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Characteristics of Education 4.0 and its Application in Industry 4.0.

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Abstract : The present study aims to present, from the main characteristics of Education 4.0, its possibilities and applicability in industry 4.0. 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 and Industry 4.0. 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. 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. 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. The originality of the study lies in the fact that education aimed at the application of new technologies still has a wide field of research and many areas still do not have the necessary depth regarding education 4.0.

Keywords: Education 4.0; Industry 4.0; New educational technologies.

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1. Introduction

Education4.0,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.

With each industrial revolution, the profile required of workers changed, moving from manual to intellectual work, which, according to AIRES et al., (2017), required companies to be concerned with the training of their workers.

In this way, we emphasize that the media, the New Information and Communication Technologies (NICT) and the informational means are important and outstanding tools for the promotion and induction of learning by the student. However, the presence of the teacher, whether as a mediator, motivator, or guide, will always be fundamental for the balance of classroom teaching – virtual or real (face-to-face).

The Industry 4.0 allows men and machines to interact equally. Currently, many operations have been migrated to robotic machines, especially procedures in which the risk of serious accidents was notorious. It is a fact that these new interactions will generate a new intelligent workforce and will have significant effects on the nature of work. In this way, the integration of workers in an Industrial System 4.0 becomes a challenge to be considered, since the World 4.0 requires people with different skills, educational levels and broad cultural backgrounds. All of them knowledgeable and adapted to the New Information and Communication Technologies (NICT).

Following the technological evolution, many experts point out that the advent of 5G internet will be the evolutionary "Big Bang" of Industry 4.0 and, consequently, of all professions that walk in this same growth treadmill. In the Defense area, wireless sensor networks, cybernetics, autonomous equipment and the use of gamified environments are probably one of the main actors involved in this technological rise.

The Figures 1 and 2 below highlight the 4.0 process, where the 4.0 World demands the services of Education 4.0. This, from the Pyramid of Education 4.0, provides the preparation of the professional and citizen 4.0.

In the case of the Pyramid of Education 4.0, it presents itself as a dynamic and sequential organism, where the infrastructure provides the necessary support so that teachers can stimulate the evolutionary capacities of students and, they can become actors and protagonists of their actions. Finally, this process allows the formation and stimulation of socio-emotional skills, which are extremely fundamental in this leaFig 1. Process Framework 4.0rning and knowledge environment.

