Education 4.0: Some Reflections, Perspectives and Paradigms

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Abstract

The reality of the old school is getting more and more distant from the current students. In this sense, it is essential to think about placing the school within an advanced technology process, placing the school within the world, placing itself within this contemporary context, especially within the current context, within the demands, the agenda of the world, although we know that the difficulties exist and we have many different realities in Brazil. In this sense, we seek to draw an overview of what this Education 4.0 would be, what its precepts, its socio-historical context of production, in order to weave reflections on the topic discussed here and so that it can serve as a theoretical-analytical mapping for understanding and future research on the topic.

Keywords: Education 4.0, School 4.0, Active Methodologies, Education and Technology, Educational Revolution

1. Introduction

When we come across a novelty, we naturally get scared. An example is when Plato quotes a story by Socrates, in his dialogue Phaedrus, about writing, which was once a novelty and Socrates said that children should not learn to write, as this would create a "(...) oblivion. in the souls of apprentices, because they will no longer use their memories, trust written characters, or remember for themselves. The specific you discovered is an aid not to memory, but to reminiscence (...) (PLATO, [1996] 1954, p. 255)".

Soon, with the passage of time, everyone learned to write and that initial concern was put aside. Another example was in the mid-1550s, when scientist Conrad Gessner decided to create a complication of available sixteenth-century books, and soon became concerned about the exaggerated access to information. According to the Swiss scientist, this technology called "printing" was something that should be treated with caution, as it could overload people with too much information (ARAÚJO, 2017).

In the same way, with the passage of time, the book has become something so common that we don't care anymore and so have the radio, the telephone, cell phones, ATMs, social media, etc.

Faced with these examples, we realize that whenever a novelty or technology is presented, we are fearful. Currently, we see this fear with cell phones, applications that "guess" what we are going to do before we even do it, for automatically reminding us about some commitment, for helping us in the propagation and acquisition of knowledge, etc.

This fear and fear, in relation to technology, is also linked to our cognitive system being, in a way, emotional when evaluating the risks of things and, generally, we do not make a rational analysis of the risk that some activity involves and we put our emotion at stake and so we end up judging risk based on one or two events (SLOVIC, 1987).

Another similar example is some studies by psychologist Paul Slovic. The American researcher shows that when we don't really know how something works, we tend to think it's too risky. A child who does not know how a vacuum cleaner works will certainly be startled and run away by the noise of one in operation (SLOVIC, 1987).

Thus, directing this brief reflective introduction to the focus of what is intended here, we know that Information and Communication Technologies (hereinafter ICT) play an increasingly significant role in the way we communicate, learn and live.

The Fourth Industrial Revolution, in turn, is the first industrial revolution rooted in a new technological phenomenon, of artificial intelligence, than in the emergence of a new type of energy, from which we can direct the physical world or even be in complete hybrid between body and technology.

In this way, a new paradigm or modality of literacy emerges: Digital Literacy (LD) which, in general, is concerned with information and mental skills, with cultural, socio and historically established factors that enable the subject to participate effectively and actively in the society in which he lives (ROJO, 2013).

Still, within this perspective of a textbook, we have a significant paradigm shift. A paradigm that also goes from School 1.0, passing through School 2.0 and School 3.0, to the fourth model of School, where new ways of thinking, acting and acting on education, teaching-learning and the world are designated. .

Thus, anchored in a textbook, thinking about the current model, of a fourth School, this implies new reading and writing skills, different from traditional skills, in new ways of understanding verbal and non-verbal codes and signs, that is, , in addition to digital literacy.

As a result, ICTs are just one part of a continuous development of technologies, starting with E1's chalk and books, all of which can support and enrich learning.

According to UNESCO guidelines,

(...) ICTs, like any tool, must be used and adapted to serve educational purposes. (...) several ethical and legal issues, such as those linked to the ownership of knowledge, the increasing treatment of education as a commodity, the globalization of education in the face of cultural diversity, interfere with the widespread use of ICT in education (UNESCO, s/ The).

