The fourth industrial revolution in education after covid-19

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Abstract

The global pandemic caused by COVID-19 has meant a great change in education since teachers worldwide have had to face the problem of having to undertake online training without adequate preparation or means. In view of this, the fourth industrial revolution, has begun to establish itself strongly as pedagogical support and there are already many governments that are pursuing changes in educational policies that insert a digital education that fragments education and prepares students for the jobs in the 21st century so this revolution is not only imminent but necessary.

Keywords: Fourth revolution, transhumanism, education, Artificial Intelligence, pandemic.

Introduction

All the revolutions that have occurred throughout the history of humanity have been endorsed by the need for rupture. This break between the old and the new undoubtedly has always posed a moment of uncertainty and opportunity. It was, for many, a moment of looking over a real precipice since it forced them to adapt and reinvent themselves with the hope of being able to keep up with everything that was happening. This was the case in the first industrial revolution when machines began to enter factories, which posed for many a huge threat since it took them away from the reality they had known up to that moment. That first revolution backed by coal brought with it an authentic unparalleled socio-economic change that in large part layed the foundations of the schools we have today, since what it entailed was training students to respond to the needs of that new society that emerged in the light of those transcendental changes (Hobsbawm, 2009) .

The second industrial revolution came hand in hand with the extensive use of electricity and knew how to absorb those machines that emerged in the first revolution to complete the automation processes of the factories, generating large and extensive assembly lines that improved production and massified the creation of products. This revolution consolidated the first one and, to a large extent, shaped capitalism and the international order that would mark the following years and which is still present today (Haradhan, 2019) .

The third industrial revolution was the implementation of ICT which was needed to assume the existing digitization. It was a revolution that absorbed that automation of the second industrial revolution and gave it a foundation in the shadow of the increasing use of the Internet as part of the process. This revolution was quite fast since from 1969 when Arpanet emerged as a communication element between

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universities after its military past up to the arrival of the World Wide Web in 1991 not many years had passed and that is why this revolution arose with terms that separated those who had not been born with that technology from those that had. The term adopted by Prensky in 2001 to differentiate digital immigrants (born before 1980) from digital natives (born after 1980) helps us to understand the fragmentation that this revolution entailed and all the changes that were integrated with it and those previously existing machines (Prensky, 2017) . From that moment on, different initiatives sought to spread digital literacy throughout the world, given that the integration of new technologies in all sectors of the population has demanded the need for digital skills for workers who, in some aspects, have resisted it (Taalbi, 2019) .

And finally, we come to the fourth industrial revolution, which for many authors is the one we are living at present. It is a revolution that is supported by the extension of 5G, the Internet of Things, the implementation of Artificial Intelligence within the world day-to-day, digital coordination, the extension of robotics in all work sectors and the use of cyber-physical systems (Gómez Salgado, 2021). For many, this revolution is going to be the most fragmenting of all the revolutions we have gone through since it means assuming a cyberconnected planet and a use of digital awareness at a global level that none of the previous revolutions achieved despite the existence of multiple threats (Saura, Palos-Sánchez and Navalpotro, 2018). Faced with this great change, there are a large number of opposing positions regarding this revolution, since where some see opportunities, others see threats, which up to now has slowed down the implementation of all the necessary changes that are needed for the complete implementation of a revolution like the one that we see today. It is paradoxical that many authors such as Aldous Huxley anticipated many years in advance the reality that this revolution presents to us, with its lights and shadows, which would be endorsed by that transhumanist term as a reference to overcoming the physical or intellectual limits of humans through the use of technology. That transhumanism for many is the hope for change in a cyberconnected world since it seeks to cross the physical barriers of humanity

in order to expand the frontiers of knowledge, which is expected to be achieved in this nascent revolution.

This whole technological approach does not leave anyone indifferent and contemplates the need for a global implementation of technology that is not yet complete. In many sectors, such as education, the arrival of the fourth industrial revolution is perceived as a threat since teachers, based on their years of experience, assume that a greater integration of technology is not necessary beyond what was achieved by the third industrial revolution. We cannot forget that schools, as we know them today, as we have commented, were structured with a mentality of the first industrial revolution, which means that the transhumanist changes posed by this new revolution are for many of the teachers, who are anchored in those traditional methods, very complicated (Vidal, 2019).

The pandemic has served, without a doubt, to force the promotion of the use of technology in the world of education, since confinements during the pandemic forced classes to be carried out synchronously. This use of technologies did not only, as before, follow the model of the third industrial revolution. Teachers realized the potential of the new revolution and the possibilities it offers to the educational world. For many authors, this time of pandemic has provided the incentive that was needed for the correct implementation of elements of the fourth industrial revolution such as artificial intelligence or the Internet of Things, despite the fact that there are still many places where there are no possibilities to start this new revolution due to the lack of proper access to this Internet which, in many ways, will continue to open the digital divide that has been expanding for years (Aznar and Rodríguez, 2021).

