EDUCATION, BETWEEN SCIENCE AND TECHNIQUE

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ABSTRACT

This paper establishes a philosophical analysis towards education. It also pretends to be an approach by rediscovering the role of education towards science and technique, without forgetting the main focus on virtual education. Methodology involved review and analysis of some of the texts quoted in this article, as potential ways to lead readers into interesting and trend topics on education. As topics are established, hypothesis in development would be: Technical object as meeting spot for science and technique, justifying new education methodology in online learning environments.

A fundamental consideration based on history richness of mankind thought and its endorsement to science and so to knowledge, only possible if it has its own replica in education. Such consideration has a heavy load in philosophical literature, which may help as a foundation for elaborating a new lecture on education in today's technological world, already familiar for all humans. Now, I would like to invite readers to discover all items and ideas here presented in order to give new approaches on the subject.

Key words: *History of Latin American Education Journal, Science, technique, education, philosophy.*

LA EDUCACIÓN, ENTRE LA CIENCIA Y LA TÉCNICA

RESUMEN

Este artículo plantea una reflexión filosófica sobre la educación. Pretende ser un acercamiento, a modo de disertación, redescubriendo el papel que tiene la educación cuando se mueve en coordenadas tan claramente definidas como lo es la ciencia y la técnica, sin desconocer que la mirada está puesta en el horizonte de la educación desde la virtualidad. La metodología consistió en la revisión y el posterior análisis de algunos textos que se referencian a lo largo del escrito,y que son posibles caminos que orientan al lector en temas interesantes y a su vez actuales sobre la educación. Así las cosas, la hipótesis a desarrollar es: El objeto técnico es el punto de encuentro de la ciencia y la técnica que justifica la nueva metodología de la educación en los ambientes virtuales de aprendizaje. Es una reflexión que se fundamenta en la riqueza propia de la historia del pensamiento humano y de sus aportes a la ciencia y, por ende, al conocimiento, si y solo si tiene su necesaria réplica en la educación. Dicha reflexión tiene una

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carga bastante fuerte en literatura filosófica, que sirve de base para elaborar un posterior discurso sobre la educación en medio del mundo tecnológico, ya familiar para todo el género humano. Basta, por ahora invitar al lector a descubrir las aristas y los puntos de interés para propiciar nuevas indagaciones sobre el tema.

A EDUCAÇÃO, ENTRE A CIÊNCIA E A TÉCNICA

RESUMO

Este artigo apresenta uma reflexão filosófica sobre a educação. Pretende ser uma aproximação, à guisa de dissertação, redescobrindo o papel que tem a educação quando se move em coordenadas tão claramente definidas como o é a ciência e a técnica, sem desconhecer que o olhar está posto no horizonte da educação a partir da virtualidade. A metodologia consistiu na revisão e posterior análise de alguns textos que referenciam ao longo do texto, e que são caminhos possíveis que orientam o leitor em temas interessantes, e por sua vez atuais sobre a educação. Desta forma, a hipótese a desenvolver é: o objeto técnico é o ponto e encontro da ciência e da técnica que justifica a nova metodologia da educação nos ambientes virtuais de aprendizagem. É uma reflexão que se fundamenta na riqueza própria da historia do pensamento humano e de suas contribuições à ciência e, por conseguinte, ao conhecimento, se existe somente sua necessária réplica da educação. Esta reflexão tem uma carga bastante forte na literatura filosófica, que serve de base para elaborar um posterior discurso sobre a educação em meio ao mundo tecnológico, já familiar para todo o gênero humano. Basta, por hora, convidar o leitor a descobrir as arestas e os pontos de interesse para propiciar novas pesquisas sobre o tema.

Palavras-chave: *Revista História da Educação Latino-americana, ciência, técnica, educação, filosofia.*

INTRODUCTION

The recurring Prometheus Mmyth on themes that runs on human capacity to be echoed back. Greek mythology[2] has it that Prometheus had stolen fire from Hephaestus and then gave it to humans along with the wisdom of Athena, a gift that later would finally lead to the mysterious Pandora's Box. That was how they reached what was needed to invent and build more live able artifacts. The Science and the Technique know-how have in the Promethean Myth the foundational justification of human thought that creates. What a great fortune, then, meant this theft!

There are three parts that articulate this paper: firstly presents a way of understanding the relationship between epistemology and technology, entitled Joining of Terms. Secondly it is a philosophical reflection on technology, centering on the Technical Object, and finally, education is located between Science and Technology, by the name of Educational Technology.