Thus, literacy practices, in general, should provide, in addition to the development of reading and writing with a certain criticality, knowing how to act through language in different social spheres and in different genres, whether textual, discursive and digital. Thus, there is a need for subjects to be digitally literate (ROJO, 2013).

The question of technologies or new technologies is what kind of school do we have and what kind of school do we want in the 21st century? With a hyperconnected brain, it is no longer possible to create a school where subjects receive information and are not really a process for their autonomy.

School 4.0 or Education 4.0 (Note 1) comes, then, with active and innovative methodologies within the new technologies, that is, to meet this need for a market, undoubtedly, for speed, for a democracy within the process of schools. , and together with this job market, exactly to bring this new perspective of what we really have in this planning of this Universe.

The reality of the old school is getting more and more distant from the current students. In this sense, it is essential to think about placing the school within an advanced technology process, placing the school within the world, placing itself within this contemporary context, especially within the current context, within the demands, the agenda of the world, although we know that the difficulties exist and we have many different realities in Brazil. Getting started is necessary!

In this sense, we seek to draw an overview of what this Education 4.0 would be, what its precepts, its socio-historical context of production, passing through the other Industrial Revolutions, what significant changes with this emerging perspective, in search of weaving reflections on the topic discussed here and so that it can serve as a theoretical-analytical mapping for understanding and future research on the subject.

2. The Socio-History Context

Much is said about the Fourth Industrial Revolution (hereinafter QRI) and Industry 4.0 (I4), but what are they? Until mid-1784, commerce was carried out with products manufactured at home, on an artisanal scale. A large part of these manufactured products were handloom fabrics. For the large scale, steam technology was added to the handloom, mechanizing the process and providing the emergence of the industry that motivated the First Industrial Revolution (PRI).

In modern history, the process of change from an agrarian and artisanal economy to one dominated by industry and machine manufacturing. This process began in Britain in the 18th century and from there spread to other parts of the world. Although previously used by French writers, the term Industrial Revolution (IR) was popularized by Arnold Toynbee (Note 2), as pointed out by Saes and Saes (2013).

Thus, RI transformed economies based on agriculture and crafts into economies based on large-scale industry, mechanized manufacturing, and the factory system. New machines, new sources of energy, and new ways of organizing work have made existing industries more productive and efficient. New industries also emerged, including, in the late 19th century, the automobile industry.

Ownership of the means of production has also changed. The oligarchic ownership of the means of production that characterized IR in the early to mid-19th century gave way to a wider distribution of ownership through the purchase of shares by individuals and by institutions such as insurance companies (SAES; SAES, 2013).

In the first half of the 20th century, many European countries socialized basic sectors of their economies. There was also, during this period, a shift in political theories: instead of the laissez-faire ideas (Note 3) that dominated classical IR economic and social thinking, governments generally moved into the social and economic field to meet the needs of their sectors. more complex industries.

Thus, in 1870, the Second Industrial Revolution (SRI) began, highlighting the use of electrical energy to drive production lines. This revolution was marked by the expansion of serial production, a concept used in the assembly line of the Ford T. In the 20th century, the centralized communication of electricity - the telephone, and later radio and television - became the means of communication to manage a more complex and dispersed era of oil, automobiles, etc., and SRI's culture of mass consumption.

At the end of the 1960s, the Programmable Logic Controller (PLC) and electronics were integrated into the control of machines, making them more flexible, advancing with the use of robots and communication networks in production lines, which characterized the Third Industrial Revolution (TRI).

In this, internet technology and renewable energy begin to merge to create a new infrastructure for an IRR that changes the way energy is distributed in the 21st century. Thus, the great economic revolutions of history occur when new communication technologies

converge with new energy systems. New energy revolutions enable more expansive and integrated commerce.