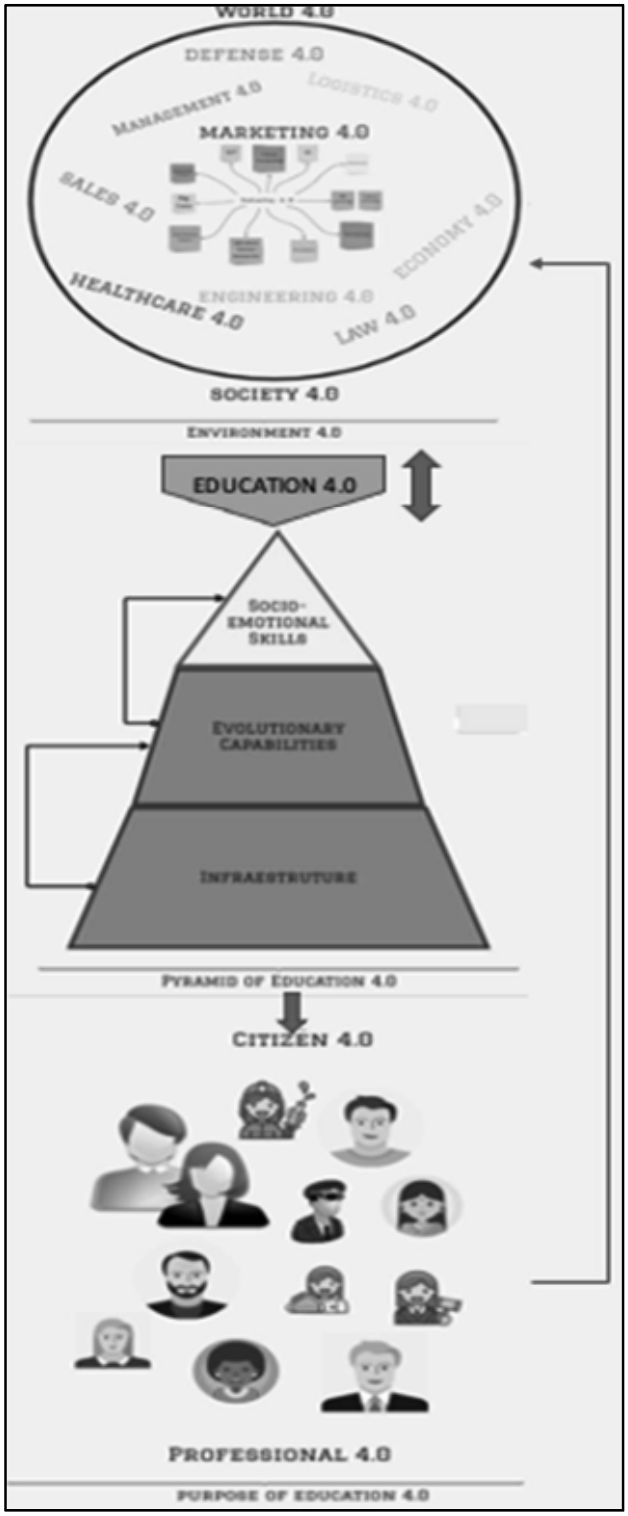

Fig 1 : Process Framework 4.0

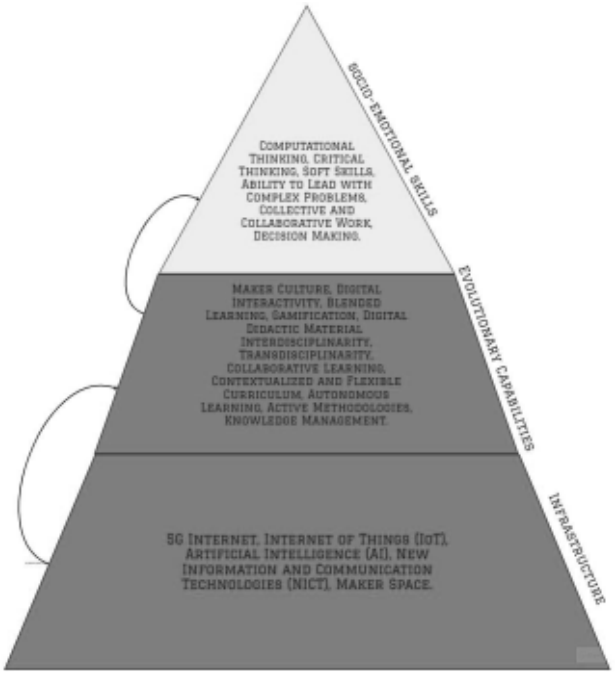

Fig 2 : Pyramid of Education 4.0

characteristics inherent to Education 4.0 and Industry 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 is of a qualitative nature (Patton, 2015), based on the methodology of bibliographic research (Martins; Theóphilo, 2009) making use, mainly, of Scopus and Web os Science databases.

Thus, the following procedures were adopted for the construction of this article (Figure 3):

Step 1. Identification in the Web of Science and Scopus databases of subjects related to Education 4.0 and Industry 4.0.

Step 2. Filtering the subjects in the databases.

Step 3. Comparison between the subjects, listing the characteristics of each one, analyzing and carrying out their interrelationship.

Step 4. Presentation of the Results of the Analysis of the comparisons made.

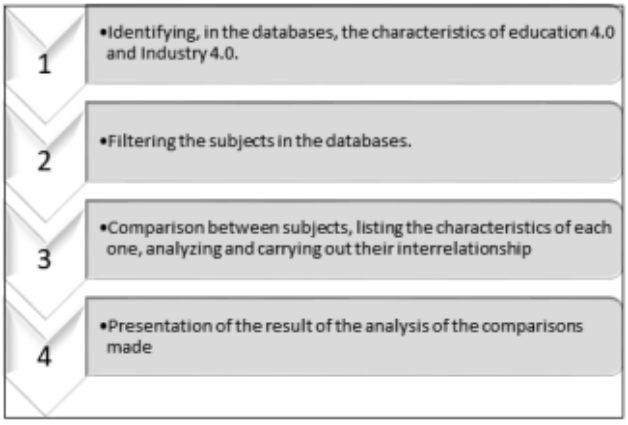

Fig. 3 : Methodological Procedure

The Web of Science and Scopus databases were accessed to obtain a relevant conceptual database for a literature review.

