this concise list of inventions and inventors, it is reiterated, there is no history of technology, perhaps because they have been regarded as ingenious craftsmen, with little academic training.At the head of these is the American hero T. A. Edison (1847 – 1931), who is said to have been self-taught and who alone created many of the technofacts that

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today, biographical reconstructions, deny. In his workshop he had a team of engineers who seemed to be the realbrains, whose skills he exploited by seizing the designs that, with speed, ran to apply for patents in his name Known is the dispute he had with N. Tesla (1856 – 1943) over the public use of direct current (Edison) and alternating current (Tesla), whose storage and transmission, was much more economical and technically manageable. (Weightman, 2008).

Something similar happens with the history of the artisans' manufacturers of scientific instruments, whose history begins in Alexandria, it is necessary to mention Galileo again, who entered the field of the manufacture of these, aware ofthe importance that these would have in the construction of scientific knowledge and the demand and demand that they would acquire in the market. Towards the middle of the fifteenth century, Nürenbergbecame the main European center of elaboration of these instruments, and was a reputed center, under thedirection of J. Müller (Regiomontanus),the pioneer of modern astronomy. It will happen that each scientific instrumentwill be part of the history of each theory and of the corresponding scientific revolution. (Bedini & De Solla, 1981).

In fact, the need to develop an epistemology of technologies was relegated, by the dominantpositivist conception due to Comte, that the technique was simply an application of the laws discovered by scientists, to production systems. It is understood thatthis statement by Comte is explainable, given that it was issued before the first "Industrial Revolution", and long before the one that occurred with theuse of electricity and the innovations that would be generated by these new information and communication technologies. Computers are the great revolution of the twentieth century and inthe XXI new innovations will bring more powerful devices in their processing speed and cyber-virtual memory will have greater capacity and more users. (Comte, 1984) (Kemp, 1986).

It should be highlighted that the new information and communicationtechnologies introduce a change in the epistemological tradition of the requirement of experimental results, since online or virtual tests emerge that force a new epistemology, all because the required experiments, whatever the purposes of these, can be carried out using this technology. The emergence of a new approach to science and technology, coupled with the need to explain its impact on society and individual behavior, imposes a significant challenge. (Humphreys, 2007), (Mulkay, 2005) It should be noted that the new communication technologies are characterized by permanent innovation, to the extent that any epistemologicalapproach to them runs the risk of being obsolete, unless the idea is accepted that any statement in this regard will always be peremptory and pending the necessary corrections. Either way and as has been established, those reflections necessarily must be underpinned in the story, so an attempt is made of it below.

METHOD

This research was conducted from the qualitative paradigm, where it is sought to understand the social and educational reality, where the actors prevail, since they are the builders of the social reality in

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addition to being flexible, giving the possibility of making modifications according to the characteristics. (Garcia Montejo, 2015).

In this sense, this research was carried out from the phenomenological-hermeneutic approach, which, for Van Manen "is orientedto the description and interpretationof the essential structures of the lived experience, as well as to the recognition ofthe meaning and pedagogical importance of this experience". (Ayala Carabajo, 2008).

From this, we resorted to documentary research that allows the collection of information to enunciate the theories that support the study of phenomena and processes, in that sense, this methodology allowed a systematic study of previous research in the field to develop an approach to the state of the art.

A STORY TO REFER TO

The first programmable mechanical computer was designed between 1935 and 1936, by the German engineer, KonradSuze (1910 – 1995), and built between 1936 and 1938, without its use becoming popular, because of what happened fiveyears later. Suze's designs were destroyedin the bombing of Berlin in 1943, so no record is kept of them. Three years later,in 1946, engineers and scientists from the University of Pennsylvania designedand built the machine called "Electronic Numerical Integrator and Calculator", known by its acronym as the "ENIAC". Look back, it was monstrous, since this machine occupied an entire basementof the Institution, since it was made upof more than 17,000 vacuum bulbs. To operate it consumed about 200 kw/h and gave off so much heat that it required an entire cooling system to keep it running. It performed 5,000 calculation operations per second. It was a decimal machine.

This problem will be solved. In 1947, John Bardeen (1908 – 1991), Walter H. Brattain (1902 – 1987) and William Shockley (1910 – 1989), developed and invented the transistor at Bell Laboratories, which would solve, the generation of heat and begin the era of miniaturization. In 1949, Jay Forrester, who is now 97 years old, designed the first memory that began replacing the unreliable vacuum bulbs. This was the technological solution of that time. In 1958, the German engineer Werner Jacobi applied for a patent for an integrated circuit or chip with semiconductor amplifier devices. The engineer J. S. Kilby, who was born in 1923, developed the first integrated circuit, a germanium device containing six transistors and a semiconductor base. Six months later, R. Noyce (1927 – 1990), designed and developed an IC with which he solved the practical problems presentedby Kilby's, such as the interconnections of all components. He simplified the structure of the chip by turning to a thin layer of metal and removing some of theconnections. In this way, mass productionof the IC was possible. It can be said thattoday, each chip is made up of a larger number of transistors, and innovations continue to grow. Miniaturization, not yet finished, made possible personal computers, laptops, cell phones, slideprojectors, small pocket tablets, which, as a latest innovation, incorporate all the functions of a current laptop.