In this sense, QRI (Note 4), also known as Industry 4.0 (Note 5), changes our entire perception of the world, the way in which the new technologies that are being invented interact with each other. QRI is not restricted to intelligent and interconnected systems, but is happening through waves, which cross several areas of human knowledge, such as nanotechnologies, quantum computing, advances in the biological area, such as DNA sequencing, internet of things and other examples that not only modify an entire area of human knowledge, but enable an interconnection with other technological waves that occur simultaneously.

3. Learning by Doing

As seen before, the path from the First to the arrival of the so-called Fourth Industrial Revolution, entails different ways of thinking, that is, it is a bubble in which this capitalist way of thinking in which we live, influences in various instances of society. Whether in industry, commerce, economy, social relations, etc., above all in teaching and education.

Thus, we are coming from a school, from an 18th/19th century context. We are still at school in a physical space formatted one by one, one after the other, where there is no process of collaboration, cooperation, in meaningful learning.

So, actually, when we move to a 4.0 school, we still have to leave the 1.0 school, which is still the blackboard, the chalk and the copyist; school 2.0, which is exactly when these methodologies are changed from the board to the Datashow, Projector, Slide; school 3.0, when talking about this internet, already passing through the relationship with the body, sensory part; for 4.0, which is exactly the outside of what we know, extra-corporeal (Note 6), we are talking about an Artificial Intelligence (AI).

As we can see in the four-synthesis of evolution in education, we are on the path, but we are not yet established on this path, we know that this change needs to happen.

3.1 The Active Methodologies

Once the brain is hyperconnected, interest supports the position of attention for the construction of memories, which is the basis of new technologies. So, how to make these technologies a differential in the educator's life? A break of resistant, that many need to bring this technology, as it is part of our daily life.

The teacher has to enter as the mediator of this new process. We have to learn to work with technology, there is the issue of infrastructure, connectivity, but there is also the process in which we are learners and, within this process, it is essential that the teacher experiences and also brings experiments to the classroom that contemplate the experience with technology, so that this student can experience and get out of this passivity and also become a protagonist.

In this sense, it is necessary to leave a directive model of education to enter a collaborative model in which everyone is a participant in which everyone interacts in this production of

knowledge.

The school, in turn, has a curriculum and this curriculum is followed, it is not done in any way, it is not loose. The planning of this class is a lot of work, it's much easier at a 1.0 school, where I put my planning notebook under my arm and go there and copy it on the board and ask to copy and punctually give a test, than actually preparing, in the preparation and always be dealing with uncertainties, because it is a classroom that overflows, goes beyond what it may have. The teacher has to have a broader knowledge, he has to understand what the students demand, what their interests are.

The teacher has to make the link with this range of references around him, if the student wants to research about Italy, he goes to Wikipedia and finds several references on that subject, what the teacher has to do is take advantage of these links and this interest of the student to go to Wikipedia, for example. When someone enters a website it is because they are looking for something, something that is missing.

At the moment when this protagonism is created in the student, creating an environment for a contemporary class is interesting. Thus, the active methodology has existed for a few decades, so, in fact, we are talking about a new educational paradigm that is within what is called active learning, focused on the student.

Active learning emerged from a series of educational and pedagogical research, which identified that a person learns best when he interacts with others, as are his learning objects and when he uses language. From there, a new paradigm emerges. Until then we have the traditional paradigm that is teacher-centered learning, the instructional model where the learning process is a model that, in theory, happens with the student paying attention. In the active learning model, the student learns by doing, interacting and building together as his object.

Thus, the lecture has entered a model that no longer makes much sense nowadays. Students arrive at the job market and experience difficulties. Another symptom is when young people are no longer aligned with society's expectations, that is, they are no longer active, they cannot build some artifacts, attitudes, they cannot interact in society to solve real problems that society has.

In this sense, when an active learning model is adopted, the teacher does not necessarily know what will happen. Thinking about project-based learning, we make room for students to bring their interests. It's no use adopting the active methodology and continuing to control the entire process, continue planning and deciding what will happen in every minute of the class. There is no room for student interest and curiosity. This is critical to any autonomous posture.