The search, carried out on March 16, 2022, used the following keywords as a base: Education 4.0 and Industry 4.0. The range of years between 2011 and 2022 was determined as the research period. This time frame was determined from the understanding that the use of the terminology "4.0" occurred from 2011, when the term Industry 4.0 was coined at the fair of Hannover, Germany. It is common ground that this terminology highlighted the 4th Industrial Revolution and the way it conceives a world where physical and virtual manufacturing systems cooperate in a global and flexible way, revolutionizing global value chains (SCHWAB, 2016, p.16).

3. Literature Review

A. Education 4.0

We started our approach to Education 4.0 bringing some important concepts to fill in the doubts that hover over this theme.

The occurrence of the number 4.0 is directly associated with the 4th Industrial Revolution, or Industry 4.0. In this way, we can understand that Education 1.0 emerged during the 1st Industrial Revolution, with the advent of the use of steam for energy.

Education 2.0, under the strong influence of the 2nd Industrial Revolution, at the end of the 18th century, gave rise to mass education. Reflection at school gave rise to specialization. The latter began to focus on disciplines, teachers and specialized content.

This gave rise to a centralization that is reflected in the school, which concentrated everything in the classroom, a place where (FAVA, 2014).

In the late 1990s, with the growth of the 3rd Industrial Revolution due to the development of the Internet, Education 3.0 was born. The Internet has given people access to connect and relate in a dynamic way. This generated an eagerness to "[...] work, share, interact, communicate, teach, study, learn" (FAVA, 2014). It is the friend of the digital age. The contents are mediated in a hybrid way where the activities take place in person or not.

Education 4.0, prioritizes practical experimentation by students, intensifies the understanding of the "maker culture", that is, Do It Yourself (DIY) culture, valuing attributes such as creativity, innovation, initiative, among others. In addition, soft skills are known to be prominent in this new form of education as these skills are in line with the attributes expected in Education 4.0, or critical thinking, the ability to deal with complex problems, quick communication decisions and empathy.

We understand that Education 4.0 came to meet the demands of Industry 4.0, corroborating the understanding from the understanding of SCHWAB (2016) when stating that

By enabling "smart factories", the fourth industrial revolution creates a world where physical and virtual manufacturing systems cooperate in a global and tabular fashion. This allows for full product customization and the creation of new operating models. [...] What makes the industrial revolution different and the previous versions between the three physical, digital and biological technologies." (SCHWAB, 2016, p.16).

Pinto et al., (2021) point out that education 4.0 has become a pressing need in several areas of knowledge. The professions have passed through the basic need for knowledge, lacking a greater range of information, actions, behaviors and individual and collective relationships for the correct performance of their activities. (PINTO et al., 2021).

However, in order to meet the demands and characteristics inherent to Education 4.0, there are a number of attributes that need to be present in the educational environment, whether in the classroom, in infrastructure, or in the skills of teachers and students. Führ (2019) describes the main characteristics that are expected in the training of professionals for "Industry 4.0":

Table 1 : Characteristics of Education 4.0 in Environment 4.0

Characteristics	Definition
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
Transdisciplinarity	It is the ability to produce an interaction between disciplines that, not being restricted only to the disciplinary content, proposing a dialogue between fields of knowledge, seeking to achieve and change the subject's perception, cognition or behavior.
New technologies of education and communication	It is the use of information and communication technologies to aid education, through software and hardware.
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;
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 concept. Through proper knowledge, people, with the right tools, can create their own solutions. It is learning in practice
Artificial intelligence	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.
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.
Blended learning	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.
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.
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.
Internet of Things (IoT) of learning	Among others things, 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.

