Universidad Europea MADRID

OBSERVATORIO DE INTELIGENCIA ARTIFICIAL EN EDUCACION SUPERIOR

Report OIAES#2 (26 April 2024)

The University in the Age of Artificial Intelligence

EXECUTIVE SUMMARY

The university continues to be the last major link in the training of people before they enter the world of work. Over time, the focus has changed, and the objective of learning has been moved from a more theoretical approach to a more experiential one, while retaining all the academic rigor, and promoting the development of transversal skills and competences. Companies are no longer only looking for profiles of graduates with a certain amount of training but are also looking for people with real skills to locate, access, relate, validate, and know how to use information accessible through technology.

The most recent social circumstances and the latest technological advances, especially in relation to generative artificial intelligence, suggest a new paradigm of the university model. If information and communication technologies have long made it possible to offer quality higher education at a distance, the confinement caused by the COVID pandemic has forced the main players to undertake changes that today show that it is perfectly possible to train and learn in a ubiquitous way. Thus, while much of the knowledge has traditionally been transmitted synchronously and orally, it is now also available for deferred training. AI can then leverage that content to implement multiple applications that enhance the learning process for students. For example: transforming and offering this content in other languages or incorporating it into the knowledge base of intelligent assistants, which are already beginning to be available to students.

In addition, higher education faces the challenge of personalizing learning, within the philosophy of the fourth industrial revolution. This involves the ability to adjust the curriculum based on students' starting level, abilities, performance, and even individual interests, using intelligent systems. Just as the 20th century saw a democratization of access to the university that turned it, in a way, into a mass service, we are now faced with the opportunity to develop what is known as the mass personalization of university education. In addition, it will be inevitable that new students entering higher education will have already used artificial intelligence to advance their learning, and therefore the university must be prepared for that reality.

Although artificial intelligence dates back to the mid-20th century, the last two years have seen the emergence of so-called generative artificial intelligence. This, coupled with almost anyone's access to advanced computational resources, is enabling a dizzying adoption of artificial intelligence in all areas. Higher education is no stranger to this disruptive technology, and it is expected, once artificial intelligence is sufficiently developed and implemented, that the higher education model will undergo a profound transformation. It is very likely that there will be major changes, including programmes and curricula; in the enrolment processes; in study materials; in the pace of study; in the classroom and in the role of the teacher; in group work and projects; and most especially, in the systems of evaluation and certification of competencies.

It will be important to consider the formats in which the explicit knowledge obtained by teachers through research will be incorporated in an increasingly virtual world, in order to facilitate its transmission to students. They will face the contrast between the virtual world and the physical world. One of the main challenges will be discerning between truth and falsehood. It is vital that the university maintains its integrity as a place of trust. In an environment where artificial intelligence is ubiquitous, the need to ensure reliability is even more apparent.

It is not easy to predict how the changes will materialize, but it is certain that there will be and they will be substantial. This report aims to outline a reasonably likely scenario of what the university of artificial intelligence might look like. Given the speed at which technological advances are taking place, it will be necessary to periodically review this foresight exercise, without losing sight of the socio-cultural, ethical, and legal aspects that will mark the development of artificial intelligence and its adoption in the field of higher education.

PROLOGUE

The Observatory's first report, published in September 2023, analyzed the potential impact of artificial intelligence on higher education. This second report aims to anticipate what the university landscape could look like in the future, once artificial intelligence is sufficiently developed and implemented. The aim of this foresight exercise is to provide a vision for a plausible future of higher education, so that each institution can establish its own road-map for a rational and orderly transition. The future described in this paper does not represent the worst-case scenario or necessarily the best or optimal, but rather a probable and viable scenario in the medium term that should serve as a starting point for reflection. However, given the high uncertainty that exists, it is imperative to be extremely cautious with any predictions and to closely monitor developments to adjust any action plan as needed and at the appropriate time.