Within the active methodologies we have the inverted classroom. The idea of the inverted classroom is not to put the desks upside down, but to make the student have a preview of a study before he goes to the environment of this classroom. It de-characterizes this classroom we know, one after the other, and we start to work with the ambiences and the possibilities within a context, a theme, where each theme of this ambience will be focused on the main theme.

The platform, the teacher will need to use a platform and feed it. Texts, videos, everything that can support a process, an academic study. Because when we say that he has to be the protagonist of the action, he has to feel responsible for it. So he needs to study in advance, because the classroom environment is for dialogues, conversations. Talk about cases. Get out of that classroom formatting that bothered them so much, the passive. Today, activity, proactivity, he has to be part of it, but how can he be part of it? How to arouse that interest? This room will extrapolate the Didactic Book, the program, which will be built together, a perspective of an interactive, inverted classroom, of active methodologies.

3.2 The Internet of Things

The internet is in everything, we can connect appliances, depending on the level of investment, of course, but how does the internet of things work in education? It is necessary to carry out a direction, and let the student explore everything around him, but give a direction of what is important for that moment, for that context that you are working. Many times the student will have difficulty, but it is no longer necessary to leave the classroom, in the case of augmented reality, we can take a student, from inside the classroom, to a museum. So that was only possible thanks to the internet of things that went viral. So, the role of the teacher as a mediator of this process and providing these guidelines is super important. What is good and what is not good. The big challenge is to arouse student interest.

It doesn't have a ready-made recipe, but it is something to be conquered, through working with active methodologies and bringing problem solving into the classroom.

4. After All, What is the Education 4.0?

In Education 4.0, we have a student as the protagonist, technology is prone to learning, from the moment you start working with these technologies, we take the student out of passivity and bring it to the center of the learning process. It is a natural process, he will become the protagonist. Thus, the educational space, at higher levels, such as the University (Note 7) advances towards a systemic qualification and continues. This justification is given by the speed with which new knowledge is produced, "(...) new technologies are conceived and new media implemented through intensive and disruptive *digitization processes* , a specific concept that supports the processes of the so-called 'Industry 4.0' or same 'Services 4.0' for a Society 4.0" (CARVALHO, 2018, p. 5).

Thus, as seen in this work, Industry 3.0 focused on its individual automation of machines and their processes. While Industry 4.0 focuses on
end-to-end digitization of all physical assets and the integration of digital ecosystems with partners in the value chain. The activities of generating, analyzing and communicating data support the gains promised by Industry 4.0, which encompasses several new technologies and media to create value, most of them of a disruptive nature such as Artificial Intelligence, Big Data & Analytics, BlockChain, Internet of Things and Industrial. , Virtual and Augmented Realities and others (CARVALHO, 2018, p. 5).

It comes to respond to the needs of I4 or QRI, where man aligns with machine to enable new possibilities, harnessing the potential of digital technologies, personalized data, open source

content, and the new humanity of this globally connected, technology-driven world. , setting a model for the future of learning, lifelong learning, from childhood schooling, to continuous learning in the workplace, to learning to play a better role in society.

4.1 Some Pillars to Think About

Among the many discussions, innovations and general changes in the world of learning, we can think of some changes, such as:

Time and Place: Students will have more opportunities to learn at different times in different places. E-Learning tools facilitate distance learning, self-learning opportunities. The flipped classroom, which means that the theoretical part is learned outside the classroom, while the practical part is taught face-to-face, interactively.

Personalized Learning: Students will learn with study tools that adapt to a student's abilities. This means high school students, for example, will be challenged with more difficult tasks. Students who struggle with a subject will have the opportunity to practice more until they reach the required level. Students will be positively reinforced during their individual learning processes. This can result in positive learning experiences and decrease the amount of students who lose confidence in their abilities. In addition, teachers will be able to clearly see where students need help and in which areas.

Free Choice: and although each subject that is taught points to the same destination, the road leading to that destination may vary. As with the personalized learning experience, students will be able to modify their learning process with the tools they feel are necessary for them. Students will learn with different devices, different programs and techniques based on their own preference.