Computational thinking	Is 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.
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.
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
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.
Teamwork	Group work, in a collaborative way, so that everyone can collaborate in the development of solutions.
Project-Based Learning	students improve their skills, using them in real-world problem situations.
Technopedagogy	This concept is also known as digital pedagogy, and can be understood as a set of concepts, ideas and practices associated with innovation and development in education in the digital age.

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.

B. Industry 4.0

According to Cheng et al. (2016) the essence of Industry 4.0 is based on cyber-physical systems (CPS) and Internet of Things (IoT), which will lead factories to reach a new level of production. CPS is based on dynamic manufacturing configuration. Unlike traditional production methods, dynamic

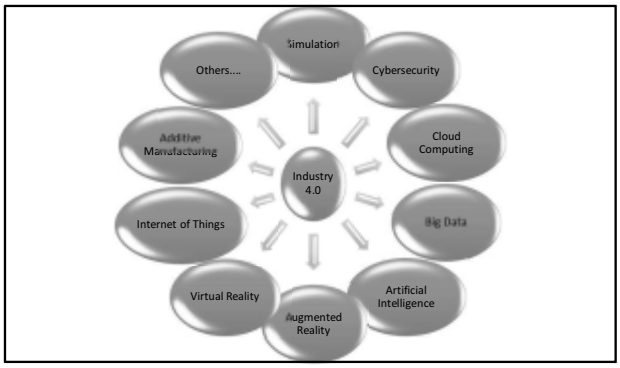

Fig 4 : Some technologies are transforming industrial production.

configuration is above the production and processes involved. Because the dynamism makes the system capable of changing the initial design of the product at any time.

The fourth industrial generation has as main characteristics: data interconnection, integration and innovation. The fourth industrial generation is based on several pillars that, in the future, will generate opportunities for technological development in the industrial field, as highlighted in the Figure 4.

In a survey carried out by the National Confederation of Industries of Brazil (CNI, 2020), it was proven that companies that adopted industry 4.0 technologies faced the pandemic better. It was highlighted that 54% of industries with Industry 4.0 technologies recorded a profit equal to or greater than the pre-pandemic period. This rate drops to 47% for those who have not yet adapted to modernity. As for profitability, it was higher in 29% of industrial companies that adopted four or more technologies from Industry 4.0, falling to 25% among those that did not adopt any resource. Another relevant data concerns the use of robotics, since, among companies that have advanced robotics in the production line, 37% increased the number of employees. In total, 30% of industries that adopted at least three 4.0 technologies increased their headcount even during the crisis, against 22% among those that did not. Among those that use machine-to-machine connection systems and sensors, the percentages are 32% and 30%.

Finally, the research revealed that the Industry 4.0 technologies that most positively impact the profitability of companies are machine-machine connection systems, sensors, big data and artificial intelligence.

In 2016, with a proposal to reimagine and rethink the institute's engineering education, MIT created the New Engineering Education Transformation (NEET) program, centered on technologies and machines of the future. To cope with new trends, an education that is compartmentalized and organized into specific areas would not be adequate. In this way, NEET was conceived as an "interdepartmental effort focused on integrative and project-centric learning", aiming to prepare students to solve problems related to advanced machines and materials, autonomous machines, digital cities, renewable energies and machines and systems in the field of biotechnology. Following one of these paths, the student should be encouraged to develop not only the technical skills, but also the interpersonal skills required in the job market, receiving, at the end of the day, a NEET certificate. This initiative was one of the ways that MIT found to create an educational approach that was more flexible, non-prescriptive and in dialogue with the global challenges of Engineering.

Silva et al (2015) performs a very interesting excerpt on the use of games and simulation for engineering teaching in Brazil. The use of Lego has been widely used in teaching operations management, applying concepts of linear programming and balancing assembly lines. In addition, JIT, Pull x Push Production and Production Planning and Control.

The lampshade, the scaffolding, Robocano, the Boat, among others, were also mentioned.

The researchers realized that the games, simulations and dynamics mean a valid tool for complementing learning, that is, when used with other forms of teaching, they allow a more concrete application of abstract concepts related to Production Engineering. In this way, the games allow the coexistence between learning and satisfaction, as it is not just a playful and stimulating activity, but, from the perspective of the participants, it is effective for the practice of learned concepts.

