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# Industry 4.0 and the digital transformation… A new challenge for higher education

# La Industria 4.0 y la transformación digital…. Un nuevo reto para la educación superior

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**Abstract**

It is important to realize that within everything that surrounds us, progress and innovation, it is being forced, we are obliged to be part of generating significant changes in the way of doing things, and the sooner we get involved, the better prepared we are. we will be there to know and apply this knowledge; education must be an integral part of this change, promoting attitudes and skills in students that allow them to be part of this new revolution, preparing them for better job, professional and personal opportunities. Objectives, methodology: Through this research, we seek to demonstrate that at present, all the technological resources that are available to us, brings as a consequence, a mandatory change in the way we see education, therefore, it is important to highlight that educational improvements are the that more are involved in making adjustments in the systems of knowledge delivery, involving different actors not only at the institutional level, but also in the productive sectors where there is an improvement in the processes that are managed and developed there; this in order to generate continuous improvements. Contribution: This research, aims to demonstrate that the implementation of the various technological tools will allow students to be better prepared when entering their professional life, in addition, will provide them with current elements to generate procedures that improve the management of information and production, applicable in various functional areas of any organization. If we try to generate an inclusive education, focused on managing the processes that every organization already manages, we will be forming significant changes in students, improving their study habits and working in advance to train better professionals focused on continuous improvement

**Industry 4.0, integral education, technological tools, process**

**Resumen**

Es importante darsenos cuenta que dentro de todo lo que nos rodea, los avances y la innovación, se esta obligandoestamos obligados a formar parte para generar cambios significativos en la manera de hacer las cosas, y mientras más pronto se involucrennos involucremos,, mejor preparados se estará estaremos para conocer y aplicar dichos conocimientos; la educación debe formar parte integral en dicho cambio, promoviendo actitudes y aptitudes en los educandos que les permitan ser parte de esta nueva revolución, preparándolos para mejores oportunidades laborales, profesionales y personales. Objetivos, metodología: Mediante esta investigación, se busca buscamos demostrardemostrar que en la actualidad, todos los recursos tecnológicos que se encuentran a nuestra disposición, trae como consecuencia, un cambio obligatorio en la forma que se vemos la educación, por ello, es importante destacar que las mejoras educativas, son las que más se ven involucradas en realizar adecuaciones en los sistemas de impartición de conocimiento, involucrando diferentes actores no solo a nivel institucional, sino también en los sectores productivos donde se dá una mejora en los procesos que ahí se gestionan y desarrollan; esto con el fin de generar mejoras contínuas. Contribución: Esta investigación, pretende demostrar que la implementación de las diversas herramientas tecnológicas permitirá a los alumnos estar mejor preparados al momento de ingresar a su vida profesional, además, los dotará de elementos actuales para generar procedimientos que mejoren la gestión de la información y producción, aplicables en diversas áreas funcionales de cualquier organización. Si se trata tratamos de generar una educación incluyente, enfocada a manejar los procesos que toda organización ya maneja, se estaraestaremos formando cambios significativos en los alumnos, mejorando sus hábitos de estudio y trabajando anticipadamente para formar mejores profesionistas enfocados a una mejora contínua.

**Industria 4.0, educación integral, herramientas tecnológicas, proceso**

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## Introduction

Currently, talking about technology implies that all aspects of everyday life are immersed in it, so it is that around us there are devices and devices that remind us of the importance of always being connected, and not only because of the ease of Be aware of what happens to us, but also because everything we do today, implies access to a resource or technological tool. One of the most important resources of any organization, lies in the importance of the way in which information is managed, making time to optimize decisions and generating processes that improve in time and form the activities that every company can carry out.

The productive order that is currently managed in all organizations, drives new processes to carry out all the tasks that are managed there, which is why it is vital that it is encouraged from the grassroots, the inclusion of systems that can give the knowledge of the students and in this way begin to change the way in which education is carried out in the classroom.It must be emphasized that the requirements have changed in the professional sector and it is a fact that we cannot continue providing education under the same guidelines.