1. Joining of Terms

Education, Between Science and Technique is a title that invites reflection on this writing. There are three terms that relate and at first sight seem to save some synonymy, for which it is necessary to clarify the following; They are not self-implicative and therefore are not equivalent, not implying a gradation of importance of epistemology on the technology[3] or the teaching of

[2] Juan Humbert, *Mitología griega y romana* (Barcelona, Editorial Gustavo Gili, S. A., 1997), 115.
[3] Technology is understood in this paper as the discourse on technique, later this sense of the term is developed.

them, nor indicate a *sine qua non* need, because they are terms with a separate etymology and story

Epistemology can have two ways of being understood and studied, one, proposed by Mario Bunge in his book *Epistemología* and another proposed by Mardones and Ursua in their book *Filosofía de las ciencias humanas y sociales*, with the proviso that they are not the only way. To the question of importance here become valid guidelines, especially because the three authors address the issue of the technological from epistemology.

Bunge's preface gives science the character of contemporary culture axle and engine technology. Epistemology is defined as the science of science or the philosophy of science – sense that is understood throughout this paper – it has involved in recent years the academic rigor of different schools of philosophy and other knowledge. For Bunge's philosophy of science is «the branch of philosophy that studies the scientific research and its product, the scientific knowledge»[4] Bunge locates the genesis of a serious epistemological reflection in the Vienna Circle (Wiener Kreis, 1927), which sought to emphasize logical empiricism, and thus, in the language as determinant factor in scientific processes. Some names belonged to this circle, such as; M. Schlick, R. Carnap, H. Reichenbach, V. Kraft[5] and later with other nuances will appear K. Popper. But, what was the contribution of the Vienna Circle? It was just a bit further with the Galilean Line to experience and to demonstrate, as it had also been treated by B. Russell technifying the language of philosophy, looking for something like a squaring of the scientific language. However, this marked interest was at once the cause of its rapid decline as the «linguistic philosophy killed the Vienna Circle from within»[6] creating a gap between philosophers and scientists.

How important is currently the science of sciences? For Bunge, the epistemologists are responsible for science and stimulate reflection on this. They allow closeness between philosophy and science generating criteria and meeting places where philosophy is involved in the various fields of knowledge to strengthen and validate the scientific proposals. The epistemology allows for a rigorous philosophical discourse making its truths consistent with the reality that we admire and which is investigated.

Meanwhile, Mardones and Ursua[7] pose the issue from the Aristotelian tradition, with a systemic corpus already developed, however, it will be said that epistemology exists from the moment that men were able to calculate the changes they could do on their environment. It is the characteristic of homo faber or of primitive men, who as toolmaker animals transformed their primeval environment. In a necessary relation to the Homo Faber, there is the Homo Sapiens, which means that it is not only to create but to know how to create and make, concept which is very well explained and coined by Aristotle in the Task of the Craftsman. With Aristotle, it is known that there was a philosophical reflection turn around knowledge, because reality is a source of

[4] Mario Bunge, "Prefacio", in *Epistemología* (Mexico: Siglo XXI Editores, 1980), 13.
[5] Bunge, *Epistemología*, 15.
[6] Bunge, *Epistemología*, 17.
[7] These authors understand epistemology not as *a priori* dogmatic system that determines what knowledge is, it is holistic and of dynamic character. José M. Mardones and Nicolás Ursúa *Filosofía de las ciencias humanas y sociales* (Barcelona: Anthropos, 1983), 67.

knowledge, and experience becomes a fundamental role, and reality is knowable by the way of dealing with it. Thus, the know-how (tekne) of Craftsmen, finds in the Aristotelian Philosophy the Archimedean lever to develop knowledge. The artist creates (poiesis), produces things or artifacts, changes reality. The gain from Aristotle is the possibility of sensory experience to generate learning and knowledge. But «the experience, apparently, is assimilated almost to science and art. Due to experience, science and art progress in men. The experience, says Polus rightly so, made the art, and inexperience made the chance»[8]. The experience allows art to be taught or passed, and is then communicated as the master – who knows how to do – can show the object created, and the disciples know that knowledge can be made. Then, the art of making is Science or Episteme to Aristotle.

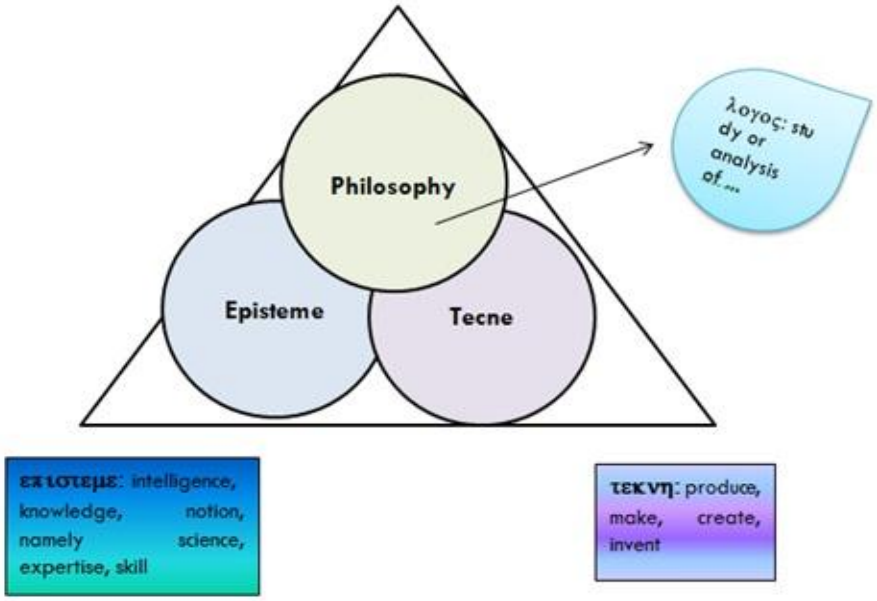
Now, it is important that science holds a systemic element that configures and facilitates its understanding. Thus,

