# Industry 4.0: The new educational paradigm?

# Industria 4.0: ¿El nuevo paradigma educativo?

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**Abstract**

The leaps and bounds advance of technology has forced us to pursue new ways of generating knowledge that have an implication that goes beyond the classroom; It is as necessary to update our teaching-learning processes as it is to raise educational quality and power; You have to accept the idea that changes are achievable for everyone, but you have to bear in mind that the results or the idea of failure has no place in society where the demand is ever greater; That is why we need to constantly adapt to new processes that lead us to satisfy the needs of our environment; all this in order to contribute to our community, providing human potential according to professional and personal demands that include good management of soft skills, to improve people's consciousness and unity.

Objectives, methodology. The present work seeks to demonstrate that the new times handle a requirement in all areas of life, therefore, it is necessary to provide the best tools for students from educational establishments, it is perhaps in this way, that it can be included in gradually, procedures that allow them to acquire practical training, focused on the application of cases that help critical and abstract thinking; where one of the fundamentals is to allow to manifest new regulations that are integrated into the study plans and considerably increase the skills that are sought today every time a university degree is finished. That is why we consider it of great relevance that the knowledge received in the classroom, is attached to the requirements that are sought in the work part, all in order to contribute favorably to continuous improvement, yes, focused on educational facilities but outlined to the professional and labor side.

Contribution. This research has the purpose of showing that the professional needs to be covered in educational establishments must increasingly encompass a greater integrity, from the processes, activities and the required level of specialization; It is not only about complementing the knowledge with the use of another language, but also carrying out parallel studies that increase and diversify the knowledge of the graduate; all this in order to generate better competitiveness and reinforce progress and significant learning

**Paradigm, Meaningful learning, Competitiveness, Process, Integration**

**Resumen**

El avance a pasos agigantados de la tecnología, nos ha obligado a perseguir nuevas formas de generar conocimientos que tengan una implicación que va más allá de las aulas; es tan necesario actualizar nuestros procesos de enseñanza aprendizaje como elevar la calidad y el poder educativo; hay que aceptar la idea de que los cambios son alcanzables para todos, pero hay que tener en cuenta que los resultados o la idea de fracaso, no tiene cabida en la sociedad donde la exigencia cada vez es mayor; es por ello, que necesitamos adaptarnos constantemente a nuevos procesos que nos lleven a satisfacer las necesidades de nuestro entorno; todo ello con el fin de contribuir a nuestra comunidad, aportando potencial humano acorde a las exigencias profesionales y personales que incluyan un buen manejo de las habilidades blandas, para el mejoramiento de la conciencia y unidad de las personas.

Objetivos, metodología. El presente trabajo, busca demostrar que los nuevos tiempos manejan una exigencia en todos los ámbitos de la vida, por lo cual, es necesario otorgar las mejores herramientas para los educandos desde los planteles educativos, es quizá de esta forma, que se puede incluir de forma paulatina, procedimientos que les permitan adquirir capacitaciones prácticas, enfocadas a la aplicación de casos que ayuden al pensamiento crítico y abstracto; donde uno de los fundamentos, es permitir manifestar nuevos ordenamientos que se integren a las especialidades de los planes de estudio e incrementar considerablemente las habilidades que se buscan hoy toda vez que se termina una carrera universitaria. Es por ello que se considera de gran relevancia que los conocimientos que se reciban en el aula, estén apegados a los requerimientos que se buscan en la parte laboral, todo ello con el fin de contribuir favorablemente a la mejora continua, enfocada en los planteles educativos pero perfilados a la parte profesional y laboral.

Contribución. Esta investigación tiene la finalidad de mostrar que las necesidades profesionales a cubrir en los planteles educativos deben abarcar cada vez una mayor integridad, desde los procesos, las actividades y el nivel de especialización requerido; ya no solo se trata de complementar los conocimientos con el uso de otra lengua, sino además, el llevar a cabo estudios paralelos que eleven y diversifiquen el conocimiento del egresado; todo ello con el fin de generar una mejor competitividad y reforzar los avances y aprendizaje significativo.

**Paradigma, Aprendizaje significativo, Competitividad, Proceso, Integración**

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## Introduction

At present, a person must not only have an individual vision of himself, since he is part of a community, he must focus on the fact that it is also necessary to identify himself as part of, as an important and necessary gear in practice and in the world work, that is of great importance, since it implies a constant reinforcement of all their capacities.