Design: As careers are adapting to the future economy, today's students will have to adapt to learning and working with projects. This means that they have to learn to apply their skills to a range of situations. Students should already be familiar with project-based learning at school. That is, how much organization, collaboration and time management skills can be taught as basic principles that every student can use in their future careers.

Experience: As technology can facilitate greater efficiency in certain domains, curricula need to make room for skills that require only human knowledge and face-to-face interaction. Thus, the "field" experience will be emphasized within the classroom. Schools will need to provide more opportunities for students to gain real-world skills that are representative of their jobs. This means that curricula have to create more space for students to complete internships, projects, etc.

Data Interpretation: although mathematics is considered one of the three literacies, it is without a doubt that the manual part of literacy will become irrelevant in the near future. Computers will soon handle every statistical analysis, describe and analyze data, and predict future trends. Therefore, the human interpretation of this data will become a much more important part of the future curriculum. Applying theoretical knowledge to numbers, and using human reasoning to infer logic and trends from that data will become a fundamental

new aspect of this literacy.

Evidence: how will the platforms assess students' abilities at each stage, measuring their competences? To the extent that a student's knowledge can be "measured" during their learning process, the application of their knowledge will be better observed when they work on projects, collaboratively, in problem solving, *learning by doing.*

Ownership: Students will become increasingly involved in shaping their own knowledge and curriculum. Keeping a curriculum that is contemporary and useful is only realistic when professionals as well as young people are really involved. Students' critical thinking about the content and durability of their courses is a must for a comprehensive program of study.

Mentoring/Tutoring: The trend may be that 20 years from now , students will incorporate so much independence into their learning process that mentoring will be critical to student success. Teachers will form a central point in content and information. Although the future of education seems remote, the teacher and the educational institution are vital to academic performance.

So these are some far-reaching challenges. For individuals and for society, new educational tools and resources hold the promise of enabling individuals to develop a fuller range of skills, abilities and knowledge and to unleash their creative potential.

5. Reflections and Possibilities

Most of the tools and technologies that Education 4.0 relies on are built to help students learn better and more effectively than previous teaching and learning methodologies. Often, learning is personalized to the student's interest. By utilizing dynamic Learning Materials such as images and videos to keep students interested in having materials accessible across devices and platforms even students are able to *log* in anytime and anywhere to learn at their own pace.

Thus, when access is democratized, freedom is given to the student. Theoretically, he will be more interested in learning because the teacher gave him that freedom. You have to see this opportunity as an extension of the classroom, so the subject's class will not end in those 50 minutes, two weekly classes, it will continue, because from the moment he has this freedom of this class and can continue, understand a little better, is giving freedom.

Collaboration then has a platform that talks to others outside of classroom hours. So collaboration is very strong within this process. Today, in Brazil, we have 67 million digitally excluded people (Note 8).

The country's economic issue naturally affects this issue of education, but the most interesting point, overcoming this issue of access, is the production of knowledge, it became democratic, once I produce knowledge, the other produces knowledge, we all produce ourselves and this is the great asset that the school has to embrace. If we look at social networks , the internet, it is the production of information, which well treated can turn into knowledge. So the school has to have this north and that's where the issue of democratization of access to information comes in. Today I can access information through a Whatsapp contact, but not everyone has

that. But it is already a step when I establish a condition that everyone can enjoy, which is a matter of you producing the information and the school must work with this profile.

It is a contemporary condition that we experience day by day. The moment you manage to bring this collaborative aspect into the classroom, you also democratize this access to information and knowledge. When you think of technology, you think of investment. Thinking about augmented virtual reality, most do not have access, within the reality of the country, financially speaking.

First step is to change the teaching model that is closer to this dynamics of the internet, social network, technology 4th, as this could help to enter this world independent of having technology in the classroom, independent of artifacts.

In the new school, that was the proposal, the role of the student, the interactivity between teacher and student, this was lost. He entered a traditional path, rescuing this can already be a beginning to enter this school of the contemporary world.