EXTERNAL EXPERTS

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3. Barro Ameneiro, Senén (Universidad de Santiago de Compostela).
4. Carrasco González, Ramón (Universidad Complutense de Madrid).
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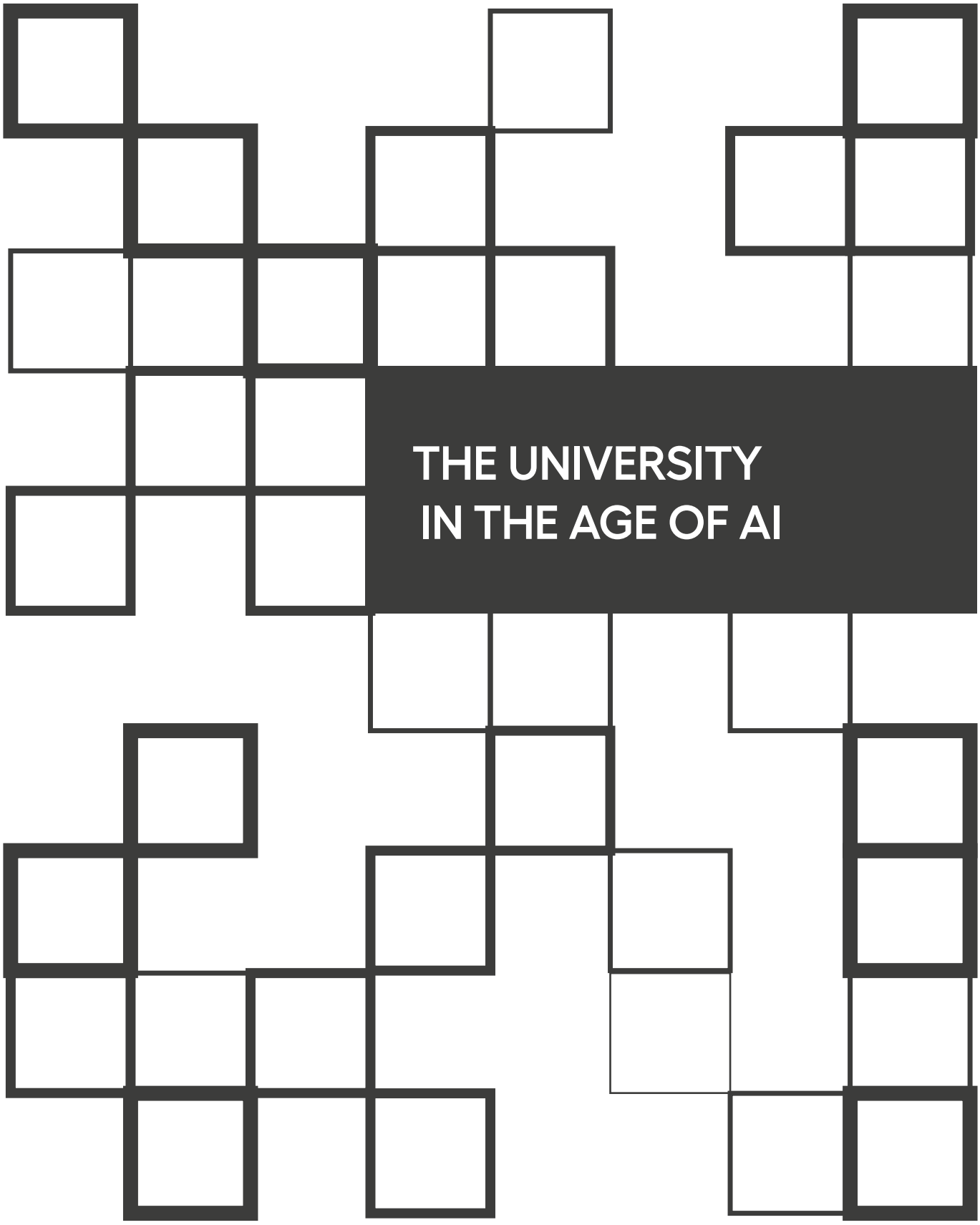


THE UNIVERSITY IN THE AGE OF AI

OBJECTIVE
OF THE REPORT

The main objective of this report is to project the future of the university, in the current context of the growing influence of artificial intelligence (AI). This report aims to offer a comprehensive and forward-looking vision that serves as a guide for both decision-making in the field of education and teacher training, thus contributing to the preparation of the university community for the challenges and opportunities that AI may present in the future.

DEFINITION
OF THE CONTEXT

The University has had several cycle changes in its history. We went from training in academies of classical antiquity, where masters taught their disciples in very small groups to transmit their experience and knowledge, to the first universities of medieval times, universities of knowledge, with an established curriculum and with specific centers. In these universities, the content and the transmission of these was the objective pursued. The next evolution came with the printing press, which allowed the transmission of knowledge beyond lectures, extending it to a wider audience. Evolution shifted the objective of learning from knowledge to the development of competencies hand in hand with the development of communications, which further extended knowledge anywhere through computers and communications systems.

The most recent social circumstances, together with the latest technological advances, show us that we are facing a key scenario that suggests a new paradigm of the university model. Information and communication technologies have long made it possible to offer higher education at a distance, but situations such as the confinement caused by the COVID pandemic have forced the main players to undertake changes that today show that it is perfectly possible to train and learn in a ubiquitous way. This has meant that much of the knowledge that was transmitted synchronously and orally is now available for deferred training. AI can then take advantage of that content to transform it and offer it in other languages, as well as incorporate it into its knowledge base, serving to nurture new systems and intelligent assistants available to students.

On the other hand, companies are no longer only demanding profiles of graduates with brains loaded with information, but are looking for people with skills to locate, access, relate and validate that information accessible through technology.