The old educational paradigm proposed that students should be prepared so that, every time their educational instruction was finished, their incorporation into society was already waiting for them, and the instructors in the classrooms had all the answers, mainly focused on to develop knowledge that would allow them to adapt to a work role based on criteria, memorization and discarding creative processes.

The new paradigm indicates that we must have a new vision of the student, recognize inherent talents and capacities, generating adequate spaces to recognize oneself from self-knowledge, allowing them to explore their aptitudes and abilities that generate adaptation to new work schemes; It is therefore that teachers, we must identify the type of intelligence, talents and qualities they possess and from there, include the use of soft skills that currently are also a fundamental part of the work process: teamwork, empathy , collaborative experiences, etc.

It is undeniable that new professional or job opportunities are getting shorter and shorter; A higher level of competitiveness must be shown, experience in the area and knowledge backed by diplomas and certificates that endorse them, this forces educational establishments to generate new proposals that include study programs focused on satisfying the needs of the "outside world ", That is why research should be carried out that is focused on how viable is the diversification of higher-level studies, if there are sufficient mechanisms to face the new needs of the industry and society in general, and what is the impact at the student level of not carrying out this mission.

## Industry 4.0

Economies are growing by leaps and bounds, which requires a diversification of processes and ways of carrying out activities in companies, one of the great fears that all societies have is that robots and data can make human beings replaceable ; Sensors are becoming a fundamental part of any process not only at the industry level, but also in our daily lives, these sensors provide us with data that allow us to manage information and mass storage that we can access anywhere and at a very low cost, bringing As a consequence, the use of Artificial Intelligence, that is, how these data extract organized information even better than the human brain itself to be able to apply it in practical solutions, at a lower price and in imperceptible times.



**Figure 1** Collaborative robots
*Source: (ielektro, 2021)*

When we talk about industrial processes, we must go back to the First Industrial Revolution, which generated the change from manual work carried out by people supported by animals to work by the same people, but now supported by engines whose operation based on water vapor included tools very basic. The appearance of the Second Industrial Revolution, marks the advance with the use of electricity, which generated greater efficiency and dynamism by producing in mass, greater volume, greater profit.

The third Industrial Revolution allowed the incorporation of digital technology, beginning to incorporate automation software into its processes.

Industry 4.0 is then a new industrial reform, which implements interconnectivity, autonomous learning, automation and optimal management of data in real time in all its processes, products and people involved, starting from the IoT (Internet of the Things), allows the connection of the physical with the digital and companies are no longer seen as isolated environments or areas, better collaboration and access to all departments is taken as this allows increased productivity, improved processes and as a consequence, continuous and sustainable growth.

**Pillars of industry 4.0**

With the passage of time, we have seen how new processes and new techniques have been included when carrying out activities not only in organizations, but also in our daily lives, generating endless solutions for any situation we have, the Fourth Industrial Revolution, handles nine pillars or "supports" to generate highly technological solutions:

- BIG DATA AND ARTIFICIAL INTELLIGENCE. It allows the capture, compilation and analysis of large amounts of information, from different sources, all in order to reinforce decision-making, supported by Artificial Intelligence algorithms to make work more efficient, anticipate events that are not beneficial, reduce waste of material and optimize processes.
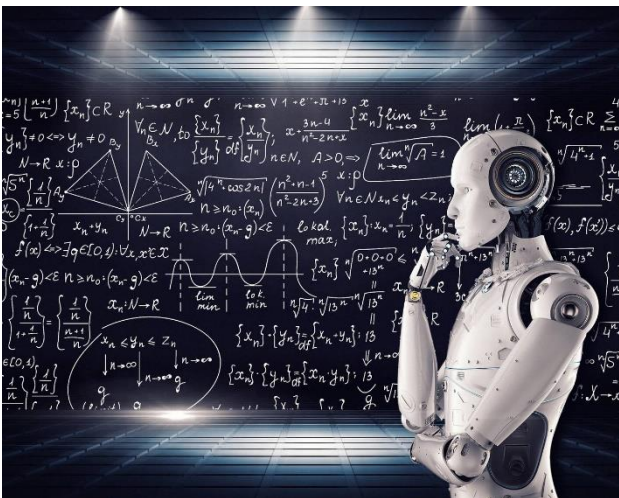


**Figure 2** Artificial Intelligence
*Source: (Digitization, politics and Artificial Intelligence, 2021)*

- AUTONOMOUS ROBOTS. They are generated at a lower cost and with a greater capacity to generate solutions, in addition to the well-known human-computer interaction.



**Figure 3** Robot
*Source: (Digital Politics, 2021)*

- SIMULATIONS. This type of "virtual testing" allows data to be grouped in real time in order to provide solutions before problems occur, helping to integrate all areas of the company and treating them as a whole.



