

LITERATURE REVIEW

Characteristics of Education 4.0: Its possibilities in times of Pandemic

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ABSTRACT

Highlights: Education 4.0, prioritizes practical experimentation on the part of students, intensifies the understanding of the "maker culture". Education 4.0 consists of an advanced theoretical-practical approach to management and teaching in formal education. We can see those features such as Digital Didactic Material, Hybrid Teaching, Digital Interactivity, Autonomous Learning and New Information and Communication Technologies were essential for education not to be stagnant in time x space during the COVID 19. Teachers need to innovate and renew their knowledge constantly. In the 4.0 environment, acting as guides, tutors, advisors, they need to be connected with the reality and the actuality of the facts, so that they can correctly lead their students in the construction of knowledge.

Goal: The present study aims to present, from the main characteristics of Education 4.0, its possibilities and applicability in times of pandemic.

Design / Methodology / Approach: As a subsidy, an exploratory study was carried out through bibliographic research in the main research bases in order to obtain updated knowledge on the theme of Education 4.0.

Results: The results denote the importance of the applicability of the main ideas of this form of education in the current and future moment, mainly because the current and future generations are very involved in the concepts of connectivity and hybrid learning.

Limitations of the Investigation: The limitations of this research reside in the fact that, as it is a new situation, which had to be adopted almost instantly, it needs to have a greater maturity and there is a need for further research and studies, mainly in the search for the best application of technologies in the educational field.

Practical implications: The practical implications highlight that the use of technologies in education is a reality in which teachers and students should increasingly perceive themselves as immersed and open to new educational possibilities.

Originality/Value: The originality lies in the fact that the various educational institutions, at different educational levels, had to adapt to a new reality imposed by the pandemic situation, where the need for the massive use of technology was fundamental for the minimum maintenance of the teaching-learning process. And this work sought to denote these characteristics.

Keywords: Education 4.0; Pandemic; New educational technologies.

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1. INTRODUCTION

Education 4.0, prioritizes practical experimentation on the part of students, intensifies the understanding of the “maker culture”, that is, the do-it-yourself (DIY) culture, valuing attributes such as creativity, innovation, initiative, among others. In addition, socio-emotional skills, known as soft skills, stand out in this new form of education, since these skills are in line with the attributes expected in Education 4.0, such as communication, critical thinking, the ability to deal with complex problems, quick decision-making and empathy.

For Carvalho Neto (2020), “Education 4.0 consists of an advanced theoretical-practical approach to management and teaching in formal education that has been demonstrating, through evidence of scientific and technological research, its transformative and innovative potential for educational institutions. teaching”.

Within a Brazilian reality, our Educational Institutions still use pedagogical methodologies from the beginning of the 20th century, where many of their teaching professionals are reactive to changes or breaks in paradigms. On the other hand, most students, as they are constantly exposed to technologies, are able and, probably, anxious to be urged to use the possibilities that cyberspace offers them.

Vefago et al; (2020) corroborate this statement by highlighting that “the university was conceived as a teaching and research environment, which gravitates to an intellectual sphere, often seen as disconnected from the practices of everyday life, precisely in what could form an ivory tower”.

The use of new educational technologies is supported by several factors, and perhaps the most important is the adoption of 5G technology. In this vein and emphasizing that these new technologies are indispensable in the training and qualification of professionals who will work in operational environments related to industry 4.0, Vilela and Faria Filho (2022) emphasize the importance of seeking opportunities to “identify and explain the possible impact on the business model. competitive relationship in industry segments, connecting to Industry 4.0 through the introduction of 5G technology and its technical and functional requirements”.

In this way, this article seeks to present the main characteristics inherent to Education 4.0, showing that, in this period of pandemic, where physical spaces were exchanged for virtual spaces, technology and cyberspace allowed the continuity of studies online or online. hybrid, according to the possibilities of the educational establishments.