Another key concept that may come into play with new advancements is the personalization of learning. This involves the ability to adjust the curriculum based on students' starting level, performance, and even individual interests, using intelligent systems. Just as the 20th century saw a democratization of access to the university that turned it, in a way, into a mass service, we are now faced with the opportunity to develop what is known as the mass personalization of university education.

In addition, it will be inevitable that new students entering higher education will have already used AI to advance their learning, and therefore the University must be prepared for that reality.

EVOLUTION
OF THE ROLE OF THE UNIVERSITY

According to some authors, the social function of the university was in its beginnings to create knowledge and propagate it, developing and disciplining intelligence to form more select people, either because of their culture or because of their ability.

According to the United Nations, higher education allows individuals to expand their knowledge and skills, clearly express their thoughts both orally and in writing, understand and master abstract concepts and theories, and increase their understanding of their communities and the world.

Apart from the debate on whether the university should exclusively train the professionals that society demands, what seems clear is that the role of higher education should be to generate knowledge, and train people so that they can develop freely, aspiring to reach a higher cultural level, greater and better employability, or both.

The recent universalization of access to generative artificial intelligence has made visible the ability of machines to perform tasks that until now seemed reserved only for humans. Now, not only can we make decisions based on AI, but we can converse with it, based on the knowledge with which it has been trained, and we can even ask it to create for us following the criteria we decide and that it has previously learned to recognize. These capabilities greatly expand the impact that this technology can have on the role and objectives of the University in the AI era, as it will become another actor in the generation of knowledge.

On the one hand, it will have at its disposal the possibility of creating intelligent agents, or co-pilots, which will allow it to carry out in a faster, more specialized and personalized way many of the tasks that currently fall to teachers and researchers and that are basically related to the transmission of knowledge and its implementation, or to the generation of new knowledge. On the other hand, it will force universities to redesign how they will meet their fundamental objectives, which do not seem to change.

In this sense, from our perspective, the university must move towards a more humanistic conception of the formation of individuals. UNESCO itself (2019) advocated a human-centric approach to artificial intelligence. In the field of education, artificial intelligence should be aimed at enhancing human capabilities, ensuring the protection of human rights and promoting effective collaboration between people and machines to ensure sustainable development.

The university, as a fundamental actor in this educational process, cannot remain on the sidelines. Therefore, you should focus on providing analytical and reflective skills rather than just transmitting and generating knowledge. It must ensure the development of values, principles and attitudes, all of which are intrinsically human. In addition, the university should encourage critical thinking and promote the development of soft skills, such as emotional intelligence, for example.

The eventuality that artificial intelligence reaches human-like capabilities is bound to transform professional dynamics. This situation raises the vision of a new era in which the value of human talent is equated with that of cheap labor. With this, it is anticipated that human intelligence will be available in abundance to all.

According to Yuval Noah Harari, humans should focus on preserving emotional intelligence and continuous learning, adapting to different roles throughout their professional lives and constantly reinventing themselves. The onus is on the university to train these professionals.

The objective will not be limited to the mere transmission of content, but will focus on training students so that, within their respective areas, they can handle and generate information using artificial intelligence tools. In addition, it will be essential to equip them with the skills to evaluate the veracity of information, make decisions and act in accordance with ethical values intrinsic to the human condition.

This inevitably involves enabling students to:

- Search, filter, analyze information and generate new knowledge from it.
- Identify options, evaluate them, judge results, and make decisions.
- Design, plan, and execute plans, projects, initiatives, or actions derived from the analyses.
- Exercise competencies specific to their area of knowledge, acquired through repeated, supervised and guided practice, supported by AI virtual agents as appropriate.
- Do all of the above, using AI ethically, complying with the regulations and codes of conduct that are developed and adopted by the different international communities.

Ultimately, the student must learn how to identify the problems they are facing and how to ask the right questions to other people, teams or even AI systems. Until now, LLM models have shown no clear boundaries, the more data they are given, the more they learn. This has led large companies to train models that require $1 billion worth of computing resources. While it is important to establish regulations to manage this growth, limiting progress is not a viable option. There is a risk of falling behind compared to those who continue to research in this field.

Therefore, it is imperative to join efforts in artificial intelligence research, which implies a significant investment. In addition, it is vital to teach students about prompt engineering and raise awareness of the underlying principles of artificial intelligence, as well as encourage critical thinking to identify reliable sources. This will help them better understand this technology and prevent it from being perceived as simply a black box. All this is necessary to identify the actions that will allow them, eventually, to design plans, to look for possible, viable and feasible solutions with the available resources. They should have the ability to select the best options, implement them, evaluate the outcome and make corrective decisions if necessary, considering the existence and impact of artificial intelligence.

In a way, students, at the end of their university stage, will acquire professional knowledge and skills and will carry with them a kind of smart toolbox that they will use throughout their lives to improve their work performance and enhance their natural intelligence using artificial intelligence.