**Figure 4** Simulators
*Source: (Technohighways, 2021)*

- INTERNET OF THINGS (IoT). One of the most significant contributions of Industry 4.0 is undoubtedly the use of sensors and technologies that allow devices to communicate and interact with each other and with the individuals who manage them, once again allowing decision-making and real-time responses.

**Figure 5** IoT
*Source: (Electric Future, 2021)*

- CYBERSECURITY. A very important aspect, since, from the processes and improvements in this area, all the information that runs in the different systems is protected.



**Figure 6** Cybersecurity
*Source: (e-Weekly, 2021)*

- CLOUD. The exchange of data, which is increasing, must allow access to them, at any time and place, so the use of clouds is an almost indispensable aspect for Industry 4.0



**Figure 7** Cloud Computing
*Source: (redfibra.com, 2021)*

- 3D MANUFACTURING. Additive printing is another very important factor, since it allows the generation of prototypes and improvement of various parts, at low cost and in a more sustainable way, since it avoids the waste of man-hours and materials immersed in the process.
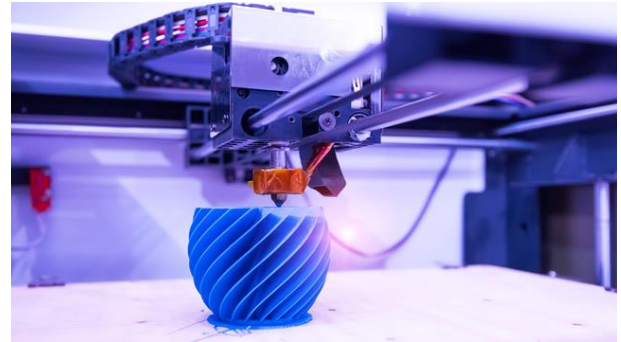


**Figure 8** Additive manufacturing
*Source: (elExportador, 2021)*

- AUGMENTED REALITY. The use of multimedia is very close to developing content that provides information in real time and improving any process based on the reality perceived by people with the use of accessories prepared for this purpose.



**Figure 9** Augmented reality
*Source: (hubspot, 2021)*

**Advantages of including industry 4.0 in the educational plan**

We have been observing all the aspects that are related to or comprise industry 4.0, at an educational level, we must find what of the model fits and what aspects can be reinforced or even get a better version of the knowledge and training at a higher level, the primary exercise here is to know RE-KNOW what are the elements that are needed to effectively contribute to generating strategies to raise education, here are some steps that can contribute to optimizing this process:

1.  LOCATE THE NEEDS OF THE ENVIRONMENT (how to strengthen the community).

2.  GENERATE APPROACH AT THE BUSINESS LEVEL ON WHAT WORKS ARE CARRIED OUT (what kind of knowledge is necessary for graduates to have).

3.  ANALYZE THE STUDY PLANS AND IDENTIFY WHETHER YOU SHOULD WORK ON THE ENTIRE STUDY PLAN OR ONLY ON THE AREA OF SPECIALTY (depending on the areas of opportunity that are had when the student finishes their studies).

4.  RAISE AWARENESS AND TRAIN THE TEACHING STAFF ON NEW TOOLS APPLICABLE TO THE TEACHING-LEARNING PROCESS (constant growth by the instructors will ensure continuous quality).

    However; Being able to make significant changes to the study plan offers us the possibility of:

a.  PROVIDE SIGNIFICANT KNOWLEDGE TO THE EDUCATOR. By working with the knowledge in vogue, significant contributions are obtained from outside the educationnal establishments

b.  GENERATE CHANGES IN THE BUSINESS AREA THAT BENEFIT THE ESTABLISHED PROCESSES. Talking about competitiveness refers us not only to a local and national level, but also to a global level, that is why, by being part of companies that work with some pillar of Industry 4.0, it allows us to establish jobs that confront us with other people who , even if they are not physically close, if they can be direct competition in the work that is done.

c.  DESIGN THE EDUCATIONAL PLANTS AS REAL TRAINING OPTIONS FOR THE INDUSTRY. Currently, companies invest large resources in training their staff with new technologies, with this, HEIs can be a reliable option to promote specialization courses for organizations' staff.