The use of the technologies of the fourth industrial revolution has been something that students have demanded worldwide since they could not contemplate a 21st century school with an approach from previous centuries. But how have they perceived the use of artificial intelligence in their learning? In order to understand it, we carried out a short survey among students from three continents who have been training during the

pandemic using the LMS Canvas. E-learning educational platforms are known as LMS (Learning Management System). Today there are more than a hundred of these platforms (Ruiperez, 2003). The LCMS arise from the merger between these LMS and the CMS (Content Management System) giving rise to a new online training action. The use of these LMS is widespread both in higher education and on other educational levels and they have served to maintain academic continuity during the period of the pandemic when face-to-face was not possible (Bovill, 2020).

Their usefulness is clear because they serve to reinforce educational action (Sangra, Guardia and Gonzalez-Sanmamed, 2007). With them, teachers can continue with their formative work remotely while using digital resources to increase student learning.

At the center and the object of our investigation, the Canvas Instructure platform has been used as the LMS platform. All Canvas technology is based

on collaborative learning (Computer-Supported Collaborative Learning) which seeks to promote learning spaces to encourage individual and group creativity. The students interact following the line of the fourth industrial revolution where the teacher simply acts as a facilitator and the student is the one who, with his classmates, manages the platform to create, guide and decide how to use it. All the work done by the student, the time he dedicates to the platform, his interaction with classmates and teachers, his downloads, his work, his contributions... everything is taken into account and analyzed by Artificial Intelligence to be able to issue a percentage and a grade for each student that the teacher can use to proceed with the evaluation (Buckingham and Crick, 2016).

Methodology

We found five phases in the design of the research that we have carried out:

Graph 1. Phases of the investigation.

Source: self made.

At the beginning we set the objective, later we prepare the survey, we analyze the threats that can be found in the application of said survey, then we apply the survey, analyze the results and formulate conclusions after the investigation.

The type of research carried out is quantitative, cross-sectional and retrospective. It is clear that we have worked on quantitative research because

we have collected quantitative data on different variables, in this case on the Canvas platform (Cohen and Manion, 1990). In addition, quantitative research allows us, through the sample we have used, which is quite significant being from three continents, to extend the results of the research to the rest of the student population. The research is quantitative since:

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1.   Nomothetic strategies have been used since it is intended to generalize the results of this research.

2.   The objects of study have been simplified by reducing the analysis to students using the Canvas Instructure platform. This creates a type of non-participating objective observation.

3.   The results will be generalized following questionnaires and the observation of the effective results that give rise to a validity.

4.   They have been objectively analyzed through the presentation of questionnaires that will show the foundation of the training received.

5.   The question to be answered is simple. Did learning improve after using the Canvas with the use of AI as a measure of understanding.

The type of design is ex post facto based on a survey method for the following reasons (McMillan, Schumacher 2005) :

•   The sample is significant since it corresponds to university students from different continents.

•   The questionnaires allow us to collect data with a descriptive and relational purpose since the students will indicate their comments and use of the Moodle platform.

•   The questionnaires allow us to quantify the results to later extrapolate them (Rodríguez, Fita Lladó, Torrado Fonseca, 2004).

•   In the university educational environment, questionnaires are commonly used to perceive the results and motivations of the student population.

The study was carried out on postgraduate students who, due to the pandemic, had to comply with the pandemic confinement and could not physically go to the places of study, so they had to use the LMS Canvas Instructure training platform to be able to do everything related to their Master during an academic year. The sampling was non-probabilistic since the students of five Masters (230 students), whose origin is Latin America, Europe and Asia, were used. Specifically, of the 230 students who took the survey, we can divide them as follows:

-142 China

-22 Ecuador

-19 Dominican Republic

-5 Chile

-9 Paraguay

-3 Argentina

-6 Peru

-7 Colombia

-17 Spain

These students have completed during the 2020-2021 academic year the following Official Spanish Masters:

-Master in Analysis of International Economic Relations.

-Master in Digital Business.

-Master in Economics and Business Management.

-Master in Political Science.

- Master in Occupational Risk Prevention

The surveys carried out included the following headings which covered the different questions:

-GROUP I.- TECHNOLOGICAL CONDITIONS OF LEARNING.