2. METHOD

This article uses the methodology of bibliographic research of authors and their understanding of the subjects of Education 4.0 and the use of new educational technologies in times of pandemic. Research was carried out to seek an inter-relationship between the themes and your use in the educational environment. Scopus, Emerald, Science Direct, Google Scholar databases were used, as well as books and magazines that could assist in obtaining knowledge to carry out the activity.

The bibliographic review is inserted in a context of integrative review as it allows the researcher to compare the problems that he wants to appreciate and, at the same time, authorizes him to draw a logical panorama in the entire development of scientific production

3. LITERATURE REVIEW AND RESULTS

Führ (2019) describes the main characteristics that are expected in the training of professionals for “Industry 4.0”:

a) Interdisciplinarity: It is a concept that makes an intersection between the contents of two or more disciplines allowing the student to build a broader view of the subjects studied, favoring the critical analysis of the different approaches of the same subject;

b) Transdisciplinarity: Its definition by the DICIO dictionary points out as being able to produce an interaction between disciplines that, not only being restricted to disciplinary content, proposes a dialogue between fields of knowledge, seeking to achieve and change the subject's perception, cognition, or behavior. (DICIO, 2021);

c) New technologies of education and communication: According to UNESCO (2021), “information and communication technologies (ICT) play an increasingly important role in the way we communicate, learn and live.”;

d) Digital interactivity: Through Blogs, Podcasts, videoconferences, interactive whiteboards and any other tool, media, or digital form that allows students to exchange information and interact with each other and with teachers;

e) Maker culture: The search for creative, innovative, sustainable, and technological solutions ended up providing greater visibility to this terminology. It is an evolution of the DIY (Do It Yourself) concept. Through proper knowledge, people, with the right tools, can create their own solutions. It is learning in practice;

f) Artificial intelligence: The Hewlett Packard Enterprise HPE website (2021) defines that the term AI “represents a set of software, logic, computing and philosophical disciplines that aim to make computers perform functions that were thought to be exclusively human, such as perceive meaning in written or spoken language, learn, recognize facial expressions, and so on”;

g) Autonomous learning: It involves the teaching process in which the student performs, in whole or in part, independently. This autonomous education today is mediated by technology, enhancing learning. In many cases, the figure of a tutor exists as a mediator, facilitator, support for doubts etc;

h) Contextualized and flexible curriculum: This is a trend in the teaching of several schools in Brazil and in the world. It aims to divide the curriculum structure, so that the student can choose some subjects of his/her preference. However, other subjects are common to all students and are not optional;

i) Blended learning: According to the Lemann Foundation (2016), this form of teaching involves the use of technologies with a focus on personalizing teaching and learning actions, presenting educators with ways to integrate digital technologies into the school curriculum. In addition, this approach presents practices that integrate the online and face-to-face environment, seeking for students to learn more and better;

j) Collaborative environment: It is an environment where all participants collaborate in the construction of certain knowledge. This environment has a repository where everyone can actively build. It is noteworthy that the collaborative environment is asynchronous, since each one, at their own time and availability, can share their contributions;

k) Digital didactic material: These are didactic materials. that make use of digital media to portray their content. They can interact with students, making it easier for them to understand certain topics or themes. For example, it allows explaining thermal and hydrostatic physics by showing simulations of gas emission from the car's exhaust in a multimedia presentation. Unites theory and reality in a few clicks;

l) Internet of Things (IoT) of learning: Smart Schools are a good example (control of entry and exit of students, in real time being managed by the school and parents. Communication school - parents etc). Accessibility for students with special needs. Connectivity between school spaces so that, through a cell phone, the student can check the library books, buy a snack in the canteen, access the laboratories, etc. Allows direct and continuous interaction between students and teachers through mobile devices, potential for mobile and ubiquitous learning;

m) Computational thinking: Jeanette Wing, currently a professor at Carnegie Mellon and vice president of Microsoft Research, defined computational thinking as the formulation of problems and solutions represented in such a way that they can be performed by information processors – humans, computers, or rather yet, a combination of both (Instituto Ayrton Senna, 2019). The activities developed in this perspective aim to contribute: in the construction of logical thinking; in the skill of pattern recognition; for the development of reasoning through the four pillars, which are: decomposition, pattern recognition, problem abstraction and algorithms. (SEED-PR, 2021);