**The needs of companies vs knowledge of expenditure**

For HEIs (Higher Education Institutions), it is of utmost importance that the study plans impact on the needs and problems that companies currently have in their day to day and even more so with the 4th. Industrial Revolution; For this reason, this research has as its main axis to analyze the needs of the company against the knowledge of the graduate, this with the aim of verifying if the study plans are sufficient or it is necessary to update the specialty, since as mentioned previously, it is of It is very important to be aware as IES, of the needs that arise in companies in relation to Industry 4.0, since it is very helpful in companies, without neglecting the professional experience that students must have, therefore, in the IES in the last semester, students take professional residencies, where the student goes to a company in which a project focused on the career is assigned and from which they can have a professional experience approach, landing the theoretical concepts of the career according to your study plan and specialty you have.

**Methodology to be developed**

The research focuses on the needs that currently exist in the company with respect to the integration of Industry 4.0 against the study plans that are still being worked on in the HEIs, all this in order to check if the tools acquired by students are enough to compete in the industry.

This research is supported by the qualitative and experimental method, taking as a sample one of the technological careers called Engineering in Technologies, which is offered at the IES.

It began by applying a survey to companies, in which students of the Engineering in Technologies career were studying professional residencies, said survey was divided as follows:

- The first part is to know if the type of project assigned was to end the study plan of the Engineering in Technologies career.
- The second part was to find out if the projects that the company is working on and assigned to residents had any relationship with the pillars of Industry 4.0.
- The third part aims to analyze whether the student's knowledge acquired throughout the career was good, sufficient or deficient to be able to develop the project and / or various activities that he is in charge of..

Next, in graph 1, shows the results of the first part of the survey, where it can be seen that indeed the projects assigned to students are mostly in accordance with the study plan of the Engineering in Technologies career, encouraging that students are not alien to the various tasks that have to be developed for the project.

1. **Does the project assign to the resident student, is it according to the Engineering in Technologies degree?**

| Yes | 15 |
|-----|-----|
| No | 2 |
| Maybe | 3 |



¿The project assigned to the resident student is according to the engineering degree in technologies?
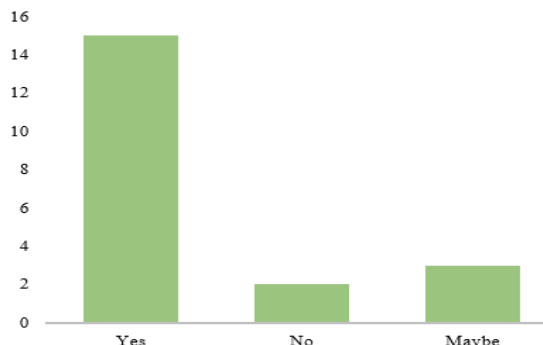
**Graphic 1** Project assigned by the company
*Source: Own elaboration*

Now in Graphic 2, the results on the relationship that the projects managed in the company have with some of the pillars of Industry 4.0, which is observed that the majority of companies surveyed do have projects related to Industry 4.0 ; In turn, Graphic 3 shows in which pillar these projects are related, where it is observed that in the majority there is a relationship with the Internet of Things (IOT) pillar of Industry 4.0, since companies refer to a digital interconnection with everyday objects. Finally, Graphic 4 shows the results on the assignment of these projects to students, which we see is even since 45% do assign it to resident students while the rest do not, this being a point of alert since it would be convenient to know the reason why it is not assigned.

2. **¿Are the projects being worked on in the company are they related to Industry 4.0?**

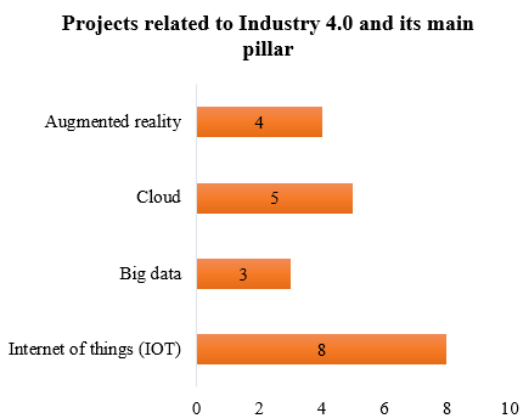| Yes | 11 |
|-----|-----|
| No | 4 |
| Maybe | 5 |



¿Are the projects being worked on in the company related to industry 4.0?