Express your reality, according to the experiences you have lived during classes in times of the pandemic and indicate what means or technological resources you used to access the Canvas Instructure Platform, the Big Blue Button tool and the other technological tools. You can select the items you consider.

-GROUP II.- LEARNING ENVIRONMENT.

Express your reality, according to the experiences you have lived during the classes in the context of the pandemic from where you access the Canvas Instructure Platform, the Big Blue Button tool and

other technological tools. You can select the items you consider.

-GROUP III.- CHARACTERISTICS OF LEARNING ACTIVITIES.

Based on the experiences you have lived during classes in the course of the pandemic when you have used the Canvas Instructure Platform, the Big Blue Button tool and other technological tools, express your opinions about their impact on your learning. You can select the items you consider.

-GROUP IV.- CHARACTERISTICS OF COMMUNICATION ASSOCIATED WITH LEARNING.

Based on your experience, express your opinions about the impact of communication in classes that use the Canvas Instructure Platform, the Big Blue Button tool and other technological tools. You can select the items you consider.

-GROUP V.- PERCEPTION OF THE IMPACT OF LEARNING.

Express your self-assessment in relation to the improvement in learning achieved in the virtual classes that use the Big Blue Button Platform, the Big Blue Button tool and other technological tools, in relation to the 9 most demanded skills in the immediate and mediate future by the labor market. You can select the items you consider.

These items were the general ones that have given us a very positive assessment of the use of the Canvas Instructure Platform and its evolution in the student learning system, but since we wanted to understand its use in view of the needs of the fourth industrial revolution, we proposed a sixth specific item that we consider perfect for this research:

GROUP VI.- PERCEPTION OF ASSESSMENT THROUGH THE USE OF ARTIFICIAL INTELLIGENCE IN THE CLASSROOM OF BIG BLUE BOTTON AND THE CANVAS INSTRUCTURE PLATFORM.

In this item we collected the following questions:

1. Do you consider that in the context of the pandemic caused by Covid-19 the learning results developed are significant for your personal and professional training?
2. Do you think that the use of the Big Blue Button Platform has allowed you to be evaluated with the use of Artificial Intelligence in a better way than with a physical presence?
3. Do you feel well valued academically speaking despite having been a year in which physical attendance could not be achieved?
4. Has the use of Artificial Intelligence as a way of evaluating your learning within the Canvas Instructure Platform and the Big Blue Button Video Conferencing Platform been beneficial to you?

The fourth industrial revolution as part of the educational learning process

For history, 2020 will be a year marked on the calendar by a pandemic, but if we look at it in perspective, the history of humanity is full of pandemics that devastated humanity. One of the most outstanding examples can be found with the polio epidemic that devastated the US in 1955. Then, as now, schools were ordered to close, and many areas of the population were confined. At that time, so that the students would not lose class, it was decided that all of them would be given through the radio, which shows us once again how education prevails despite all the adversities that occur (Altenbaugh, 2006).

If we go back further, we can understand that humanity has always lived in the shadow of small viruses ending human existence. The bubonic plague or the Spanish flu are authentic examples of this, and their study helps us to understand how the human being prevails against everything and seeks to improve in every way. In the same way, what happened due to the COVID 19 pandemic has served to transform society, but we must not only look at it with a reformist attitude, we must delve into the intrinsic changes derived from

everything that has happened to analyze the possibilities and difficulties passed.

The arrival of the fourth industrial revolution, despite the fact that some authors consider that we have not yet fully entered into it, is perceived as something unstoppable. New technologies have been and are a disruptive element that change people and their mentalities. Our society already speaks of a digital literacy in the manner of what was once a literary cultural. The new revolution is in many ways an element of rupture and transition, as was the Gutenberg Bible in its time. It is in the midst of this maelstrom of situations when those within the field of education look with dismayed concern at everything that can happen and many of the traditional teachers, who have already made a considerable effort to introduce ICTs into the classroom during the third industrial revolution, think that the change that occurs with the Internet of Things can become a threatening element in to their jobs, so they resist this predictable change. Faced with all this, the pandemic, without a doubt, forced the entire society to leave the comfort zone (Kelly, 2020). A world in which everyone had to be at home and contacts had to be kept at a distance, are the perfect breeding ground for the importance of the fourth revolution, and all that it entails, to manifest itself. In all sectors of society, digital skills acquired great strength and teleworking became the only way to keep the productive flow mobile without losing what was previously done (Malleret and Schwab, 2020). All the companies in the different sectors have had to take a leap of faith towards a digitization of which many resisted and it is in this context where education undergoes a great change since, compared to the many teachers who were anchored in traditional records In order to continue learning within the different educational levels, the need arises not only to teach to continue learning, but also to evaluate that learning, looking for ways to promote the acquisition of skills and abilities that allow students to continue their learning at all levels (Elayyan, 2021). There is no doubt that the effort on the part of all teachers to complete those months of emptiness has been a Herculean task since. As we have said before, it has taken them out of their comfort zone, but we cannot deny that the search for a solution to facilitate training has been perceived by many

sectors as the continuation of a revolution that was already not only perceived but also demanded.