> *There will be no need to look for the subjacent substance to phenomena as mathematical laws unveil the actual structure of the physical world. Galileo is a typical representative of the new mentality that changes the physical quality explanations of Aristotle for Archimedes mathematical formulations*[9]

The above represents a benefit from the Galilean perspective, which relates phenomena to mathematical laws, and therefore to numerical laws. It also represents Bacon's insistence to assert that nature would be written in mathematical characters for interpretation, and that such interpretation transforms nature. In this line of argument are authors such as Copernicus, Brahe, Kepler and Galileo himself up to Newton in what is known as the Scientific Revolution, which in turn implied a new way of being of men and their relation to the cosmos. Although the focus is on mathematics as a guide for science, which is intended to be shown, is that reflection has a basis on experimental testing and method, in regards of physics and of the emerging chemistry era here mentioned. This expansion of knowledge already described, allowed to develop a philosophy of science embodied in the positivism of A. Comte and Stuart Mill, who even allowed sociology to be counted within the Sciences. The connection between the epistemological and the technology determines the proximity of the concepts; the philosophy is the hinge that opens the reflection of each other. It is not and it can never be a concentric reflection, since concepts are not subsumed. Each concept has its own dynamics, and the relationship and explanation is shown in Figure 1. Philosophy is the bridge to move from one bank to another and the logos is the splice or connector between the episteme and the techne.

[8] Aristotle, *Metaphysics* Book I - Chapter I - 981ª (Madrid: Gredos 1998), 5-10.
[9] Mardones and Ursúa, *Filosofía de las ciencias humanas y sociales*, 19.

Figure 1: Venn diagram explains the union of terms.



Source: Own

Aristotle defined man as a "rational animal" ζωον λογον εχον[10]. Logos (λογοσ), meant the ability to make rational judgments, therefore, to be right is to have logos. Immediately, this creates a common thread between reason and language, as the judgments or statements were ontic expressions in words. Thought is expressed by means of spoken and/or written language. The concretization of thought is realized in discourse with the features that it has, that is, valid, consistent and above all, argumentative, purposeful and critical. The way the exercise of thought is measured, is by the argumentative ability of discourse, how to spin the statements, the logic of propositions and the creativity placed on what is said, like poetry, for example. For this case of study the logos is the axial point between episteme and techne philosophers, in other words, all three are expressed by the logos.

2. The philosophy of technology [11]

> *"Below us, set on the shores of a small cove, was the giant nuclear reactor, still under construction, a huge brown rectangular block and two white domes. [...] Just at that moment another sight caught my attention. In line with the reactor and Diablo Rock but much farther from the coast, a California gray*

[10] Aristotle, *Metafísica*, 8.

[11] The title of this paragraph is based on the concern that has been generated in the group of philosophers who have written about the peculiarity of philosophical and technical changes. These include Mitcham, Winner, Ortega and Gasset and Heidegger, among others mentioned indirectly in this research work.

> *whale suddenly rose to the surface, took to the air a column of steam from his blowhole and then disappeared beneath the waves. An overwhelming silence overcame me''*[12].

Is it possible to do philosophy of technology? Sure it is. In recent years much has been written about it. The origin of philosophy is given in the sense of admiration, which is an action humans perform towards the changing reality. And in this sense there are indeed reasons enough to admire, because reality has changed, and in some cases it has changed thanks to technology. In this connection, to Ortega y Gasset the technique is: «..the reform men impose to nature in regards of meeting their needs. [...] a reform in the sense of needs being cancelled to stop being bypassed satisfaction problem»[13]. The heading of this section guides the direction of this reflection, causing astonishment to recognize that the natural world has changed. Surely this Langdon Winner inspired to title his book *La ballena y el reactor*, is one of the books on philosophy of technology where the emphasis is laid by the author on the political issue and reason, subject already in Plato, to define politics as the art of governing. So, art, poetry and politics find their relationship in art.