We would also add:

a) Knowledge Management: Collective and collaborative form of repositories with the purpose of managing the knowledge created and shared, aiming at the maintenance of information, accessible to all who do not need it;

b) Cyberculture: According to Levy (1999) cyberculture is characterized as the “set of techniques (material and intellectual), practices, attitudes, ways of thinking and values that develop along with the growth of cyberspace”. In other words, it is culture — understood in a very broad sense as human production, whether material, symbolic, intellectual — that takes place in cyberspace;

c) Cyberarchitecture: it is a concept integrated into Education 4.0 solutions that contributes to the study and design of innovative environments dedicated to education. For Carvalho Neto (2006), it is a recurrent concept of Education 4.0 that allows the creation of different integrated physical and digital environments, to serve the educational processes of basic and higher education;

d) Technopedagogy: Cabezas (2019) transcribes the concept, also known as digital pedagogy, understanding it as a set of concepts, ideas and practices associated with innovation and development in the area of education in the digital age;

e) Problem Solving: Within the Education 4.0 environment, the student is encouraged by the teacher to seek answers in order to solve problems, ceasing to be a passive element, only

absorbing content, becoming an active element in the construction of existing problems;

f) Storytelling: Valença; Tostes (2019) define the term as, roughly speaking, “the use of narratives with social or cultural meaning to promote reflection on concepts and values, in order to consolidate these abstract ideas through the perception of relevance and significance of such concepts and values to a group of individuals”;

g) Teamwork: Group work, in a collaborative way, so that everyone can collaborate in the development of solutions;

h) Soft Skills: These are the personal, mental, social and emotional capacities that people acquire throughout their lives. Your personal experiences and experiences. In short, it's your behavioral skills;

i) Creativity: It is the person's ability to create, compose, invent, innovate in the environment in which they work, live or study;

j) Project-Based Learning: students improve their skills, using them in real-world problem situations;

k) The BYOD (Bring Your Own Device) system: It is the use of personal smartphones, notebooks and tablets in the educational environment. For this, it is essential that the logical infrastructure is viable and accessible to all users.

These characteristics aim to meet the demands inherent to Industry 4.0, which has been inserted in various professional areas worldwide, such as engineering, logistics, the healthcare environment, military technologies, telecommunications, transport, agriculture etc.

Rasquilha; Veras (2019) cite the most valuable skills that are expected of a student, from their insertion in an Education 4.0 environment: Analytical thinking and innovation; Active learning and learning strategies; Creativity, originality and initiative; Technological design and programming; Critical thinking; Solving complex problems; Leadership and social influence; Emotional intelligence; and, Reasoning, problem solving and ideation.

Systems analysis and evaluation: Data analysis. We are immersed in a deluge of data (Data Deluge), where data increasingly lacks filters to be separated, worked on to become information and knowledge. Big Data will be fundamental in this analysis process, so that we can extract the necessary information.

We noticed a series of characteristics inherent to Education 4.0 that, in one way or another, has been used by some schools, either continuously or experimentally. In the current scenario, where the existing pandemic in the face of COVID-19 resulted in the closure of schools at all school levels, many educational establishments had to reinvent themselves and seek solutions for the continuity of the educational flow. The most adopted practice was the use of remote teaching to bring knowledge to students. It should be noted that this form of teaching is performed synchronously, that is, teachers and students are connected and communicate through software (ZOOM, SKYPE, TEAMS, GOOGLE CLASSROOM etc). Another form used was Distance Learning which, asynchronously, made materials available in virtual environments and students interacted with teachers, according to their available time.