It is in this context of pandemic and of emerging technology which can facilitate the absorption of knowledge, that we place our article. At a time when the world has been unable to foster relationships, the need arises for all training elements to meet the learning objectives that fulfill their social function. That is why everything that is included with in the fourth industrial revolution helps and encourages individualized learning that, following what Gadner formulated about multiple intelligences, makes individualized learning effective, taking into account the singularities of individuals and their ways of learning (Scepanovič, 2019) .

It is this context, where students of different nationalities who were studying an official Master's degree in Spain in person had to assume the impossibility of attending class due to the pandemic caused by Covid-19, which led to the need for synchronous training from their countries of origin (Montacute, 2020). Specifically, we are talking about students from Ecuador, Colombia, Peru, Chile, Argentina, the Dominican Republic, Spain and China. These students had to comply with the online training that they had to assume, comprehend it and understand it to adquire five different official master's degrees of the corresponding Spanish degree. The master's degrees covered different fields of learning from new digital technologies, to qualifying master's degrees related to Occupational Risk Prevention, which in many fields represented a complication since they needed the expertise of their teachers to achieve meaningful learning. But their greatest concern was how they were going to evaluate their participation in the online classrooms since, these were master's degrees that required face-to-face attendance, they broke away from the normal learning line. That is why it is interesting to understand how the LMS Canvas Instructure Platform has an artificial intelligence model which it defines as new analytics, where students are evaluated for all their activities within the virtual classroom. The AI analyzes each entry by the student, the time spent reading and moving the documents provided, how he/she interacts with the Big Blue Button Video Conference Platform. It
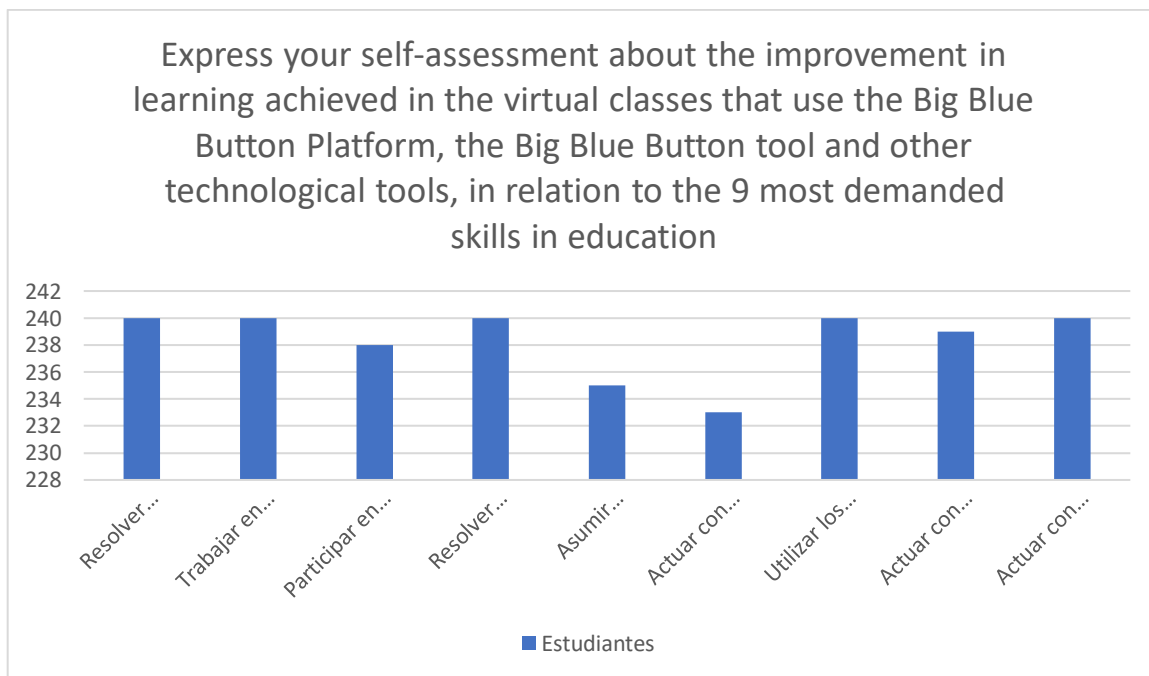
reviews the student's contributions and gives each student a grade and a percentage, to which it adds a grade that the teacher used to evaluate the student online. With the use of AI in the platform, all the student's work was analyzed with millimeter efficiency, which was appreciated by them since they understood that their study time counted for the Master's qualification. Undoubtedly, the contribution of this AI allowed, in all justice, the summarization of all of the student's contributions in the virtual classroom, which in many cases would not have been possible in a physical classroom, since a teacher with forty students in the classroom cannot reach the level of exclusive dedication to which AI reached with student work in virtual classrooms (Altbach, 2008) .