Carl Mitcham in the preface of his book *¿What is the philosophy of technology?* defines the technique as «.a set of procedures implemented to achieve a particular result»[14] A simple definition in terms of approach but in terms of the author, he argues and builds from different authors who have already spoken about it. At the beginning of his book, Mitcham develops what he calls the two traditions of philosophy of technology, that is, the philosophy of engineering technology and philosophy of technology in the humanities. The first tradition highlights the contributions made by Ernst Kapp and the second; the reference is more prolific as mentioned by Mumford, Ortega and Gasset, Heidegger and Ellul. These are some of their contributions:

Ernst Kapp (1808-1896) is the one who coined the term *Philosophy der Technique* or philosophy of technology, and his early research interests are around geography generating a reflection on what we might call an ecology or environmental philosophy. Kapp is a Leftist Hegelian highly influenced by Marx, «undertook the task of formulating a philosophy of technology, in which the tools and weapons were understood as different types of 'projections of the organs»[15]''.

In the second tradition, stands out Lewis Mumford (1895-1990), whose contribution is directed towards the *myth of the machine* (title of one of his works), and above all to explain the psychological or cultural origins and material and efficient causes of technology. His input is very interesting for this paper, therefore makes a hermeneutics of human action in the symbolism of language «it was incomparably more important for human development than the splintering of a bunch of hand axes»[16]

[12]Langdon Winner, *La ballena y el reactor: una búsqueda de los límites en la era de la alta tecnología* (Barcelona: Gedisa, 1987), 188.
[13]José Ortega y Gasset, *Meditación de la Técnica y Otros Ensayos sobre Ciencia y Filosofía* (Madrid: Alianza, 1982), 28.
[14]Carl Mitcham, *What is the philosophy of technology?* (Barcelona: Anthropos. 1989), 12.
[15] Mitcham, *What is the philosophy of technology?*, 29.
[16] Mitcham, *What is the philosophy of technology?*, 55.

Elucidation so far has revolved around technique, but, what is technology? One could argue that it is the epistemological theoretical corpus that analyzes and describes through language, oral and written, the technique as human action. The *etymological dictionary* of Corominas Quiroz Gonzalez quoted in his book *El porvenir de la razón en la era digital*, defines technology as:

> *... a word that appears in the Spanish language in 1765 (like the adjective "technical" used to refer to specialists, and resulting in the noun "technique" in the late nineteenth century) and is derived from the Latin adjective "technicus" which comes from the Greek word "tékhne" which means art, skill, procedure, etc*[17].

Some authors refer interchangeably to technique and technology. This suggests that the technology is the scientific philosophical reflection about the technique. What is being done in this paper is a techno-logos, which is a dialogue, a dissertation on the vast world of art that does not stop at the mere dialectic, it references and frames in the language of both engineers and architects, and as discussed at the end, even in the language of educators, this reflection has as main character the technical object.

a. The technical object

> *Individuals are signal-sign systems. All individuality is intensive: therefore, it is like a waterfall, like a lock, communicating, embracing and affirming in itself the difference in the intensities that constitute it*[18].

To say «things» the Greeks had an appropriate term such as *pragmata* (πραγματα), amphibological itself, because it could mean stocks, business, thing, fact, object[19]. The importance of this etymological analysis is the Greek expression that in Spanish refers to practical or pragmatic, or to the use of something; things that have a specific use become practical tools. «These are technical objects, that is, things that have an specific instrumental purpose as tools, or as utensils (useful to men), many of them have been meeting human customs and are not regarded as strange, for example; a spoon is not defined as a technical object or instrument, it is more a tool, something familiar, its pragmatic could be interpreted as congenital for humans. Not being the same situation for a hammer, whose pragmatic or practical use is casual and as a tool is a technical object»[20]. In aesthetics, culture has readily accepted the beauty of the artwork, while maintaining some reluctance with the technical object, recognizing that phenomenological and existentially talking, we are not only immersed in a world of things, we are also immersed in world of technical objects.

[17] José Luis Gonzales, *El porvenir de la razón en la era digital* (Madrid: Síntesis, 1998), 13.
[18] Gilles Deleuze,*Diferencia y Repetición* (Buenos Aires: Amorrortu, 2009), 367.
[19] J. M. Pabón, *Diccionario Vox Manual Griego* (Barcelona: CREMAGRAFIC, 2000), 495.
[20] It has been a concern in the inquiry of the writer of these lines, to make a judicious study from what the technical object is and its impact on the educational space. On this respect: José Alberto Rivera P., "Hermeneutics of distance education from a philosophy of technology", Journal of Research UNAD Vol: 9 No 3 (2010): 7.