Finally, beyond its formative role, the university will play other roles for other purposes. For example:

- In addition to generating knowledge, contrasting, assuring and certifying the validity of this new knowledge, probably using AI, all its agents will be involved: students, teachers and administrative staff, through digital training.
- To further strengthen its role as an enhancer of innovation, being an incubator that fosters a controlled environment for scientific-technological innovation, including that derived from AI.
- Promotion of AI research.
- To act as a supervisor of third-party technological developments, especially those of AI developed by companies and institutions outside the University, which will require its seal of quality assurance and ethics from it according to the corresponding applicable regulations. For example, the university could ensure that developments comply with the so-called Hiroshima Process, which is an international code of conduct that aims to promote safe, secure, and trustworthy AI around the world
- Certifier and accreditor of professional competencies that do not have to have been developed within the university itself. In this role, they could partner with companies that would endorse in some way the value of these competencies.
- Creator of comprehensible AI models and alternatives to those used in the industry, free of commercial interests. These models, in principle, may have broad applicability, but they can also be adapted to be more specific according to the particular interest or use case for which they are developed, taking advantage of the specific knowledge of each university.

TRANSFORMATION OF HIGHER EDUCATION

CHANGES AT THE UNIVERSITY

With the full implementation of artificial intelligence, society will undergo a profound and inevitable transformation that will also significantly affect higher education. The way in which students will acquire knowledge, skills and competencies will be radically different from today. The role of the university as an accreditor of the learning outcomes acquired will be considerably strengthened thanks to the wide availability of virtual agents that students will have at their disposal. Table 1 summarizes the main differences between the current environment and a possible foreseeable scenario.

Table 1. Comparison of the characteristics of higher education.

Characteristics of teaching in higher education	Current University	University of the Future (AI)
Registration	In a degree.	At university (except in the case of some qualifying degrees, such as medicine or architecture).
Program studied and curriculum	Standard; All of them study one of the degrees offered. Very little personalized. Very fixed plans, with very few elective subjects.	Tailor-made programmes, except in exceptional cases of highly regulated professions (architecture, medicine, etc.). The student chooses the subjects that will provide the learning outcomes they wish to achieve and have accredited.
Pace of studies	Standard; In general, 60 ECTS are taken per year with some flexibility.	Highly personalized; each student will have the ability to determine the ECTS credits to be taken at each stage, based on their interests and study ability. Similarly, those less experienced will also be able to opt for more structured models.
Study Materials	Standard; Equal notes and resources for all.	Very personalized; There will be texts, audios, presentations, videos, etc., Each student will use the ones that best suit their way of learning.

Table 1. Comparison of the characteristics of higher education. Part II

Role of the teacher	He is responsible for the teaching of each subject.	Their role as coach and mentor becomes more important, assuming the role of guide in the learning process and curator of the contents, transmitting their experience to the student. In addition, you are expected to possess advanced competencies for the implementation of artificial intelligence tools in the classroom.
Tuition	All subjects have their class hours assigned from the beginning of the course; the class hours depend on the number of ECTS of the subject.	Each subject offers a number of contact hours to students, more in the form of tutored workshops than formal classes. Some subjects may, due to their special nature, have a number of compulsory class hours, to address topics of special complexity.
Teamwork	Group or team work is carried out in each subject and, normally, the teacher assigns the groups.	There will be work that the student must do in a group, voluntarily joining one, or requesting to be assigned to a group. The groups may be multidisciplinary or even interprofessional.
Bachelor's or Master's Thesis	Usually individual work, which involves the culmination of the studies completed.	In some degrees, this last work could disappear with the current format. In highly regulated areas, it is likely to be maintained, but in other fields it could evolve into larger projects carried out in multidisciplinary teams.
Evaluation and certification systems	Important, because they provide an objective and reliable measure of student achievement and allow teachers to adjust their teaching methods and subject curriculum to improve learning.	Extremely important, as it will be possible to identify learning patterns and specific areas that require special attention and design adaptive competency assessments that automatically adjust to the level of each student, thus maximizing their learning potential.

Source: Own creation

In the age of AI, students, teachers, and non-teaching staff will have numerous personalized virtual agents that will help them be more effective and efficient in the performance of their tasks. As there are no specific qualifications, with the aforementioned exceptions, but rather learning outcomes, such as the knowledge, skills and competencies acquired by the student, the boundary between university education and professional activity is blurred. Students will begin their studies and, from a certain point on, they will be able to start a professional activity that they can combine with their educational process, adapting it to their own learning pace.

The university's role as a certifier and accreditor of competencies is strengthened, in response to the growing need for companies and organizations to ensure that the people they hire have the required competencies. To this end, assessment systems will become especially critical, as students will have multiple resources at their disposal, inside and outside the university, to acquire knowledge, skills or competencies, including generative artificial intelligence tools. The university should play a more prominent role as a guarantor of the authenticity of the work with which students manage to accredit their knowledge and skills.