All this activity carried out, typical of another type of education, led teachers to reflect on the advantages of introducing Artificial Intelligence in the classroom and to try to question students about how they considered themselves valued

during the pandemic. For the teachers it was important to measure their level of learning and to know how they felt evaluated since many of them, because of all this activity, had to leave their comfort zone and did not feel confident that they had met the training objectives. In spite of everything, we can also analyze that the intuitiveness of the Canvas Instructure Platform facilitated the work of all the teachers and they all considered very satisfactory the fact that the platform itself evaluated all the work of the students, which helped them when it came to giving the final grade. The level of work of the professors would be another nuance that we should analyze, but from everything that has been analyzed with the educators of the different Masters, we have no doubt that an LMS platform that uses artificial intelligence to analyze student behavior is very well received. because it favors teaching work and facilitates certain analyses that would be impossible to address without this tool.
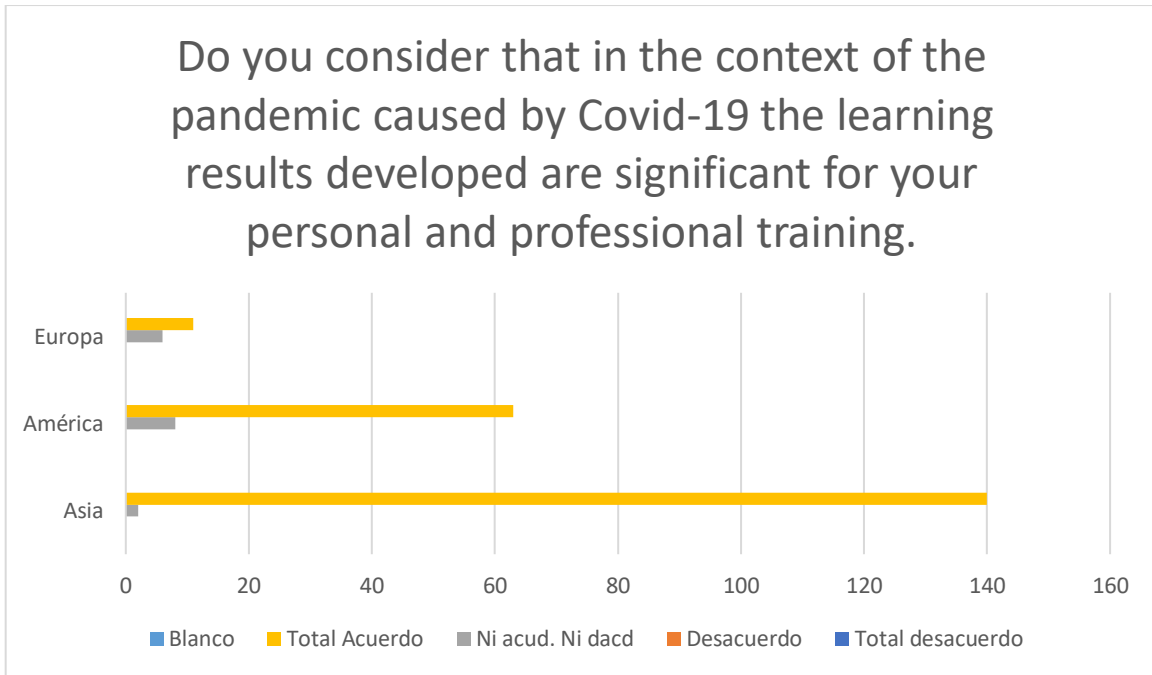
The results of the surveys were as follows:
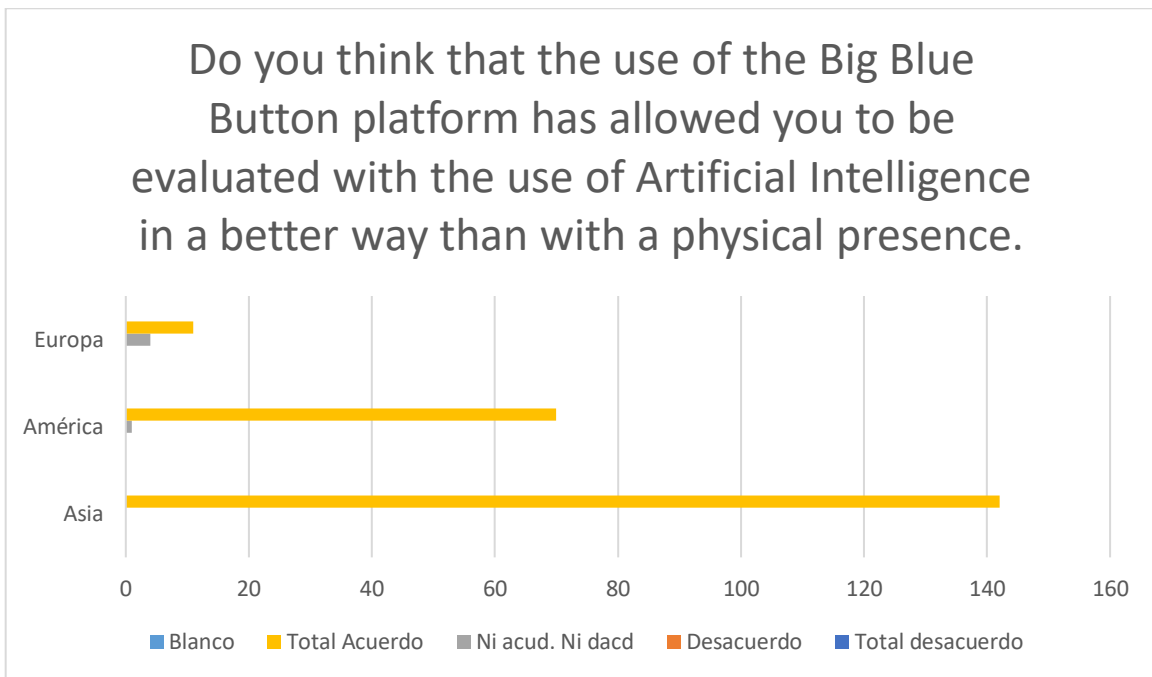
Graph 2. First survey.
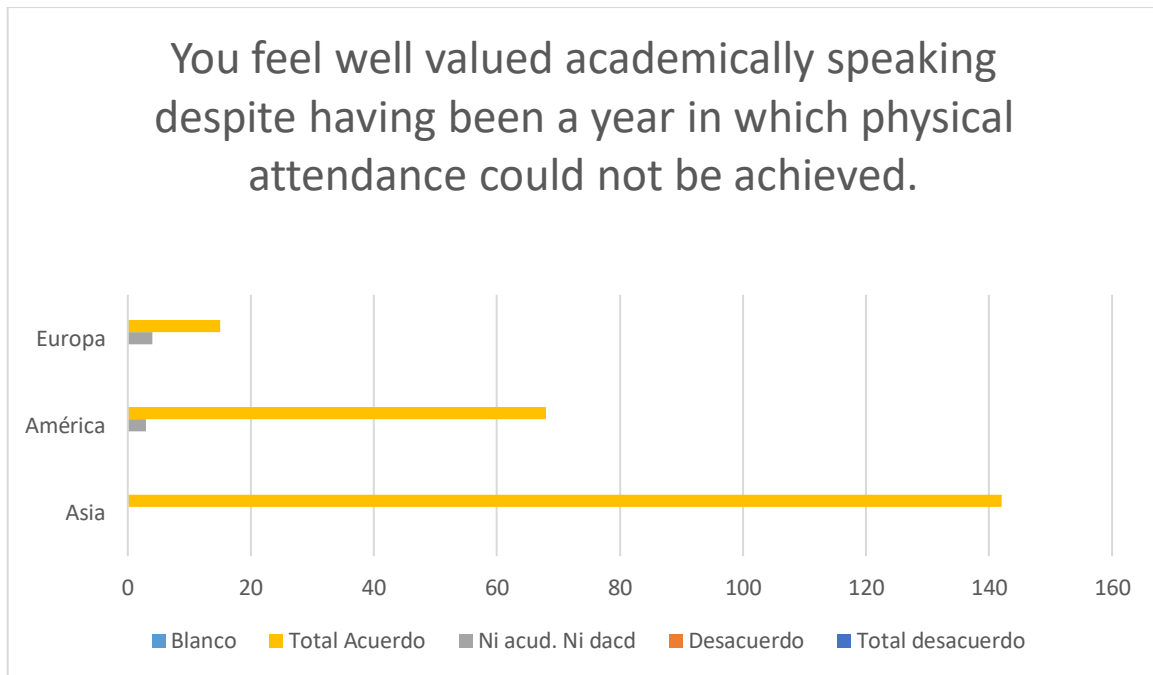

Source: self made.