For Heidegger, things develop into useful/technical objects, in their most usual expression, in their reference to the «for» from the way to be used. The better a hammer is used the more original its use becomes, it then becomes employable, and therefore as all technical things, they carry their reference in themselves, becoming useful as they hold a certain purpose. The dealing with things makes it useful or not, depending on their reference towards the person who uses the thing, if it is practical or not for the job a person wants to perform. Heidegger in his article *The Question Concerning Technology* [21] says

> *"The word comes from the Greek language - Τεχνικον - meaning something which is in a certain way that belongs to the τεχνη In view of the meaning of this word we have to pay attention to two things. First τεχνη is not only the name for the making and the know-how of the manual worker, but also for the art, in the highest sense, and for the fine arts. The τεχνη belongs to the bringing-ahead, to ποιησις it is something poietic.*
>
> *The other thing, in regards of the word τεχνη, that is to be considered. The word τεχνη from early times until the time of Plato is in agreement with the word επιστημη both words are synonym names for the verb "to know" in the broadest sense. What they mention is an understanding of something, to be understood in something. Something becomes apparent from knowledge. [...] The τεχνη is a mode of αληθευειν. it takes from what is hidden something that is not produced by itself and is not yet ahead, and therefore may appear or happen this way or another. Who builds a house, a ship, or forges a sacrificial goblet and brings out from the hidden what-needs-to-be-brought-there-ahead, and does something according to the perspectives of the four ways to cause something"*[22].

One of the great unknowns of the philosophy of technology is the philosopher Gilbert Simondon, author of *The mode of existence of technical objects*. He has been called the lawyer of the technical object and the teacher of the machinery, he is also a critic of those who demonize the art and put it on another level. This French philosopher makes a reflection in his own terms of the technical phenomenon, that is to say, he named everything from the fields of electricity, electronics and general industry. It is a philosophical reflection with engineering terms, with its own language.

Above, it has been said that the logos allows transit between the science of science (epistemology) and the technology, which is to say that the language allows displaying the closeness and that the protagonist of this dialectic is necessarily the technical object. Why is it more important a work of art than a technical object? Isn't it possible to say that an engine, whatever it is, is also beautiful?

> *"Therefore, the discovery of the beauty of technical objects cannot be left only to perception: it is necessary to understand and comprehend the object's function, in other words, we need a technical education so that the beauty of technical objects may appear as insertion technical schemes in a universe, in key points of this universe"*[23].

[21]Martín Heidegger, *Lecture given at the Bavarian Academy of Fine Arts*, en Vörtrageund Aufsätze, 1953.
[22] Martín Heidegger, *Lectures and articles.* (Barcelona: Ediciones del Serbal, 1994), 24.
[23]Gilbert Simondon,*El modo de existencia de los objetos técnicos* (Buenos Aires: Prometeo, 2007), 203.

Simondon moves in a triangular explanation: religion, technicality and aesthetics[24]; these also called phases, which in their displacement or gap originate one from each other and in turn on each there is a split in a theoretical and practical way. In the field of aesthetics, Gadamer has studied the ontic character of the work of art and has said that as *repraesentatio* (representation), the picture is an artistic expression, a mimesis Image[25]. Somehow this explains why in the world of things, a work of art, whatever its manifestation, acquires right of existence and ontological significance to be recognized by the culture, while a hammer, an ax, a computer, refer immediately to their unilateral, utilitarian, and external maneuver functions. How does the technical object gain ontological space?

b. The ontological statute of the technical object

With Simondonel, technical object acquires an ontological dimension, somewhat complex to understand, as he calls it individual. The technical object becomes individual and the precondition of individuation is in response to a need, addresses to a real lack, it is phenomenologically clear that an object is a thing among things, while the individual acquires a different ontological representation given by self-determination that makes it a subject different from the object-thing. Despite the complexity it may represent at first:

> *"The principle of individuation of the technical object through recurrent causality within the associated media allows [...] to know if it must be treated as technical individual or as an organized collection of individuals. We shall say there is technical individual when the associated media exists as a sine qua non of operation, while there is a set in the opposite case"*[26].

The technical object also functions as a mediator of collective intelligence as Pierre Levy puts it in his book *What is the virtual?* Because it is a witness of change and progress, the object is in the hands of each other. It is crossed by the various operations that deliberately makes it a subject and puts it touch with reality. «Our subjectivity opens the game of common objects which builds, with the same symmetric and complicated gesture, the individual intelligence and the collective intelligence, as the front and back of the same tissue[27]. This is the opportunity to raise closeness between the educational means of education supported by ICT (Information and Communication Technologies) and the learner.

c. The evolution or concretization of the technical object.

From what is discussed in this section is to explain the concretization process, nearly evolving to reach the technical object, from the technicality as generator of technical objects

[24]Simondon "*El modo de existencia de los objetos técnicos"*, 206.
[25] Gadamer in *Facts about the beautiful and in Truth and Method I,* makes a phenomenological study of the work of art in the cognitive sense of imitation. There are two elements to highlight in this conception: the playful nature of the work of art and its ability to be known to play imitation, which draws attention from the world of education to make learning a playful space of knowledge. Later in the latter part mentioning the virtual learning environment as a dynamic of knowledge.
[26]Simondon, *El modo de existencia de los objetos técnicos*, 81.
[27]Pierre Lévy, *What is the virtual?* (Barcelona: Paidós,1999),119.