GOVERNANCE

Artificial intelligence governance refers to the set of policies, procedures, and practices that govern its development, implementation, and use. A legal, ethical, and technical framework needs to be put in place to ensure that AI is safe, responsible, and beneficial for all involved. This includes considerations of security, privacy, interoperability, transparency, and explainability.

In higher education, where AI is increasingly prevalent in all areas, it is critical that universities adapt and leverage this technology to improve learning and research. University academic and administrative leaders have a key role to play in ensuring that AI is deployed responsibly, ethically, and safely. This includes establishing clear policies for data use, privacy protection, and computer network security. In addition, they must work closely with AI experts to effectively integrate AI into the academic curriculum and provide training to both students and staff on its proper application. Collaboration with organizations and companies can also be beneficial in promoting the development of innovative solutions for AI governance in the context of higher education.

AI governance should be integrated into the curriculum of all academic programs. Students should be trained in topics related to AI ethics, safety, and governance so that they can effectively work with this technology in any field. In addition, academics and higher education practitioners have a key role in the research and development of tools and methodologies for responsible AI governance. This may include designing and evaluating governance systems, creating industry standards, and collaborating with government and industry organizations in this field.

There are three main pillars or basic principles of AI governance:

1. Flexibility and adaptability. AI is constantly evolving, at an ever-faster speed, and its impact is increasing, in more environments. That is why it is vital that supervision and control mechanisms are extraordinarily agile and flexible, in order to adapt in real time to new developments and capabilities of AI.

2. Management with a global vision. Given the disruptive nature of AI and its extraordinary potential in all environments, management with an overview is essential. It is necessary to properly involve all stakeholders, with a truly holistic approach.

3. Risk containment. Like all technologies, AI has extraordinary potential, but it also carries significant risks. The adequate containment of these risks, in all dimensions (technological, temporal, etc.) is essential to maximize their positive impacts, while minimizing the undesired effects.

STUDY PLANS

A transformation is envisaged in the current structure of the curricula and degrees assigned to the faculties. Except in some highly regulated professions, such as medicine and architecture, the student will not enroll in a faculty; Only at a university, where you will do your study itinerary to achieve the necessary skills according to your professional goals.

In the case of highly regulated professions and free study pathways, intermediate situations similar to the current qualifying programmes could arise. This is especially observed in areas such as some engineering, physiotherapy or psychology, where the competencies to be achieved are widely established by a regulatory body.

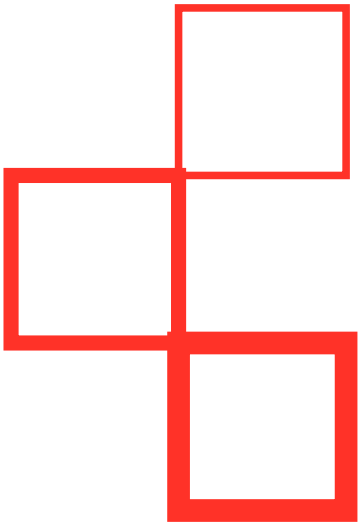
This transformation will focus on the personalization of learning, resulting in more flexible curriculum models tailored to students' individual interests and abilities. This curricular flexibility will foster greater interdisciplinarity in curricula, allowing students to combine subjects from different areas, preparing them for a job market that increasingly values the ability to work across disciplines.

In this new educational environment, the understanding and use of artificial intelligence will become essential competencies in all pathways, and it will be necessary to incorporate an ethical and responsible approach in the use of new technologies.
The training itineraries will be flexible, customizable and revisable at the end of each course, adapting to the individual needs and preferences of the students, and keeping the content updated with the most recent developments. These itineraries will integrate different areas of knowledge, generating hybrid degrees and promoting the training of polymaths. It will be necessary to accept that the profile of graduates will not be limited to current university degrees, but will be determined by the set of skills acquired.

Rather than being based on content and learning activities, curricula will focus on adaptive and personalised learning outcomes and assessment systems. The main objective will be to ensure that students achieve concrete learning outcomes, recognising that learning can happen anytime, anywhere. Artificial intelligence will play a crucial role in this process, facilitating personalized and continuous assessments of student progress.

To implement these training itineraries, the integration of multidisciplinary teams, including education specialists, supported by an artificial intelligence assistant, will be essential. This collaboration will ensure a diversity of perspectives and skills, fundamental for the development of curricula that respond effectively and balanced to the individual needs of each student. The AI custom virtual agent will bring its advanced analytical capabilities to identify patterns and trends, aiding in the decision-making process. Students will be able to understand, apply, and create, regardless of the time they physically spend in a classroom, face-to-face or virtual, or spent on academic assignments. With advanced tracking and analytics systems, artificial intelligence will be able to continuously assess student progress, identify areas of strength and improvement, and adapt teaching materials and approaches to meet their individual needs. In addition, more personalised assessments can be carried out, moving away from traditional exam-based methods and adopting forms of assessment that more accurately and holistically reflect the learning and qualification profile acquired by the student.