**Graphic 2** Projects worked with Industry 4.0 relationship
*Source: Own elaboration*

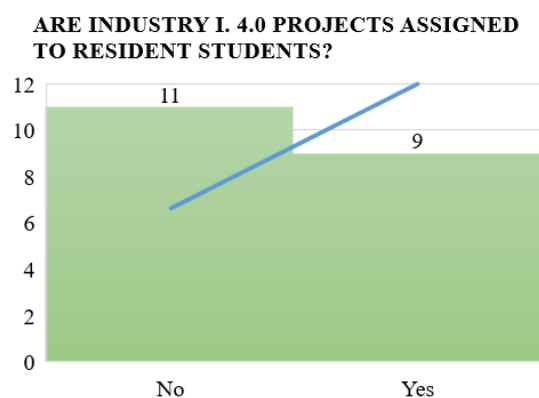3. **¿Are projects related to Industry 4.0 which pillar do you focus on?**

| | 8 |
|---|---|
| **Internet of Things (IOT)** | |
| **Big data** | 3 |
| **Cloud** | 5 |
| **Augmented reality** | 4 |



**Graphic 3** Projects related to Industry 4.0 and pillar
*Source: Own elaboration*

4. **¿Are projects of this type assigned to students' residents?**

| Yes | 9 |
|---|---|
| No | 11 |



**Graphic 4** Assignment of projects related to Industry 4.0 to resident students
*Source: Own elaboration*

Lastly, in the third part of the survey, and no less important, it can be shown in graph 5 that companies evaluate the knowledge acquired by students throughout the career as sufficient, since, in observations they mention who are unaware of certain techniques and / or technological tools that impact on the development of the project and of which are related to Industry 4.0.

5. **How do you evaluate the students' knowledge acquired throughout his career help the development or appropriate use of new technologies in industry 4.0?**

| Excellent | 1 |
|---|---|
| Okay | 2 |
| Regular | 4 |
| Enough | 11 |
| Deficient | 2 |
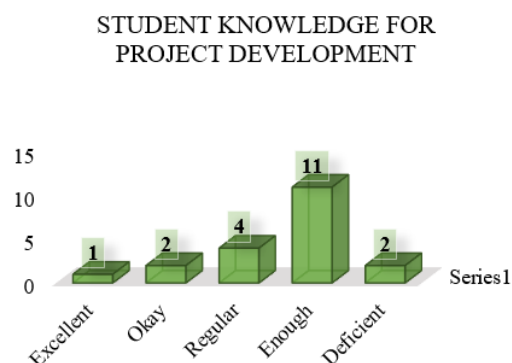


**Graphic 5** Knowledge acquired by students for the development of projects and also related to Industry 4.0
*Source: Own elaboration*

According to the results of the survey, we can observe that when comparing the needs of the companies against the study plan of the career taken as a sample, they do not go hand in hand at 100%, since it is important that the students are trained with the current tools so that they have a great competitiveness, since the knowledge acquired in the classroom is not entirely attached to the labor needs.

**Results**

It is very true that currently students have to have a broader vision inside and outside the classroom, motivated by meeting needs in professional and work life, in turn HEIs have to adapt to these new needs, since The objective is for companies to employ graduates and at the same time cover the needs they have today. This research manages to make a comparison between the knowledge acquired by students in the classroom, against what companies require, since in the surveys carried out they show that 75% of companies are focused on the use of new tools that allow streamline processes or that are focused on some pillar of Industry 4.0, which indicates that it is increasingly important for HEIs to be in constant communication and link with companies, since in this way it is possible to detect the new needs that exist to that can be covered in the classrooms offering educational quality to students, all this would take place by adapting the specialty of the study plan to the new needs that companies have.

The result is also verified that companies are working collaboratively to improve their productivity, all this with the help of Industry 4.0 and its pillars, having as an impact a sufficient but not excellent knowledge on the part of the students, which should encourage HEIs to prepare both with the teachers and with the updating of the laboratories.

What is a certainty is that it is becoming more and more evident to have to match study programs to the needs of companies, so that Industry 4.0 becomes a leading tool from which to start work effectively, thereby achieving that students leave better prepared and are more empathetic to the environment they are inserted.

## Acknowledgments

## Conclusions

The research shows that companies have a need that is not covered 100% with the study plans offered in HEIs, since currently the projects that are being worked on in the workplace are focused on new tools technologies that offer the pillars of Industry 4.0, since today the main tool is to be able to work collaboratively, because it leads to improving processes that previously took more time, and having better connectivity with projects that interact with the IoT , this being one of the pillars in which they develop the most and in which students are not yet trained.

With the above result, it is proposed that HEIs have greater links with companies, and training programs for teachers and implementation of specialized laboratories in the areas of Industry 4.0, so that together with the updates of the specialty of the curricula offered in the various careers, it is possible to meet the educational quality of the graduates and in turn with the satisfaction of the companies that ultimately support the graduates to have professional experience.

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