Experiential learning, through alternative dynamics, makes the main role of the teaching-learning process shift to the student, who becomes the center of the process, unlike traditional teaching that focuses on the role of the teacher. This facilitates greater involvement, through the desire to pursue competitive and cooperative learning. Group work prevails over the expository and individual presentation of the teacher.

Barbosa and Moura (2014) approach Problem-Based Learning and Project-Based Learning. The researchers emphasize that Engineering teaching offers many opportunities to apply active learning methodologies in different areas of professional training. They highlight the case of laboratory classes, workshops, group tasks, teamwork inside and outside the school environment, technical visits and project development. These activities are naturally participatory and promote student involvement in the learning process.

With regard to Problem-Based Learning, it began in the 1960s in Canada, initially being applied in medical courses, later being adopted in several areas, including Engineering.

Its dynamics consist of contextualizing a situation – problem seeking self-directed learning. It is opposed to traditional methods based on the transmission of teacher-centered knowledge. In this way, this form of learning focuses on the student and the teacher acts as a guide in work groups, in which the interaction between teacher and student is much more intense than in purely expository classes.

According to Araújo (2009), Problem-Based Learning seeks to transform a problem as the basis of motivation for learning, emphasizing the construction of knowledge in a collaborative environment. The idea is not to always have the problem solved at the end, but rather to emphasize the process followed by the group in search of a solution, valuing autonomous and cooperative learning.

In this form of learning, the teacher must: mediate discussions; acting to keep groups of students focused on a problem or issue; motivate students to get involved with the tasks of the solution search process; stimulate the use of the intellective functions of thinking, observing, reasoning and understanding.

The Project-Based Approach has as its principle the consideration of real situations related to the context and to life, in the broadest sense, which must be related to the central object of the project under development.

Araujo (2009) cites an experience of applying active learning methodologies, using this approach in engineering courses, which has been developed at LACTEA – Open Laboratory of Science, Technology and Art of the Federal Center of Technological

Education of MG - CEFET-MG /(Brazil). His proposal is to bring to the school routine, as a component of the curriculum of some disciplines, the experience of carrying out projects, by groups of students, under the guidance of a teacher. This experience at LACTEA has been analyzed in several surveys of the Graduate Program in Technological Education at CEFET-MG, showing the value of project-based learning in Engineering teaching.

The Academia Militar das Agulhas Negras (AMAN), Higher Education Establishment for Training Officers of the Brazilian Army in the Military War Training Line, inaugurated, in 2016, the Fire Support Simulator aimed at training not only its Cadets, but, also, in the operational preparation of the professional force of the Brazilian Army.

The System aims to perform a virtual simulation of the battlefield. In this context, we understand that this type of simulation.

Virtual Simulation is the type of simulation in which real people operate simulated or computer-generated systems. It represents a lavish training tool as it is an immersion process that seeks the greatest possible realism, preserving human, material and financial resources. (OLIVEIRA FILHO, 2015, p.39).

It is important to emphasize that, in the search for greater effectiveness, the use of modern technologies has been increasingly used, with simulation being an aspect that is proving to be increasingly viable, as it allows an increase in the quantity and quality of teaching, instruction and training, without wearing out the actual equipment; allow the measurement of performance; to allow lessons to be learned regarding the use of weapon systems, units and respective supports and the training of General Staff without the need to employ troops in the field, all with reduced cost and time of carrying out exercises.

This type of system allows carrying out the actions foreseen in a real activity, guaranteeing training and training.

Nunes (2020) highlights that, among the positive effects generated by the adoption of this simulator, are:

The improvement of the performance of the fire support crews, the saving of ammunition used in live fire, which are quite expensive to acquire, the possibility of repeating the shooting exercises without increasing the expenditure on ammunition until the proposed results are achieved , safety in carrying out indirect fire exercises, the possibility of shooting in reduced instruction fields and without the need to interrupt air traffic by Notification to Air navigators, among others (NUNES, 2020, p. 41).