It should be noted that education must be modified to adapt it to the new requirements of society, the challenge is: How to carry it out? Obviously, one of the levels where this process is vital, is the superior, since students It emerges directly to the labor sector, so it must be considered suitable and have its own tools to develop the activities that are requested in the best way and with the level of quality required;

That is why the role that teachers and educational institutions should take must be recognized, since this change will be carried out successfully to be based on their actions and the updates generated in the educational plans. One of the ways to carry out this change is to include project-based educational models, which will generate in the student the capacity for critical development to be able to implement knowledge in the solution to real situations that occur in the day to day in any organization.The pillars included in Industry 4.0 will also be reviewed and the way in which they can be approached to include them and make them known in the classrooms, thereby carrying out real actions that can enhance knowledge.

The central hypothesis that is managed lies in the fact that it demonstrates that, if adjustments to the curricula are included so that new ways of dealing with information focused on the management of projects and real problems of today's society can be implemented, they can be generated new forms of critical and abstract thinking to deal with labor aspects, capable of allowing solutions to optimize resources, supporting sustainability models, necessary in today's world.

In addition to this maelstrom of current events, it is very important that teachers have adequate training, according to their area of expertise to be able to correctly support the requirements that at the labor level should be considered as a basis in the formation of the development of new processes that are significant in the professional.

## What is Industry 4.0?

It consists of the digitalization of industrial processes through the interaction of artificial intelligence with machines and the optimization of resources focused on the creation of effective commercial methodologies. (Logicbus, 2019)

One of the main ways to generate economic development at the state level, is undoubtedly innovation, so it is not exaggerated to say that it is in a moment of change where it is essential to be able to include new processes in the activities that are developed throughout organization, this in order to promote the mobilization and management of information in an appropriate manner that allows and improves decision making.

Industry 4.0 comprises nine pillars that are developed in different areas or divisions of the areas that comprise organizations; these are:

– Big data and data analysis. Focused on the management and management of large amounts of information, allowing the processing of historical data that manages the fluctuation in the data within a given period.

– Autonomous robots. Mainly used in production processes and sometimes in the logistics and storage of merchandise.

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– Simulation. It allows the implementation of new processes since their incubation, optimizes their use before they are implemented, and therefore, before economic investments related to these items are made.

– Systems for vertical and horizontal integration. It allows to integrate different applications and software to be able to implement activities within the areas involved, SCM, ERP and CRM are some examples.

– Internet of things (IIoT). Through the use of different electronic devices, communicated with each other, it is sought that activities that may be repetitive within an organization be facilitated, or as is currently done, for personal use, such as Home Automation.

– Cyber security. It focuses mainly on the implementation of adequate mechanisms to protect the information generated in all organizations, in order to prevent attacks or misuse of it.

– Cloud computing One of the main problems we have is the indiscriminate use of paper and physical artifacts to store information; This pillar aims to optimize and eliminate the use of these resources, implementing virtual spaces for this purpose.

– Additive manufacturing. Commonly known as 3D Printing, it allows generating useful prototypes in different areas, from the production of tools to useful molds to generate organs and medical accessories, which would reduce time and costs in transplants, making it possible to improve the quality of life of patients involved.

– Augmented reality. There is currently a great boom in this sector; mainly focused on the educational area, where a large part of educational material and tools, is being developed using this instrument, through various applications that are not only explanatory, but also applicative.

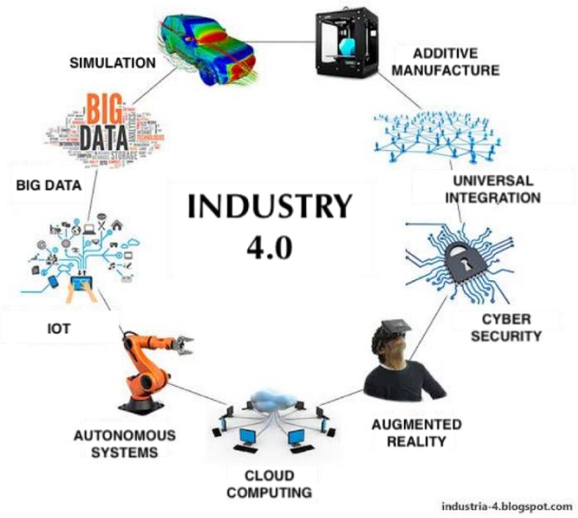


**Figure 1** Pillars of Industry 4.0 (Sahifa, 2019)

**Why is it important to include Industry 4.0 in higher education?**

At present, there is a worldwide boom due to the use of any electronic device that allows us to have and manage information in real time, derived from it, procedures have been implemented that take us to use these elements to complement activities within and out of all organizations; the importance of implementing within the curricula, the pillars that Industry 4.0 manages, part of the fact that it is not good to stay with a technological lag, therefore, teachers must be trained first so that they can adapt curricula to the use of cutting-edge technologies and tools.