Graph 3. Second survey.

Do you consider that in the context of the pandemic caused by Covid-19 the learning results developed are significant for your personal and professional training.

Legend: Blanco, Total Acuerdo, Ni acud. Ni dacd, Desacuerdo, Total desacuerdo

Source: self made.

Graph 4. Third survey.

Do you think that the use of the Big Blue Button platform has allowed you to be evaluated with the use of Artificial Intelligence in a better way than with a physical presence.

Legend: Blanco, Total Acuerdo, Ni acud. Ni dacd, Desacuerdo, Total desacuerdo

Source: self made.

Graph 5. Fourth survey.

You feel well valued academically speaking despite having been a year in which physical attendance could not be achieved.

Source: self made.

Graph 6. Fifth survey.

Has the use of Artificial Intelligence as a way of evaluating your learning within the Canvas Instructure platform and the Big Blue Button video conferencing platform been beneficial to you?

Source: self made.

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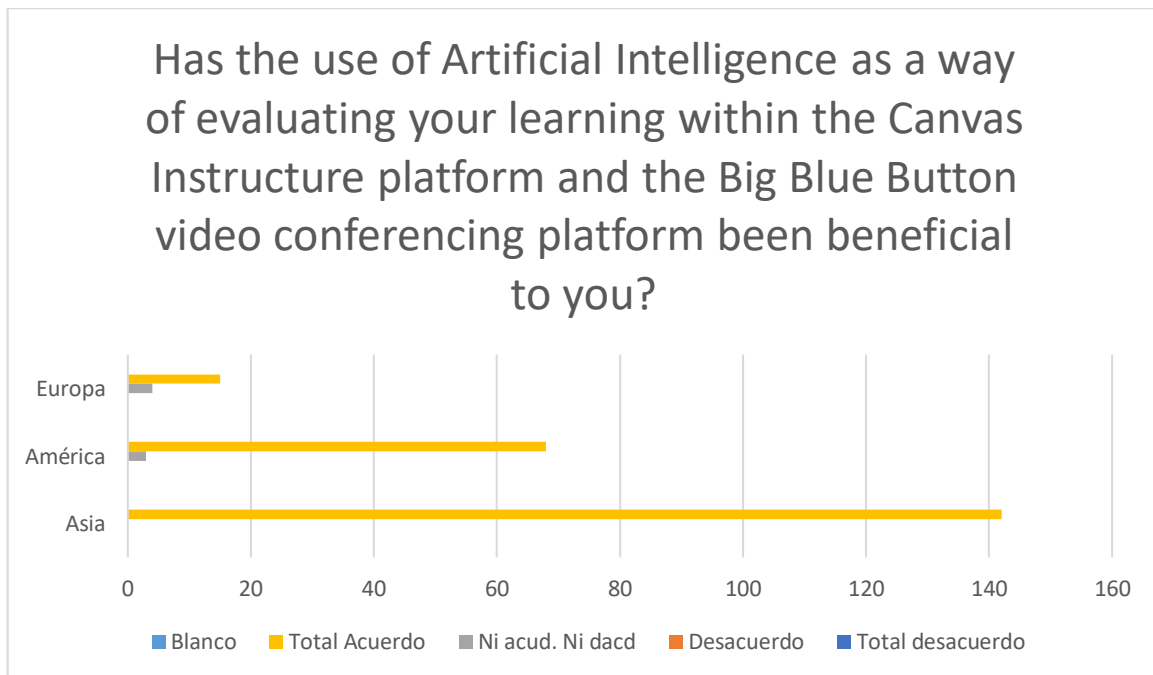
The results of the survey leave no room for doubt and we can understand that all the students felt that with the use of Artificial Intelligence within the virtual classrooms, in this case with the LMS Canvas Instructure Platform, they felt correctly evaluated and cared for with individualized attention since the system indicated to the teaching staff the students who were lagging behind in knowledge and the teaching staff was able to try to accompany these students so that they did not fall behind in the learning of the different subjects that make up the Official Master's Degrees they were taking . As we can see in graphs 3, 4, 5 and 6 the results are very positive. It is interesting, within the questionnaires carried out, to be able to understand how students from the Asian or American continents value the use of virtual learning platforms more positively compared to European students, specifically Spaniards, who could have a greater facility when it comes to being able to attend the classrooms. We have doubts about the origin of these students since there were face-to-face from different parts of Spain and there are diverse results, but the presence of students from Madrid was higher than that of other provinces, so the results can be motivated by their ease of access, when going to places of university study. Despite these differences, all students have very positive results that are related to the learning obtained during the Master's degree. They consider, as we can see in the different graphs, that the platform with the use of AI has adequately measured their learning and they feel satisfied with the results obtained, which confirms the hypothesis that the use of the contributions used by this fourth revolution industry are satisfactory for students who find in the use of these digital media the opportunity to be measured and evaluated in a fair and direct way, using, in this case, all the potential of an AI in learning in higher education (Holmes, Bialik and Fadel, 2019).