We can see those features such as Digital Didactic Material, Hybrid Teaching, Digital Interactivity, Autonomous Learning and New Information and Communication Technologies were essential for education not to be stagnant in time x space and these students were left without the syllabus.

Tokarz et al;(2021) highlight some opportunities that arose from the advent of Covid-19 that are quite relevant to the educational environment supported by new technologies, such as the use of 3D printing, technology for information management, the use of online services etc. Reis et al; (2021) highlight the use of artificial intelligence and call attention to the impact of machines on industry 4.0, which, consequently, will generate possibilities and needs to be mitigated by education 4.0, aimed at meeting the existing demands in industry 4.0.

Obviously, students and teachers, accustomed to the physical environment of the classroom, had to learn to situate themselves in this new environment. Despite this, most of these generations fall between Generations Y or Millennials (born between 1980 and 1994) and Generation Z (born between 1995 and 2015). Other generations ended up being reached by this demand. Not to mention the Alpha Generation (born from 2016), where several schools tried, in some way, to interact digitally with these children.

Those born from Generation Z are known as belonging to the connected generation, have accounts on social networks, use smartphones to perform almost all their tasks, use apps to solve most of their personal lives, etc. They are connected day and night. For them, the change may not have been so frightening or traumatic. However, for people more reactive to technologies, it certainly generated a series of misfortunes and questions.

With the growing demand for professionals aligned with the skills expected for Industry 4.0, it is to be expected that schools will start to adopt systems that adhere to existing concepts in Education 4.0 methodologies. In this way, teachers and students need to be prepared for the changes. Probably today's students, because they were born inserted in this technological

context, cyberconnected, having experienced and participated in these changes, do not suffer so much when they leave their comfort zone. These future professionals are expected to have been urged to develop, during their academic journey, a series of attributes, such as teamwork, analytical thinking and innovation; Creativity, originality and initiative; computational thinking; o Critical thinking; a Solving complex problems; in the lead; in Reasoning and problem solving and ideation; in soft skills, among others.

These are behavioral and cognitive characteristics expected for this 4.0 professional.

However, for these professionals to reach this cognitive and operational level, it is essential that they have teachers that are as or more connected and qualified to provide them with the necessary, real and feasible guidance in the achievement of these attributes.

Therefore, the 4.0 teacher must have the perception and flexibility to put himself in several roles: of learner, mediator, advisor, and researcher. He will need to have well-defined goals and objectives to create the best conditions for learning.

The education 4.0 environment has some pillars that must be understood by professionals who want to be part of the concepts of Education 4.0. Figure 1 demonstrates 4 characteristics that should be given special attention by the 4.0 teacher. These pillars must work continuously where one depends on the other, generating a flow, like a moving propeller, so that we do not perceive a blade, but the circle formed as a whole, thus creating the teaching Helix of education 4.0:



Figure 1 - Education teaching helix

Source: Author

a. Technological Knowledge

The teacher needs to break the paradigm of “I-centrism”, where it is placed as the center of knowledge, and of the traditional teacher. In no way is the teacher's knowledge contested. In fact, this knowledge will be essential for him to work with students in 4.0 environments. In this, access to information is very dynamic, so that knowledge ends up becoming accessible to all those who have equipment that allows access to the internet. Therefore, proposing problems, guiding actions and their course corrections, coordinating debates are proactive actions that allow students to interact with each other and with the teacher. In this way, they become actors in the construction of their knowledge.

By adopting technopedagogy, the teacher ends up reconfiguring his actions for characteristics such as: the use of digital teaching material, hybrid teaching, the collective and collaborative environment, digital interactivity, the maker culture, the internet of learning things, computational thinking, the use of new information and communication technologies, interdisciplinarity, robotics, etc.

The teacher 4.0 goes from being a single active pole to a leading actor inserted in an environment with other actors on the rise. He becomes a guide of actions, co-creating with the students, encouraging them to break the barriers of stagnation and become controllers of

their own knowledge.