> *The invention, which is a creation of the individual, involves in the inventor, the intuitive knowledge of the technical nature of the elements, the invention is satisfied at that level between the concrete and the abstract. [...] In the reflection of the consequences of the technical development in relation to the evolution of human societies, which must be taken into account, first of all, is the process of individualization of technical objects, the human individuality is increasingly separated from the technical function by building technical individuals…*[28]

Fortunately, the history of humanity has been benefited from the process of concretization of the technical object. This input will reaffirm apologetic character that Simondon wields against the denigrating and demonizing attacks that are made on the technical and technological advances. The technical object, then, after leaving a traditional phase reaches its concretization in the middle ground between the natural and scientific representation, as their actions are exerted on the laws of science. «They are just invented, properly speaking, the technical objects requiring a media partner to be viable…»[29] A computer is possible today, because associated media allows it to exist, because there is a requirement of the media, because it is a historical necessity in that it represents evolution to humanity. The particular and the object itself allow it to be such by the process of concretization, which is projected into the future.

Regardless of the philosophical reflection made on the technical object; it exists and does not need any permission for this. The logic of programming, algorithms, microprocessors, cell phone, iPhone, and many concretizations given from the technical object allow positive reaffirm of human inventiveness. The invention is a mental operation that puts in reality a complexity that exceeds the saturation of the machine that allows man to be in regard to ontic character. «... That is, the technical object to the extent that it has been invented, designed and loved, taken by a human subject, becomes the symbol and support in this relationship we would like to call *transindividual*»[30]. This allows, even to Simondon, to assert that in the invented object there is something of the nature of its inventor, there is human nature in the technical being. Thus, the creature would depend on its creator and the technique on the technician. This statement would reassure the concerns some people have regading the management and independence of the technical world, because «...the objects appear at a certain time, but the technicality precedes and exceeds, technical objects result from a technicality objectification, they are produced by it, but the technicality is not limited to objects and not fully contained in them»[31]. Just as the Aristotelian *ousia* (substance), can give support to the reality of things, the technicality allows to justify the appearance of the technical object, the purpose or teleology of the technique is given in the process of concretization of the object, a process achieved by supersaturating thereof.

Although the acceleration process has been invaluable and amazing and all that remains to advance and discover is too broad. For example, the Internet today has made the electronic highway more complex. Simondon glimpsed in some way when addressing the issue of reticularity.

[28]Simondon, *El modo de existencia de los objetos técnicos*, 100.
[29]Simondon, *El modo de existencia de los objetos técnicos*, 78.
[30]Simondon, *The mode of existence of technical objects*, 263.
[31]Simondon, *The mode of existence of technical objects*, 180.

> *Therefore, to the extent that a polytechnic technology replaces (sic) separate techniques, technical realities, in their objectivity performed, adopt the network structure, they are in relation to each other, [...] but technical sets are real networks, they are specifically linked to the natural world [...] but it a network cannot change, cannot be built: a it can only be connected to the network, adapt to it, participate in it, the network dominates and encircles the action of the individual, dominates even each technical set*[32].

Without forcing anyone to say something different, the current interpretation of this section could well be done from the Internet. Human culture has been changed by this technology, humans' relationship with the world and with themselves have changed, the culture has been permeated by this virtual environment.

3. Educational Technology [33]

> *Education is possibly the most important branch of scientific technique, since it greatly affects our entire existence. We must not continue to allow a practical situation prevent the huge advances that are within our reach. [...] The kids play for hours with mechanical toys, crayons, paper and scissors, noisy artifacts, puzzles ... in a word, with almost everything that makes significant changes in the environment and is reasonably free of unpleasant/aversive properties*[34].

The coordinates have already been laid and well delineated, one is technical and the other is the episteme or science, in this sense; where is education ranked? It is necessary to say that education as a human process has never been away from the positive impact of technical progress; on the contrary, it has been enriched by them. It is conceivable that the blackboard, chalk, pencil, notebook and text are technical objects that have facilitated the teaching and learning throughout human history.

The computer – concretized technical object, both in software and hardware– has facilitated the educational processes[35], possible by advances in word processing, graphics, tables, etc... Ultimately,

> *…the reality that we build on the screens not only influences our behavior, but also our perception of the world, often making us live in a reality that is somewhat virtual, but from the media itself can be presented as real-reality*[36].