In Latin America, the Pontificia Universidad Católica de Chile (PUC) is touted as an emerging leader in engineering education. The process of reviewing and modernizing its courses gained momentum in 2014, with the launch of The Clover – Ingenieria 2030 project, a partnership between PUC and Universidad Técnica Federico Santa María. The project was designed in response to the government's program Nueva Ingenieria para el 2030, which aims to promote ambitious curricular and organizational change in the country's universities. Thus, in order to "help Chile reach the status of a developed country", PUC pointed out that it is necessary for Chilean engineering schools to evolve from good to excellent, to become institutions of excellence at a global level and to be able to offer new technologies inside and outside the country. In these terms, changes have been promoted in the ways of teaching and learning in order to prioritize student-centered education, which combines multidisciplinarity, focus on the user of technology, social responsibility and strong interaction with industry and society.

4. Results

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.

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 problem; 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.

We highlight what was presented in the military environment, in particular at AMAN, where cadets have been using virtual reality to simulate combat. The instructors who teach military techniques and tactics are from another generation, and many did not have the opportunity to use digital means for training, but had to update themselves, both in the use of technology and in the way of teaching it to the new generations.

CEFET/MG, through the LACTEA experience, has been using the experience of carrying out projects, by groups of students, under the guidance of a teacher, making clear the situation of the teacher and the student in this process.

However, the use of problem-based or project-based learning, despite not being "modern", is very current and requires a significant effort on the part of the teacher to create the study environment, bring it to the knowledge of the students and make them collaborate in the investigation and search for a solution.

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.

We also verified that actions by MIT and PUC in Chile highlight the importance of several characteristics inherent to education 4.0 to be developed and stimulated in their engineering students. This is perhaps one of the areas most strongly influenced by Industry 4.0.

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 5 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:

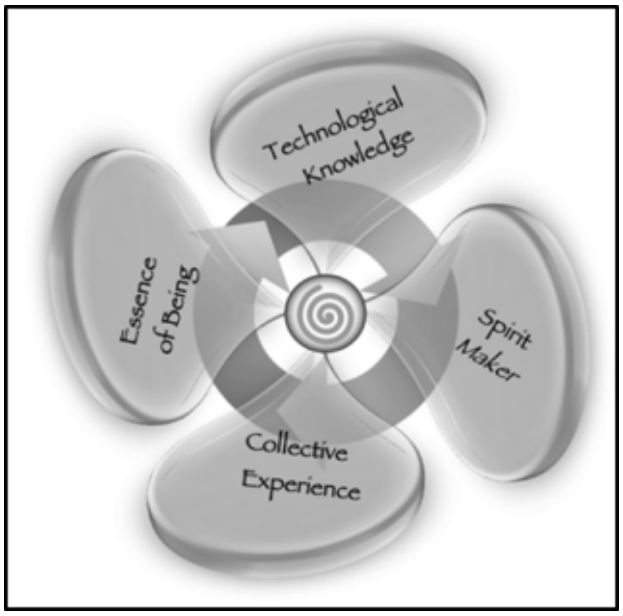

Fig. 5 : Education teaching helix

1) 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.

2) 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.

3) 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.

4) 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.

5. Conclusion

The present study sought to list the main characteristics of education 4.0 and how they influence and are influenced by industry 4.0.

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 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, new information and communication technologies, end up adopting the concepts related to education 4.0. However, more than the physical and infrastructural adoption of this concept, it is essential that the educational body update itself and adopt this knowledge in order to be able to use it in the classroom, virtual or real, with their students, encouraging them to create and to grow; be the actors of your own creation.

During the 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 blended learning, distance learning and remote learning. The use of existing technology, the use of the internet and educational programs, in addition to digital materials, were the alternatives found so that there was no discontinuity in teaching.

We also realize that industry 4.0 depends heavily on qualified and prepared people to be actors and not supporting actors. In this way, an education focused on and based on the characteristics of the world 4.0 is essential for these professionals to feel and be prepared for current and future challenges.

With the return to normality approaching due to the end of the pandemic, these and other practices will be reviewed, updated, incorporated, or abandoned. But it is a fact that these technologies were the basis for the continuity of education in Brazil and in the world.

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