In this sense, the student will carry out an initial assessment of their qualification profile, which will be made up of knowledge, skills, competencies and personal preferences. A personalised virtual agent will identify and propose the personalised training itinerary that best suits your profile and needs. This itinerary will include a plan of learning activities and content specifically selected to help the student develop the knowledge, skills or competencies that they lack.



As the student will be able to learn in different environments, complementing what the university offers with other available resources, and considering that the fundamental thing is the competencies achieved, the certifying and accrediting role of the university acquires greater importance. This implies that the prestige of the university will be more relevant in the future, as it will facilitate the acquisition of knowledge, skills and competencies, and will be a guarantor of the levels of performance achieved in each learning. In a society of specialization in tasks and knowledge, the certifying role of the university will be more important than ever.

SUBJECTS

All subjects will be guided, to a greater or lesser extent, by artificial intelligence. Students will interact directly with artificial intelligence systems as part of their learning process. Artificial intelligence will not only facilitate access to relevant information but will also allow students to request specific summaries of complex topics using concrete descriptors. In addition, they will be able to evaluate and filter the answers provided by artificial intelligence, thus building their own educational content. This approach will not only ensure the acquisition of theoretical knowledge but will also promote the development of essential skills and competencies in the interpretation and management of information generated by artificial intelligence, preparing students to face the challenges of the ever-evolving digital world.

Other subjects will be specific to artificial intelligence itself, and its use in specific areas. They will be based on practical cases that can benefit from the application of artificial intelligence and will address its use from different perspectives: technical, ethical, and sustainable.

TRAINING ACTIONS

The university of the future, as mentioned, will focus on the personalisation of learning, with training actions designed to adapt to the individual needs of students. Through a wide variety of learning activities, students will be able to develop the knowledge, skills and competencies necessary for their professional future. This involves developing skills and effectively adapting learning to meet both present and future demands of an ever-changing labour market.

1. Traditional theoretical, practical, or theoretical-practical classes will continue to be relevant as spaces for discussion and learning of complex content that requires direct interaction with a teacher.

2. Simulation activities, both face-to-face and virtual, supported by artificial intelligence, will provide students with hands-on, realistic experiences essential for effective learning, by recreating complex or dangerous situations that might prove difficult or even impossible to experience in real life.

3. Research and projects will allow students to collaborate with companies or research groups, actively participating in decision-making and the execution of tasks thanks to the use of tools based on artificial intelligence. This will provide them with deeper perspectives that will allow them to perform more complex analyses, thus improving their contribution to the projects in which they participate, strengthening their understanding of the scientific method and preparing them for itineraries focused on research and innovation.

4. Face-to-face and remote workshops with interprofessional groups will be key to solving problems or carrying out complex projects, and to integrate acquired knowledge and develop relational skills necessary for effective teamwork.

5. Autonomous work guided by a personalized virtual agent will allow students to acquire knowledge, skills and competencies specific to their training itinerary at their own pace and with a personalized methodology.

TRACKING

The monitoring and issuance of alerts or warnings on student performance and possible needs for reinforcement or corrective actions will mainly be carried out by an artificial intelligence supervised by teachers. Continuous and personalized monitoring of student performance will be carried out, identifying early students who may be at risk of underachievement. In these cases, an AI virtual agent could issue automatic alerts to both teachers and students, allowing corrective actions, such as additional academic support or personalized advice, to help students overcome obstacles and improve their performance.

In addition to addressing academic challenges, artificial intelligence will also contribute significantly to strengthening attention to diversity in the educational environment. By providing features such as automatic captions and audio transcriptions, artificial intelligence will facilitate the full participation of students with special needs. This inclusive approach will ensure that all students, regardless of abilities or limitations, have equitable access to education. The ability to personalize attendance to each student based on their specific needs demonstrates how artificial intelligence not only improves overall performance, but also promotes equal opportunities in education.

ASSESSMENTS

As mentioned above, the role of the university as a certifier or accreditor of the learning outcomes achieved by the student will be more critical. Among the competencies that students will acquire is a basic transversal one, the ability to use artificial, generative, and predictive intelligence tools effectively and ethically. It will also be essential to certify or accredit that students have achieved the competencies required for teamwork, such as active listening and effective communication, resilience, among others.

The evolution of AI-driven educational assessment will transform both the form of feedback and the nature of assessments. Instead of relying exclusively on manual review of assignments and exams, AI systems will play a predominant role in providing instant and personalized feedback to students. This revolution in feedback will not only be limited to the correction of answers, but will also encompass guidance in research projects, identifying areas of strength and opportunities for improvement accurately and efficiently.