This AI also analyzed participation in the video conferences, which provided a clearer aspect than even in a physical class where, due to the number of students, the teacher cannot sometimes clearly and directly perceive the learning of certain students who go unnoticed. The AI collected all kinds of information and that increased the significant learning of the students, ensuring that none of them would be left behind or none of them would be considered disappointed by the form of evaluation. Added to this survey, it would be necessary to take into account many other points that can be continued in other investigations, but it must be emphasized that it has been the year with the best student satisfaction in learning, which without a doubt surprises as it has been such an atypical year within the global regularity (Atiku and Boateng, 2020).

The use of Artificial Intelligence and all the potential of the fourth industrial revolution favor, as we have already said, adaptive learning, personalization and efficiency in the instructions. The pandemic has given rise to an opportunity and a demand that we understand will be resolved in a short space of time, to take advantage of all the potential that the fourth industrial revolution offers us for the improvement of education at all educational levels (Altbahc, 2008).

The results of graph 2 are also significant. In them we can see how students perceive having acquired the skills that the future job demands, which would be a great step for the learning of the Masters. We cannot forget that, as many authors have commented, we are at a time to demand Soft Skills and Hard Skills from our students. The hard ones are already included in a master's degree or other strong learning, but the soft ones are the ones that are most in demand on the labor market at this time and we can find them reflected in that graph that the students have responded to so positively. The 230 students have agreed on some points, which allows us to confirm that the soft skills demanded by society have been worked on correctly. During the last few years, university learning models have been working so that students graduate with these soft skills, among which the critical sense stands out in a world in which information is available to everyone, but the student must know how to be critical with that information, that sometimes it is not true. On the other hand, the most important thing is the teamwork demanded by the vast majority of multinationals dedicated to the digital world. If, as we can see in graph 2, students consider that they have achieved all these skills, it can be affirmed that postgraduate studies fully prepare them to

Conclusions

The great changes in humanity have always been a fragmentation between the previous and the following. There is no doubt that the COVID-19 pandemic has been a moment of important change and social relations are being reviewed in all sectors of the population to find a way to prepare for future pandemics. It is in this field where the fourth industrial revolution is arriving and it is something very necessary since it meets the preemptive need for a transhumanization that is being demanded socially, not only as a search for human improvement but as a response to a society that seeks to avoid physical contacts as a form of prophylaxis. The fourth revolution is beginning and we can glimpse, with everything analyzed, the great possibilities it offers us. In the field of education, everything related to 5G, the Internet of Things or Artificial Intelligence will finally allow the individualization of learning and consolidate the learning of skills and abilities that are in high demand today. Now this pandemic has forced us to delve deeper into the changes that this revolution favors, and all educational levels have perceived the benefits of a system where digitization acquires a greater role.

Everything that happened during the pandemic has served to understand that the integration of AI, the Internet of Things and the analysis of the information offered by Bid Data offer great possibilities and will offer significant changes that will favor individualized learning for students.

In the field of higher education, the use of LMS platforms that mix a type of AI with the explanation in the classroom to corroborate that learning has served, as we have been able to analyze for students from different continents, to feel how learning and participation were measured and evaluated in a much more consistent way and their learning has not been affected. It is still significant that the results of the forms show that students from continents outside of Europe felt more supported by the LMS platform that mediates their learning through AI than European students, who were closer to the university centers and found it easier when within their own territory.

The world of the fourth industrial revolution that is taking shape in the shadow of everything experienced in recent years seeks to improve learning, and interaction tools are well perceived by students since digital natives have been demanding a Higher education that not only prepares them for the 21st century society but also measures, teaches and evaluates them with the same tools that they use in their day to day and that already use a large part of the potential of the fourth industrial revolution (Rivas, 2020). Without a doubt, we can make it clear with everything analyzed that the fourth industrial revolution, like the previous industrial revolutions, is here to stay and the pandemic period has favored their integration not only into the university sector but, we can say, in all sectors of the population.

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