However, it must also be taken into account that the requirements and needs at the business level, are changing very regularly, so that institutional governments must focus a large part of the resources that are assigned to the improvement in technological equipment within the institutions, this may seem like a utopia, however, if you focus on the fact that this aspect can result in a win-win, you will have over time, the economic development that can bring you to society and then to country, resulting very attractive and very strong to take into account.

The student is responsible for forming new logical processes that adapt to the generation of responses to everyday problems in working life to which it will be included closely; hence lies the importance of including such activities as part of their academic training.

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**Figure 2** Digital technology (Elpaís, 2019)

It should be emphasized that, it should also be taken into consideration that knowledge represents 50% of the necessary mechanisms, the other 50% is made up of cognitive skills and abilities to create, solve, coordinate, make judgments, negotiate and be flexible in their resolution.


**Figure 3** Skills by 2020 for students (Educational innovation, 2019)

## Is the teacher really prepared for a paradigm shift towards Industry 4.0?

*"Much of the technological learning is gradual and incremental. However, there is no inevitable progression towards an increasingly distant and always more unreachable border." (Rodríguez, 2017)*

One of the most significant challenges to achieve the inclusion of students to Industry 4.0 is that education must be necessarily active and collaborative.

So that actions are included allowing students to practice problems based on real situations, simulating interaction in the various areas that may be related within the organization. This in order to create and develop ideas where the teacher is a facilitator in the process. The instruction must be bidirectional, therefore, the teacher must be able to allow a participation in the development and adaptation of the subjects of study, thereby achieving an autonomy that marks in the students the inclusion of interesting content for the students.


**Figure 4** Teacher and Industry 4.0 (Nuevo día, 2017)

In addition, the teacher must have knowledge about the use of technological tools, because at present, most of the classes are expected to occur in an interactive way, a fact that results in the fact that teachers must encourage the use of current technologies to promote results that include these elements.

We must always look for innovation, since it goes hand in hand with the change of paradigms in the students' way of thinking, they can no longer be expected to enter the classroom to receive instructions on the activities they are going to do, it is time to encourage in them abstract thoughts that allow them to issue solutions to tasks that are even repetitive or merely theoretical, the main thing is to optimize times, costs, resources and encourage collaborative work.

For this, it is very important that the instruction, the teaching staff and students with the technology go hand in hand, in order to fulfill the evaluation correctly and adequately satisfy the skills that are required to fulfill professional functions within the organizations , who already require and use the different resources in terms of technology to benefit in the decision-making process effectively and efficiently.

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In addition to this, it must also be understood that there is an increasingly competitive market, where there are more and more people prepared in the use of digital tools, transnational companies where large amounts of information must be managed in real time and have it available of all, activities to get products and services to more people in a large number of places; All of this implies that school preparation must be of the highest quality.

Previously, it was said that teachers should serve as guides and imparters of knowledge, in this reality, nowadays teachers "encourage" the acquisition of knowledge, show the whole range of wisdom for young people to develop jobs that activate their critical sense , participation, inclusion and flexibility of thought, not only to make knowledge, but also to implement issuing real solutions, applicable to the society of which they are part.

For the aforementioned it is important that the teacher is integrated to the use of technological tools, but in case it is not provided, strategies for adoption of the technological tools will be sought, through teaching courses, stimulation and benefit of the use of tools within the classroom.