Oral assessment will also undergo a revolution with the intervention of artificial intelligence. It will not be limited to analyzing the content of students' responses; It will go further, evaluating aspects such as fluency, argumentative structure, and emotional expression. This comprehensive approach will provide a more complete understanding of students' mastery of the subject. Artificial intelligence's ability to assess emotional expression can take assessment to a higher level, allowing not only factual knowledge to be measured, but also the student's ability to effectively communicate their ideas and emotions.

Experiential assessments, supported by immersive virtual environments and AI-generated simulations, will represent another milestone in the transformation of educational assessment. These assessments will allow students to demonstrate their knowledge, skills, and competencies in contexts that mimic real-world situations. The authenticity of these assessments will be enhanced by the ability of artificial intelligence to create complex scenarios that reflect current challenges and issues. This approach will measure students' theoretical knowledge and assess their ability to apply it in real-world practical situations, providing a more authentic assessment of their ability to apply the learning outcomes acquired in practice.

Artificial intelligence will not only change the way knowledge is assessed, but it will also transform the very nature of what is assessed. Students will not only be assessed on their ability to retain information, but also on their ability to think critically, solve problems innovatively, and apply their knowledge, skills, and competencies in practical and challenging contexts. Ultimately, the integration of artificial intelligence into educational assessment will promote a more holistic and authentic approach to measuring student achievement, better preparing them for the challenges of the real world of work.

LEARNING SPACES

The learning and teaching processes will be implemented in both face-to-face and online spaces that are more flexible, with customization and inclusive options:

a) Face-to-face learning spaces

University campuses will be transformed, configuring more open and versatile spaces where various actions can coexist aimed at meetings, exchange and joint creation.

Theoretical classrooms as they are known, with students located unidirectionally, will progressively disappear and more laboratories, collaborative work spaces, spaces for simulations and flexible classrooms that integrate mobile furniture and technological resources that allow people to connect with people from other locations will be integrated.

These learning spaces will allow the development of tasks such as: presentations, generation of technological and non-technological products, research or personal interaction.

b) Online Learning Spaces

The LMS or virtual campuses accessed by students and teachers will integrate artificial intelligence and offer functionalities such as the following:

- Evaluation tests to identify competency profiles and thus be able to generate learning itineraries with the supervision of the teams.
- Follow-up of progress in the personal learning pathway. It requires the effective processing and visualization of data from students, teachers or support teams.
- Adaptive study lessons that are shown differently for each person.
- Personalized analytics for different profiles that facilitate decision-making.
- Chatbot to provide quick answers to frequently asked questions and provide guidance and support to students and teachers during the learning process.
- Customizing the Display of the Environment.

ACTORS

As described above, artificial intelligence is revolutionizing teaching at all levels, including in higher education, offering unprecedented opportunities to personalize and enrich learning. AI is redefining the roles and competencies of both students and teachers. In this context, the role of the student evolves towards greater autonomy and a much more active participation in their educational process, and the role of the teacher is diversified in terms of specialization and functionality.

a) Student role in the age of AI.
The student "of the future", regardless of the educational path he chooses, will have to develop some transversal skills. These competencies will challenge their autonomy and their own vision of their academic and professional future. Among the competencies that we highlight for this student profile are:

- Decision-making and information management: In the digital age, students are faced with a constant flow of information. AI can help filter and organize this data, but students learn to analyze the starting data, make informed decisions and discuss them considering the previous state of the art, as well as to criticize with their own biases that their use could generate, and also to make critical decisions based on this information.

- Capacity for analysis and critical thinking (critical analysis): Closely linked to the previous competence is critical analysis. The power of AI is undeniable to provide complex analyses, but interpreting and critically questioning these results are human competencies that students should foster. The student will also have to work autonomously in the development of these competencies, probably taking a more active role in their learning in the field of interest.

- Creativity: AI can be a tool to boost creativity, offering new perspectives and solutions. Students should be trained to use these tools innovatively and effectively in problem solving.

- Interpersonal skills: The ability to work in a team, communicate effectively, and resolve conflicts is crucial. AI can provide scenarios and simulations for the development of these skills.

- Social and ethical awareness: It is essential to educate students in ethics and social responsibility, especially in the use of technologies such as AI, promoting integrity and transparency. Even this competence could be integrated under a more generalist one that we could call Digital Humanism.

- Autonomy and adaptability: In an ever-changing world, the ability to learn autonomously and adapt to new situations is essential. AI can offer personalized learning paths to foster these skills in the learner.

- Global vision and digital skills: Understanding the global context and anticipating trends are key competencies. In addition, AI literacy and constant updating are necessary to stay competitive in the job market. It will be necessary to develop hybrid profiles of professionals who, although they are not specialists, will have to effectively apply artificial intelligence tools in their professional field.