Inside a classroom we have three types of brain, present bodies and offline minds, in school 1.0; in the 2nd, the student's brain, that copyist, even on the board or slides, he is copying, he reproduces; When we talk about new technologies, blended learning, new learning and active methodologies, etc., in inverted classes, we are talking about the brain of the student, the researcher, which starts with education. Childish. This can form totally different people. This needs to start in kindergarten and not high school or kindergarten, it comes from our base. Making the student start to appreciate the creative processes that this child has from the observation of the student is a total change of mentality.

Education 4.0 rescues a concept of kindergarten, because the kindergarten for children is so striking, because they experience it, have the opportunity to explore, have the opportunity to transform this curriculum into practice and education 4.0 follows this line, it needs to rescue this kindergarten from childhood for this school.

Acknowledgement

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Notes

Note 1. School 4.0 derives precisely from this Fourth Industrial Revolution, especially from the concept of Industry 4.0, since, when the paradigms of society change, automatically its areas also need to be re-signified, that is, if in the First Industrial Revolution we called Education 1, 0 and so on, in the Fourth Industrial Revolution, it is called School 4.0 and Education 4.0. They will be designated in this work, not as synonymous, because for Education 4.0 we understand that it refers to a paradigm shift, something broader. Whereas for Escola 4.0 it would be the reflection of this paradigmatic change that influences, reciprocally, in the School. Still, the present work only intuits a brief reflection on the subject, without going into the issue of Education and Citizenship *versus* Commercialization of Education.

Note 2. Cf. TOYNBEE, A. *Lectures on the Industrial Revolution in England.* London: Longmans Green and CO., 1894.

Note 3.The expression symbolizes economic liberalism, in the purest version of capitalism that the market should function freely, without interference, fees or subsidies, with just enough regulations to protect property rights.

Note 4. The term Fourth Industrial Revolution will be used in this work, as an "umbrella" term, understanding that several social, economic, historical, educational, etc. 4.0, Education 4.0, etc. According to SCHWAB (2016, p. 16), the QRI "(...) however, does not only concern intelligent and connected systems and machines. Its scope is much broader. Waves of discovery occur simultaneously in areas ranging from genetic sequencing to nanotechnology, from renewable energy to quantum computing. What makes the fourth industrial revolution fundamentally different from previous ones is the fusion of these technologies and the interplay between the physical, digital and biological domains."

Note 5. We should not confuse QRI with Industry 4.0, a term originated in Germany, to designate only the robotization of factories (Cf. *Principles for industrie 4.0 Scenarios* : http://www.iim.mb.tu-dortmund.de/cms/de /forschung/Arbeitsberichte/Design-Principles-for-Industrie-4_0-Scenarios.pdf Industry 4.0 is then "(...) a term coined in 2011 at the Hannover fair to describe how it will revolutionize the organization of chains By enabling "smart factories", the fourth industrial revolution creates a world where physical and virtual manufacturing systems cooperate globally and flexibly. This allows for full customization of products and the creation of new operating models"

(SCHWAB , 2016, p. 16, emphasis added).

Note 6. Cf. Cyborg or Cyborg. It can be said that the cyborg curriculum is the composition of analog pedagogy integrated with digital technology. Within the curriculum planning this can occur intentionally or not, that is, the student can make use of digital technologies in their educational tasks even if the teacher does not consider the use as a command. In this way, the cyborg curriculum is part of our reality, it demands a new way of planning and organizing knowledge. Cyborg learning is the fusion between "analog resources, common in schools, with digital technologies and the connections they produce with cyberspace and cyberculture" (SILVA, 2016, p. 153). As it is a fusion, it not only unites these dimensions, but gives new meaning, creates new ways for the process and adapts to society's new ways of life.

Note 7. Reference Of Professions That Will Call To Exist.

Note 8. According to O Globo.

https://oglobo.globo.com/economia/brasil-tem-45-milhoes-de-excluidos-digitais-22286508

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