Consistent with the above quote, today we use intelligent interfaces, environments that have all the features necessary to simulate and create dimensions and virtual coordinates that facilitate real learning as the information provided is true and accurate. Something to note in this

[32]Simondon, *The mode of existence of technical objects*, 236-237.
[33] The Educational Technology is currently a topic of great interest, which is shown in the extensive literature and concern to the respective orientations, especially when they involve an educational challenge. In this paper, it has been taken the book of Cabero *Tecnología educativa*. (Madrid: McGraw Hill, 2007).
[34]Burrhus F. Skinner, *Tecnología de la enseñanza* (Barcelona: Labor, 1970), 34.
[35]To expand on this topic, review Chapter 11 of the book by Julio Cabero, *Tecnología educativa* (Madrid: Mc Graw Hill, 2007), 173-193.
[36] José López, José Luján y Eduardo García, *Filosofía de la tecnología* (Madrid: OEI, 2001), 89.

connection is the contribution of Nicholas Negroponte about teaching children through play, when he says:

> *The boys who today use LEGO learn physical and logical principles that you and I have learned in college. Anecdotal evidence and detailed test results reveal that the constructivist approach is an incredibly rich learning through a wide variety of cognitive and behavioral styles. In fact, many children who were supposed to be incapable of learning, improved in the constructivist environment*[37].

Games have some important features that are useful nowadays in education supported by technical means. Among these features are their dynamic, autonomous and collaborative features. Learning through games is not only imperative for early childhood education, since it is valid also in different stages of human formation, and even more when a person has the tools to build dynamic spaces thanks to media, simulators and remote laboratories; the list will continue, thanks to the increasing way of different learning, even if the same characteristics of the game mentioned above prevail.

Today pedagogy is mediated by technologies or didactics, which are based on the technical media[38], so that their reality is imposed, using the publicized facilitators supported by ICT for teaching and learning. This does not mean that we are exclusively in a historic privileged moment for education, as at other times in history, technical progress or new discoveries have enabled progress in education, it is enough by far to mention the invention of printing, as well as the pencil and paper.

The writing has lost its field, in Levy's words of deterritorialization of text[39]. This has allowed the information be easily accessible. So, the Web has revolutionized the world of education, to the point that it is well[40] to talk about virtual learning environment, and all this just because:

> *Virtualization, far from annihilating the text, seems to coincide with its essence suddenly unveiled. It's like contemporary virtualization fulfills the destiny of the text, as if we stepped out of prehistory and some text adventure had just begun, as if, in short, we had just invented writing*[41].

In 1958 B. F. Skinner writes an article entitled "*Teaching Machines*"; most directly began writing about the teaching machine in a historical context framed by the launch of the first Sputnik, the radio and the tube TV, the phone beating the telegraph and other advances of the industrial

[37]Nicholas Negroponte, *El mundo digital. Un futuro que ya ha llegado* (Barcelona: Ediciones B, S. A, 2000), 237.
[38] Elena Barberà y Antoni Badia. *Educar con aulas virtuales. Orientaciones para la innovación en el proceso de enseñanza y aprendizaje* (Madrid: Machado libros, 2004), 4. For these authors, technology "should be a means to achieve educational purposes"
[39]Levy, *what is the virtual?* 45.
[40]On this point it is worth mentioning that some authors express certain dissonance on the subject of hypertext, Kerckhove warns against the power exercised by the text on the reader as "you can control the reader through the power, speed and complexity of its operations." Derrick de Kerckhove, *Inteligencias en conexión* (Barcelona: Gedisa, 1999), 127.
[41] Levy, *what is the virtual? 47.*

revolution. Jose Castro, author of the preface of Skinner's book writes that in this context emerged the expression: "let's technify education", which would improve the educational system of that time. It was also applied to the learning process, giving rise to teaching machines, from which, the first was taught to make numerical calculations similar to the ones from Babbage, and the other one taught spelling to third grade students. With all this, we must accept that education has reached this stage rather late,

> *... perhaps because the task was not well understood. However, thanks to the invention of television, the so called audiovisual aids are being reconsidered. Motion picture projectors and slides, television sets, record players and tape recorders are increasingly introduced in schools and colleges of America. Audiovisual resources can complement and even replace the readings, demonstrations and school text works*[42].

Skinner's presentation in this regard is valid as long as it its contributions are recognized from the technical object materialized in the teaching machine. However, it is necessary to emphasize some nuances regarding the role that currently the student and the teacher have, very different from the conception that the learning psychologist had during the 60s in the last century. Capacho draws attention to this particularly topic, criticizing certain learning environments:

> *Skinner's conditioning theory, in the sequence E/R/Z, makes learning become an input-output relationship. Then, based on this relationship, the formation processes are supported by virtual learning environments based on ICT that operates at input and output, similar to the operation of hardware components and software in ICT, which operate at input-output, and in most cases, for non-technical users, the internal functionality of the base component functions as a "black box" similar to the concept of black box behavioral theory*[43].

Virtual learning environments are the best concretization that education has attained through technique. The virtuality[44] is a favorable environment to strengthen pedagogy and provides tools to advance the teaching; however, it is necessary to address the attention not to fall into once outmoded theories. On the contrary it is to revalidate and rescue the characteristics of learning that occur in such areas where the student is the protagonist of learning and autonomously takes this process with the guidance of the teacher-tutor. Today teaching machines make use of multimedia resources that allow the student to enter the virtual environment to be almost getting sensory information through the five senses. It is a totally different dynamic that occurs in the traditional environment classroom where the teacher instructs from the chair.