Basically, the teacher becomes a great conductor of knowledge and his students a great orchestra where, each one, from their instrument (their soft skills) will, collectively, engender a beautiful symphony.

b. Spirit Maker

The teacher becomes a performer of actions with their students. By entering the maker context, it provides the student with the possibility of professional qualification, where the student learns by doing, putting his "hands on". This behavior allows the broad development of cognitive skills, since, in the exercise of performing, the student learns, not through "osmosis", but through execution.

In the traditional concept, the teacher, sometimes, has the characteristic of demonstrating the way to reach a certain solution to the problem. He does and the student copies him. In a maker environment, the student receives small "inputs" and builds, together with the teacher, the knowledge and the way to carry out a certain action or procedure. The use of manuals (physical or digital), 3D figures, animated videos are some tools to support students in their knowledge construction.

In this way, when presented with a problem, the student is urged to seek the best solution, to work in groups, to communicate, providing him with the development of skills that go beyond the motor capacity to carry out the assembly or creation of something.

c. Collective Experience

The teacher must be able to propose exercises, problems, challenges to students that allow them to solve them collectively and collaboratively. In this way, students will go through conflicts, frustrations, negotiations, to seek the best way to solve the proposed problem.

In a plural environment of ideas (understanding that this plurality is because each person has their convictions, values and knowledge), conflicts, personal interests, contradictions, among others, are common. In all professional environments, from the most liberal to the most hermetic, where values, customs and traditions are strongly active, there is the presence of conflicting ideas seeking to meet an existing solution. This is what we live in the "real world". The school environment must prepare the future professional to know how to act and behave in this universe. It is important to understand that, once the decision has been made, it is up to everyone's intellectual discipline to follow the path chosen to solve the proposed problem.

d. Essence of Being

The teacher must act as a potentiator of actions and behaviors. As we saw earlier, the student must be prepared to interact in their job market, to live "the real world". Therefore, it is up to the teacher, as a curator, to develop actions that allow the student to expand his personality, allowing him to operate with greater self-sufficiency, being able to identify, judge and perceive the situation around him, coming to have the ability to very well-grounded decision-making.

4. CONCLUSION

The present study sought to list the main characteristics of Education 4.0 and how they were and are being used during this pandemic period caused by the SARS-COVID-19 virus.

We verified that Education 4.0 has a series of specificities that are only possible from access to the internet and based on the technological concepts of culture and pedagogy.

We realize that teachers and students need to be inserted in technological environments aimed at education, knowledge sharing and the development of special skills, the so-called "soft skills".

Teachers need to innovate and renew their knowledge constantly. In the 4.0 environment, acting as guides, tutors, advisors, they need to be connected with the reality and the actuality of the facts, so that they can correctly lead their students in the construction of knowledge.

Educational institutions, by making use of informational means, that is, of new information and communication technologies, end up adopting the concepts concerning Education 4.0. However, more than the physical and infrastructural adoption of this concept, it is crucial that the educational body updates itself and adopts this knowledge to be able to use it in the classroom, virtual or real, with their students, encouraging them to create and grow; to be the actors of their own creation.

In this moment of a pandemic, many institutions, teachers and students find themselves, overnight, forced to reinvent themselves and adapt to the appropriate conditions for the continuity of classes. In this way, they reinvented themselves and started to adopt hybrid learning, distance learning and remote learning. Resorting to existing technology, the use of

the internet and educational programs, as well as digital materials, were the alternatives found so that there was no discontinuity in teaching, especially for those who were about to take the ENEM¹ exam.

Probably, after the return to normality, these and other practices will be reviewed, updated, incorporated or abandoned. But, it is a fact that these technologies were the mainstay in the continuity of education in Brazil and in the world.

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¹The National High School Exam (Enem) is an annual test that aims to assess the quality of high school education in schools across the country. It is the main gateway to courses in public and private universities.

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