The incorporation of AI tools in the learning process can help develop these competencies, as a virtuous cycle, and should be done in a way that complements and enriches the educational process. This includes the use of adaptive learning systems, interactive scenarios, and AI-based educational simulations and platforms that promote collaboration and critical thinking.

b) Teacher profile in the age of AI.

With the advent of AI, and its transformative effect on teaching, the role of the teacher as a transmitter of knowledge will be transformed into that of a facilitator of learning, guiding and supporting students.

Although in many university institutions there is already a distinction in the profiles of teachers, such as teacher-researchers, experts, etc., it is expected that the teaching profiles will become more specialized. In this way, and based on the vision of the university described above, a functional classification of teachers could be established into:

- Researchers: if, as is foreseeable, the University maintains its vocation for the development of knowledge, it will continue to be necessary to have research profiles in the different areas of knowledge. One of these areas of research must be AI, and it must go hand in hand with the developments implemented by companies, where most of the generation of knowledge in the field has been concentrated in recent years. AI greatly enhances research capabilities.

- Content experts: the University must establish itself as a guarantor of the advancement of knowledge and the accreditation of the training and development of students' skills. The expert profile specialises in curating content in a field of knowledge and maintaining an up-to-date knowledge profile, with conti-

nuous training, in their field of interest. The figure of the expert professor will also be that of the specialist in the area who, in addition to his professional activity, imparts the latest knowledge of the field to university students.

- Experts in curriculum design: with the immersion of AIs in the curriculum, it will be necessary to have teachers who are experts in learning experiences or situations. This teacher profile can be an innovator/researcher profile in the field of educational innovation. With a technological-pedagogical profile, they create and adapt AI-based educational tools, assessments, itineraries, etc.

- Mentors: this would be the evolution of the "current teacher", in that they would no longer transmit theoretical knowledge, but would focus on the personalized accompaniment of students, participating with them in simulated scenarios and real cases, guiding them, promoting autonomy, teamwork, critical thinking, offering guidance and evaluating their performance, by objectives and competencies (like Structured Objective Clinical Exams).

- Expert in knowledge transmission. A teacher who is able to transmit knowledge in a stimulating way, even with passion, who has a deep command of the subject and is able to relate its contents to others, to the discipline as a whole, to the world (at least its world of knowledge and experiences), who fosters critical thinking and intellectual curiosity, who motivates, is empathetic, etc.

The integration of AI into teaching should be done in a way that expands the teacher's capabilities and enriches the educational experience. This includes the use of automated assessment systems, interactive teaching resources and collaborative platforms for research and knowledge management. Depending on the profiles, teachers will need to acquire and develop specific skills, some of them transversal such as updating their digital skills and understanding of AI systems.

REFLECTIONS/FUTURE ACTIONS

Artificial intelligence is going to mean a profound transformation of educational models at all levels, from primary school to university. It is not easy to predict how the changes will materialize, but it is certain that there will be and they will be substantial, affecting, among others, governance, degrees, curricula, teaching and research profiles, systems for the evaluation and certification of competencies, etc. Although the function of the University will certainly not change, the way in which it carries out its work will.

Thus, for example, it will be important to consider the formats in which the explicit knowledge obtained by teachers through research will be incorporated into an increasingly digital and less physical world and with an increasingly blurred dividing line. This, without a doubt, will force a deep reflection on the way students learn and how teachers participate in that process to facilitate the transmission of knowledge to students. The University will have to turn towards a more humanistic approach that focuses not only on knowledge but also on the development of the human being as a thinking entity and capable, with critical judgment, of making the best decisions to continue advancing society in a world in the age of AI.

Discerning between truth and falsehood will become a real challenge and it will be vital for the university to maintain its integrity as a place of trust. In an environment where artificial intelligence is ubiquitous, the need to ensure reliability is even more evident and the role of the University in ensuring the explainability and transparency of AI will be fundamental.

From the student's point of view, the training they will seek will be much more personalized, but not only in the way in which they will relate to their teachers, through training activities where AI will be very present, but also in the way in which they will design their own training itinerary by betting, when they wish, on the by more flexible paths or adapted to their needs.

But AI will also bring more efficiency and a better use of the time and talent of managers, professors, researchers and students. Virtual assistants will play a key role in each and every process and for every role involved. Of special interest is the role they will play in the evaluation of students because of the possibilities they will give a more personalized and immediate feedback, but also because of the threat of perverting the system and preventing a rigorous and reliable evaluation.

In any case, and as a final reflection, given the speed at which technological advances are taking place, it will be necessary to periodically review this foresight exercise, without losing sight of the socio-cultural, ethical, and legal aspects that will mark the development of artificial intelligence and its adoption in the field of higher education in particular and in the needs of society in general.

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