Technology and Education fortunately have found their relationship and on this subject has been written and there is great interest to advance, particularly recognizing the benefits it brings from the technological to the educational[45]. This has allowed making education interactive and has

[42]Skinner, *Teaching Technology*, 43.
[43]José Capacho, *Evaluación del aprendizaje en espacios virtuales-TIC* (Bogotá: ECOE, 2011), 79.
[44]For Cardona "... virtual education is the best combine work with study, it has more possibilities to solve this problem as it may consider life experiences as part of the assessment, in accordance with the recognition or denial that society makes of its successes and failures respectively ..." Guillermo Cardona. "Tendencias educativas para el siglo XXI, educación virtual, On Line, y @learning. Elementos para la discusión", *Edutec* No. 15 (2002):10.
[45] Julio Cabero, *Tecnología educativa*. (Madrid: McGraw Hill, 2007), 34.

something different from the conventional spaces to educate; e-learning[46] or e-learning has been inserted into the dynamics of the globalized world and has opened the frontiers of knowledge. Certainly, all education has been positively affected in regards of these changes, despite the difficulties that may involve education from a traditional classroom due to economic resources[47] being poor, or economic levels not permitting it. Students live in a digital world, and despite the circumstances, their lives are immersed in a reality to which we must respond with the minimum possible, but not hide or spare no efforts that are required to provide education with technological resources, at the beginning of this section it was said that the book, the text and pencil are technical objects.

Educational technology, today, does not remain hermetic; on the contrary it takes some challenges which allow energizing and rebuilding from the curriculum to the generation of new media coming to support the work of teachers and allows:

> *…radically transforming their teaching models in all areas of the curriculum as teachers appropriate changes, their traditional role and collapse the boundaries traditionally imposed to the curriculum, allowing the various disciplines getting integrated and interact when performing tasks and projects*[48].

It is then spoken about the effectiveness of instructional design and formative ecology, creating an even more complex trail which is necessary to keep track of. Authors such as Barbera, Cabero, Sangra, among others in Spanish language have enriched reflection on this aspect. It is worth reiterating that education is located in a favorable historical and healthy moment, and draws attention on one question of concern for the future, especially since teachers, in their new roles, should rethink their role and duty to do from the areas already described[49]. It is important to start looking into the process of completion and saturation of the technical object and its new requirements and supports for the immense educational horizon.

CONCLUSIONS

In addition, technical advances have been vast; the retrospective does not cover everything that should be displayed. But the meeting of education and technique has been beneficial, rich and complementary. The reflection ends at a peak since it suggests a new step and moving involves analyzing and studying the pending in regards the educational implications and even educational policies. Education is not just a catalyst for the processes involved in the relationship between technology and scientific knowledge; it must rather be the vehicle of progress visibility, especially when it allows energizing new learning processes. Education must adapt to both technical advances and to new teaching and educational requirements that challenge in the

[46]Elena Barberà, *Aprender e-learning*. (Barcelona: Paidós, 2008), 13.
[47]Manuel Castells, *La era de la información*, vols. I-III. (Madrid: Alianza, 2000), 407.
[48] Manuel Cebrián, *Tecnologías de la información y comunicación para la formación de docente* (Madrid: Ediciones Pirámide, 2009), 35.
[49]On this point, expanding what Sangrà states: "In order to bring education to all who need it, distance education practices have appeared. These practices have always demanded the existence of a mediating element between the teacher and the learner. Generally, this mediator has been a technology that has been changing from time to time." Albert Sangrà, "Enseñar y aprender en la virtualidad*". Revista EDUCAR*, No. 28(2001), 122.

implementation of new guidelines from the educational field. It is imperative[50] that the educational process is efficient, effective for men located in this changing and sufficiently described context.

The center of the writing revolved around the technical object, the continuous task is reviewing other technical objects that are located in cyberspace and that respond well to education. It is not about a hermetic and inert artifact; the rescue is in regards of dynamic conferring new didactics in teaching from virtual learning environments. A new challenge rises from now; it is to continue the research on this new reality of technology-supported education, but placing the eyes on the subject who is educated. It inquires into the subjectivity of the cyborg[51], the new individual inhabiting cyberspace. The task in this dimension continues.

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[50]Today we talk about online learning in these terms: "The management of this knowledge through new communication processes with the use of technological networks, new information channels and digital content that are currently the raw material/substance that serves as basis for many distance learning processes, which constitutes the current development strategic resource and is placed in the center of the processes of social transformation. "Carles Dorado. "The networking as a source of learning: possibilities and limits for knowledge creation. A critical view".*Revista EDUCAR*,No. 37 (2006), 14.

[51] The essay by Teresa Aguilar entitled *Cyborg Ontology* sheds light on this point so particular and also genesis of a new inquiry.

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