Connected the previous account with the origin of the Internet, it must be narrated that this had its origin was the creationof the project "ARPANET" (Advanced Research

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Projects Agency Network) of the Ministry of Defense of the United States, as a purely military Project to create a network of computers, in order to unite the centers for defense research ,in case of attacks by enemy powers (readthe USSR), with the requirement that they could maintain contact remotely and continue to function in case one of the nodes was destroyed. The idea came up in academic research centers, such as MIT, the Stanford Research Inst., the U. of California (UCLA), the Rand corp. E, Inst. For defense analysis and oversaw the respective consolidation Taylor (He has today 84 years of life), J.C.R. Licklidler (1915 – 1999), the promulgater of the concept of "Galactic Network", Ivan Sutherland (78 years) and Laurence G. Roberts, born in 1937 and considered one of the fathers of the Internet.

Specify that the Internet is today a decentralized set of interconnected communication networks that use the technological kinships of TCP/IP protocols, which is the guarantee that the heterogeneous networks that make it up functions as a single logical network of universal coverage. Its beginnings must be found in 1960; in 1961, Leonard Kleinrock, with 81 years of existence,published the first elaboration on the switching of packets and convincedLawrence Roberts (born in 1937) of the feasibility of this communication instead of circuits, which was a great advance.It will continue, to make the computers dialogue with each other. In 1965,Roberts, he linked a TX2 computer in Massachusetts to a Q-32 in California, via a telephone line, thus creating the first network. Even though we must wait until 1969, when the link between UCLA and Stanford is established by means of a switched telephone line.It is in 1969, when the creation of ARPANET occurs. In this context, the "World Wide Web", WWW, the "Web"is created. This is a set of protocols that makes it possible to quickly and without complications to consult files.

Overcrowding and its consequences

Today and towards the second decade of the twenty-first century, most people in the world own a cell phoneand are connected via satellite with others regardless of where they live. In the same way, that majority hasa laptop computer and, "Systems", a school discipline has been made, for which these institutions have aspecialized teacher and a classroom equipped with these machines. College students carry a laptop in their bags that they deploy in their classrooms.

There is no one today who does notconnect to a network and a search engine to find solutions to theirpractical and intellectual needs. The idea that if someone is not on the Internet, for example, they simply do not exist, is making a career.

This technology has stripped us bare, making privacy outdated. In thisregard, it must be said that many figuresin the academic sector have developeda page with their titles, awards, and remarkable achievements; for which it is enough to know his full name and, witha "clip", appear on screen everything he has revealed about his personal and professional life. And it is in thisfact that all the difficulties and problems are hidden. Since computer criminals can enter each account and conduct unimaginable misdeeds. No one is exempt from these circumstances, except those who prefer to live in anonymity, and this is not acceptable for those who work in the academic or business world.

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They clone credit and savings cards. They impersonate the account holders; they threaten them with kidnapping to be paid certain millions to prevent it; and they pirate without the costsrequired original texts that they print to offerand sell on the illegal market. As a result, all global police organizations in the worldhave created a specialized unit to identify cybercrime and prosecute cybercriminals.

Although the above is true, the Internet is, as already specified, a means by which you can obtain information at hand, with only one clip at the selected email address. Especially for academics and researchers, most of the current issues of specialized journals are published and uploaded to that cyberspace. There is no scientific or popular article that is not found through a search engine.

It is important to understand that technology has transformed the daily life of people, and more than extensions of the body, they have become tools that help the construction and public dissemination of science and new knowledge, thus creating the knowledge society, a space where they are, easily and instantaneously, theknowledge of all and for all, decentralizing itfrom libraries and educational institutions,and allowing everyone to have access.

In addition, I transform passive users intoan important and active part of the data production process, giving impetus to the generation of collective intelligence, whereit is not necessary to know everything, buteach of the members of the community contributes their knowledge, and together, they build a larger knowledge, which gradually becomes knowledge. The pedagogical and didactic problem.

Of teaching this technology

By analyzing the background exposedit can be deduced that technology has changed the way the world works, for example, it is no longer necessary to makelong lines to perform a diligence, most transactions and service requests can bemade online, from paying a receipt, tax, services. or shopping in any supermarket,technology has made people's lives easier, but it has also brought about a change in the way they relate, as wellas in thinking and the way they act. We are no longer the same as a few decades ago, society was unified, as Marshall McLuhan (1911 - 1980) would say, in his posthumous work, the world was transformed into a "global village", hyperconnected, in which any event can be followed live, the news "chivas" ended, since from any electronic terminal anyone can be informed or misinformed.