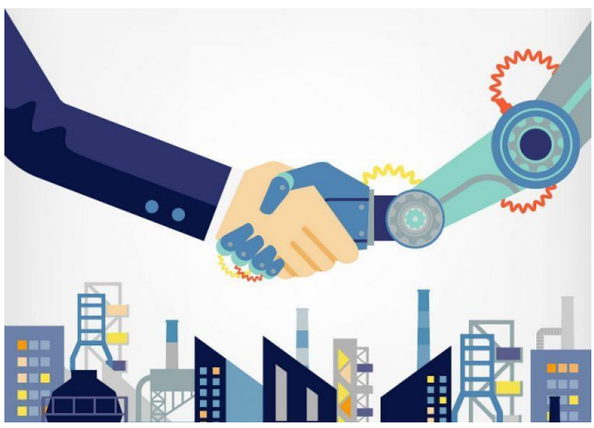
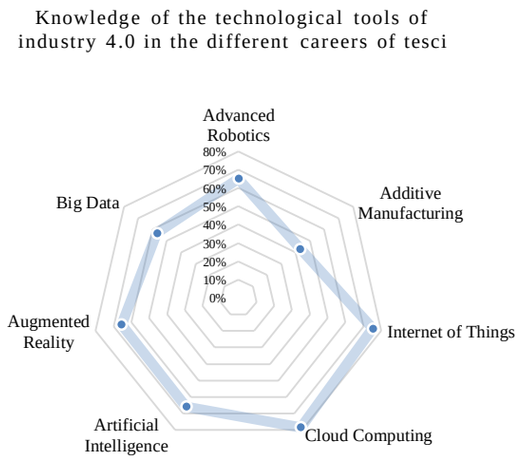


**Figure 5** (Engeman, 2109)

## How do students impact the inclusion of knowledge focused on Industry 4.0?

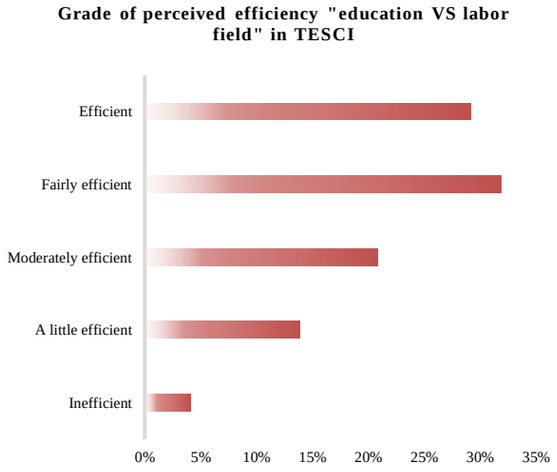
Despite the reactions that may exist, as in any change, it is very important to make known and use new tools, which are considered of interest to young people in higher education, who see in their use a way to gain experience that may be applicable at the time of insertion in the professional environment.

The technological education that is sought, will promote cognitive development environments that focus on the implementation of new ways of carrying out the work, new implements of productive processes and improvement in the optimization of resources for its adaptation within the different areas of an organization. According to the study conducted at the IES, students who have knowledge about the pillars that Industry 4.0 manages demonstrate that they have managed Cloud Computing as a support tool in the development of projects and school activities, although they have their own knowledge in the other disciplines that are part of it.




**Graphic 1** Level of knowledge of technological tools

The following graph shows what information students perceive about the importance of handling any of the pillars of Industry 4.0 in relation to the elements necessary to perform required activities in the labor field.




**Graphic 2** Efficiency perceived in the HEI

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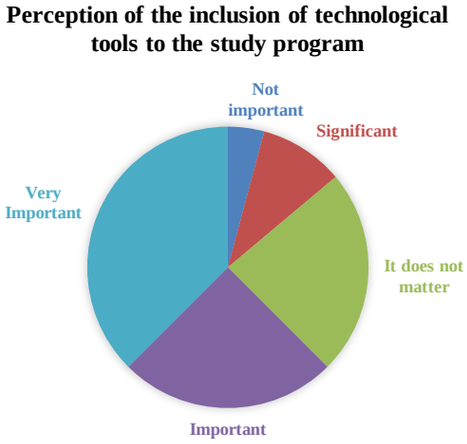
As can be seen, only 27% of the respondents consider that the management of the tools of Industry 4.0 is important to be able to carry out and implement work activities that cause a real impact and that the work carried out is truly significant.