The teaching-learning process has not been exempted from these changes. during the technological developments indicated, education has been immersed in the process. The first major event occurred in 1960, with a development of the University of Illinois called Programmed Logic for Automatic Teaching Operations – PLATO, whichconsisted of a platform for the trainingof the United States Armed Forces; although the program was cancelled, from there were generated advances such as the touch screen, widely used atthis time, instant messaging services andonline forums, among others. Regarding ICT in education, an important reference in Colombia in the decade of the 70s and 80s was the implementation of the baccalaureate by radio, an example in Latin America. This consisted of listeningto the classes through the radio and the students received the

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papers and texts through physical mail. That said, system was of significant help for the timely graduation of many Colombian peasants, unfortunately this was dismantled.

In the 90s there were experiences in computer-assisted teaching, taking advantage of the processes of multimedia, clear examples would be the Microsoft Encarta encyclopedia, first generation interactive courses, didactic games, simulations, among others. Multimedia forever changes the use of computer systems in educational projects, as the learner uses more than one sense toreceive information. From the knowledgerevolution and the advent of the web, the creation of virtual learning platforms was given way. In 2002 Moodle was born, anopen-source platform created by Martin Dougiamas; which is based on the concepts of constructivism and tries to generate collaborative learning. One of the problems that this platform has had is that teachers use it as a repository of documents and for the realization of exams, in addition the courses are designed from face-to-face courses; so, its use has not been potentiated. At the end of this decade, the Payment Platform Black Board was released, which has similar features and functionalities of Moodle; therefore, its use is also not appropriate from the standards of e-learning.

Another profound change happened with the massification of mobile devices, in 2007 the term M-learning was born, which is based on the use of these devices for education, taking advantage of the fact that people can access information at any time, an example is Duolingo, a platform for language learning.

The last big change that will be analyzed in this article is the arrival of the Massive Open Online Course (MOOC), these achieved that anyone in the world with an internet connection could take courses with the most important universities in the world; these courses massified the learning in the network through different platforms such as: Coursera, Myriad X, Edx, the platforms of Harvard University (HarvardX), MIT (MIT Open Course Ware), among the most important.

In addition to the thousands of virtual courses that are created day by day in the format of MOOCS, it is possible to find multiple courses in video format on YouTube, users have many options, however, you must analyze the quality and learning objectives, which, in some of these courses do not meet the minimum requirements and, sometimes people are tricked and deceived. It is necessary to have a good filter, see who certifies the course, what the methodology is and the price.

From the pedagogical processes, the pedagogical paradigm of connectivism should be pointed out, which conceives learning as a process of network formation. There is an analogy between neural networks, that is, the way neurons are connected for information transfer, and computer networks. According to George Siemens: Connectivism is the integration of principles explored by the theories of chaos, networks, complexity, and self- organization. Learning is a process that occurs within diffuse environments of changing core elements – which are not completely under the control of the individual. Learning (defined as applicable knowledge) can reside outside of us (within an organization or database), is focused on connecting specialized information sets, and

connections that allow us to learn more are more important than our current state of knowledge." (Siemens, 2006)

The starting point of connectivism is the individual, their knowledge is made of a network, which feeds information to organizations, study groups, institutions, which at the same time make the feedback in the same network, achieving that the knowledge is applied, improved and is disseminated and acquired by the individual, by having this development cycle the apprentices can stay updated in the field of knowledge that interests them. The characteristics of the connectivism model are:

- It is student-centered.
- The central axis is learning.
- Intellectual skills and capacities are developed.
- Assesses short-, medium- and long-term achievements.
- Technological resources are the basisof the model along with teamwork, collaborative and social networks (learning networks)
- The teacher becomes a guide within the chaos of information (the network).

The application of connectivism favors teamwork, both synchronous and asynchronous, having unlimited resources (internet), helps students to discover new skills, developing them and contributing them to their group or network, and, finally, develops critical thinking; in that sense Gallego Torres R.A. (2020) says:

To that extent, the current methods are no longer valid, and cyber-citizens are no longer left with the given concepts because they investigate, analyze, and reflect from the web, refuting everything, which results in absolute truths no longer exist, models are distorted, and we are close to a new scientific revolution that will change again the view we have of our reality. (p. 7).

CONCLUSIONS

In the past 20 years, technological development has exceeded what was done in the previous two centuries. Communication, information, and the learning process have been rapidly transformed. People are immersed in information, and their model of how to learn has been transformed. According to Marc Prensky in his book Teaching Digital Natives, people born since 1980 have new skills in terms of how they learn, so forms of teaching have evolved as well as new paradigms. The advent of the digital age has profound effects on human nature.

Teachers must update and improve their teachings since, with the elements and tools available on the net, students swim in information.

The teacher must change his role as a class dictator, to become a guide who helps make the knowledge acquired relevant in the learning process of the students.

Education has become a dynamic and changing process, the school is no longer necessarily a physical space, it can also be digital, full of challenges that must be faced by those responsible for educational policies, to incorporate technology step by step and with an appropriate planning to the changing modern world. It is important to understand

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that quality in education is important and that you must have parameters for its measurement and standardization, in the case of virtual education it can be said that the biggest problem they have is the misuse of tools by teacher switch leads to a lack of experience in users.

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