**Profit vs. Investment**

According to the study carried out within the campus of higher education (IES), it is visualized that students are very interested in knowing and adapting to new technological tools, for this, teachers must be prepared to adapt the curricula with inclusion of projects based on case studies, where answers are given to real situations that help students to understand that reality at work causes different paths to be taken into account to generate a solution, which is important to include different areas of the company in the decision-making process, because all the areas intervene to a greater or lesser extent and that managers must have openness to allow impact responses to adapt according to the requirements and cutting-edge technology.

The results obtained also show that it is an important time to change the educational paradigm, not only can you continue to instruct on the basis that the teacher is always right and education should start from it, it is important to show that students have everything type of digital tools that make it a technological inhabitant. Therefore, it should include activities that allow an alternative thought development, which combines with technological actions and from there, allow more active participation within the different educational disciplines.




**Graphic 3** Grado de aceptación de herramientas tecnológicas

**Results**

It has been found that, for students, it is very important to combine the implementation and use of the seven pillars of Industry 4.0, in order to adapt to the use of current technologies that guarantee adequate adaptation to the resources that are considered indispensable within of the companies; innovation forms a very important issue as well, since, it is not about discovering the black thread, but about adapting it and giving it new uses where required.

**Conclusions**

Everything indicates that the country is slowly moving towards development, and one of the factors that affect it is precisely the fact that digital technology is not introduced into companies, because the processes in organizations have not adapted to the requirements that They can make our country as a competitive nation**.**

Much of the lack of advancement is that, from the educational foundations, there is no recognition of the importance of optimizing resources and costs based on including cutting-edge technology for its development.

Therefore, it is recommended to adapt the HEI curricula, and train teachers so that their role as instructors is adequate to meet the needs of companies or small businesses that are in development, because it would be a key point to stimulate to the students and you are beginning to see the higher institutions and graduates with the expertise of handling any pillar that makes up the industry 4.0

It is also recommended to have a company-IES link, since that would have greater openness so that students and teachers can carry out research or practices that bring them closer to the labor field in which they will face once they have graduated from the institutions having greater panorama to give proposals. or solutions to companies. Hay que hacer incapié en adaptar los planes de estudio y en capacitar a los docentes para que su papel como instructores y guias sea adecuado para cubrir las necesidades de la vida actual.

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**References**

Arroyo, C. (15 de julio de 2018). *Blogelpaís.com*. Obtenido de http://blogs.elpais.com/ayuda-al-estudiante/2013/12/la-neuroeducacion-demuestra-que-emocion-y-conocimiento-van-juntos.html

Coleman, G. (07 de 11 de 2019). *lampadia.com*. Obtenido de www.lampadia.com

*Educación en Valores*. (18 de julio de 2018). Obtenido de https://diananahir.wordpress.com/educacion-tradicional-ventajas-y-desventajas/

*Elpaís*. (26 de Marzo de 2019). Obtenido de http://www.elpais.hn/2019/03/26/que-es-el-cloud-computing-y-que-modelos-existen/

*Engeman*. (Noviembre de 2109). Obtenido de https://blog.engeman.com/es/industria-4-0-que-es-y-como-prepararse/

*Innovación educativa.* (2019). Obtenido de https://www.ipn.mx/assets/files/innovacion/docs/Innovacion-Educativa-80/Retos-de-ingenieria-enfoque-educativo.pdf

*Logicbus*. (Noviembre de 2019). Obtenido de https://www.logicbus.com.mx/que-es-la-industria-4-0.php

*Nuevo día*. (Septiembre de 2017). Obtenido de https://www.eldiarionuevodia.com.ar/local/info-general/2016/9/20/introduccin-industria-40-capacitaron-docentes-directivos-tcnicos-impresin-29392.html

Rodríguez, J. M. (Septiembre de 2017). *Cepal.org*. Obtenido de https://www.cepal.org/sites/default/files/document/files/rodriguez_final.pdf

*Sahifa*. (Noviembre de 2019). Obtenido de https://www.gruposc.com/blog/2017/12/06/los-9-pilares-tecnologicos-de-la-industria-4-0/

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