BULLETIN OF THE TECHNOLOGICAL OBSERVATORY OF THE UNIVERSITY OF LIMA

Artificial Intelligence and the Future of University Education

Systems Engineering Undergraduate Program
Year 1 | No. 4 | November 2023

CONTENT

Talking about the use of artificial intelligence in university education no longer represents a novelty factor, especially for those companies that have been applying it for years. Beyond generative AI, which has been in the spotlight all this year, universities are responsible for taking full advantage of all existing AI variants and for achieving their convergence with both mature and emerging technologies.

From the perspective of internal academic processes, higher education organizations should apply technology in all aspects, from the training of professors in order to keep them updated and prepared for the use of new tools to the management of the entire student life cycle in aspects such as academic performance, evaluations, risk analysis, among others, framed in full capabilities of personalization and flexibility for students.

In addition, one of the key dimensions of universities is research, which is currently undergoing a major transformation in its work methodology, as it allows researchers to conduct broader and deeper studies, as well as to increase their productivity.

In this issue of the bulletin, we will address these topics in such a way that relates AI-based technologies with other digital tools that, in their convergence, will promote universities much more than when used in isolation.

PERSONALIZING TEACHING WITH AI

Author: Joaquín Teves

Artificial intelligence (AI) is rapidly transforming and improving the way industries such as healthcare, banking, energy and retail operate. There is also one industry in particular that offers incredible potential for the application of AI technologies: education (Pelletier, 2023).

AI can facilitate personalized learning, improve content comprehension and retention, and adapt to the pace of learners. A study by Das et al. (2023) explores the impact of AI-driven personalization on students' academic performance. Through quantitative and qualitative analysis, the research demonstrates a positive correlation between personalized AI-based adaptive learning and improved academic performance, engagement and satisfaction.

There are several practical applications of AI in education: AI-based tools and platforms that enable personalized learning. These tools can adapt to the student's learning pace, provide instant feedback, and help students better understand and retain content (Rouhiainen, 2019). Some examples of these tools may include the following: Thinkster Math, which plays the same role as a math tutor; Quizlet, which helps memorize flashcards containing difficult concepts, terms, words or ideas; Prisma, which uses 3D technology, animations, audios, simulators, among others; or Knewton Alta, which helps educators, parents and administrators to offer personalized support to their students (Sabater, 2023).

Platform	AI Characteristics	Description
Quizlet (Quizlet, 2023)	Magic Notes, Q-Chat (AI tutor)	Provides a personalized learning experience.
Knewton Alta (Knewton, 2023)	Adaptive learning technology	Personalizes education for each student, so that it adapts content and assessments to individual needs.
Thinkster Math (Thinkster Math, 2023)	AI algorithms for monitoring, scoring and providing feedback	Offers personalized math tutoring for K-12 students.

Some universities use AI-based intelligent tutoring systems to provide learners with personalized instruction (Zawacki-Richter et al., 2019). There are several success stories in universities where AI has been implemented. For example, the Catholic University of the Maule (UCM), which has applied AI to personalize and improve teaching and learning processes (Ámbar Lillo, 2023); or the University of Murcia (UMU), which has successfully implemented a chatbot called Lola, which can answer more than 38,708 questions with an accuracy level of more than 91% (Universidad de Murcia, 2023).

However, it is important to note that not everyone agrees with the benefits of adaptability in education.

Pelletier (2023) argues, in her paper, that while adaptability may seem appealing at first glance, it raises questions that have historically been central to education as a professional practice and field of study.

AI shows great potential in education since it offers personalized learning and improves academic performance. Although tools such as Thinkster Math and university tutoring systems demonstrate its benefits, it is crucial to consider the ethical and pedagogical challenges they pose. It is essential to use AI responsibly to ensure quality education.

AUTOMATING STUDENT ASSESSMENT WITH AI

Author: Josefina Toribio

Assessment is a fundamental part of the educational process that allows us not only to measure students' progress but also to provide essential feedback to enhance their learning. With the recent advances in artificial intelligence (AI) and the emergence of automated assessment systems, this scenario has undergone a radical transformation so that it now offers more accurate and efficient tools for analyzing and assessing students' responses.

Currently, advances in natural-language processing facilitate the assessment of large responses, thus helping to identify trends and provide specific feedback. This innovation saves teachers half of the time they used to spend on assessment (Bryant et al., 2020).

In addition, thanks to this new way of providing feedback, high levels of personalization have been achieved, which show in detail students' areas of strength and opportunities for improvement (Hashem et al., 2024). In addition, AI-enabled assessment personalizes quizzes and tests based on learners' skills, knowledge and capabilities, which increases motivation levels (Harve, 2023). With the assistance of AI tools, such as ChatGPT, teachers get a complete picture of their students' work and progress, making it easier for them to identify and correct irregularities in student learning by reinforcing concepts (United States, Department of Education, 2023).

According to Balla (2023), here are some ways in which AI technology impacts educational assessment through automated grading systems:
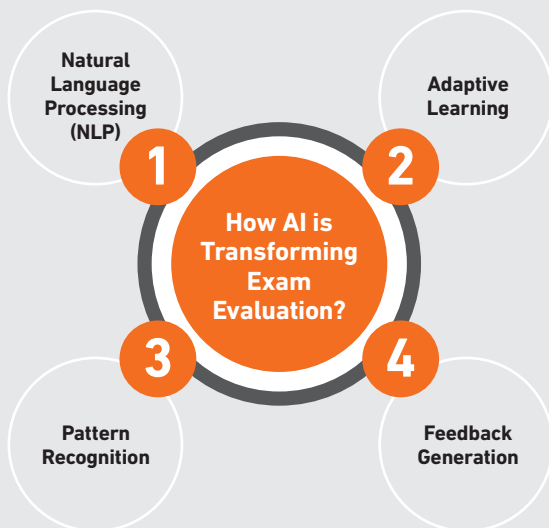
Source: "Automated grading systems: how AI is revolutionizing examevaluation," by E.Balla, 2023.

1. Natural Language Processing (NLP):
This enables automated grading systems to analyze and understand written responses. By employing machine learning techniques, AI can assess the quality, coherence and relevance of the student's answers.

2. Adaptive Learning:
By analyzing vast amounts of student data, AI-based grading systems can adapt and improve over time to provide personalized feedback and recommendations for individual learners. This personalized approach helps students progress at their own pace.

3. Pattern Recognition:
AI-powered systems can recognize patterns in student responses and identify common errors or misconceptions. This allows educators to pinpoint areas where students may be struggling with and tailor their teaching strategies accordingly.

4. Feedback Generation:
AI algorithms can process students' answers and generate detailed and structured feedback for students, which also saves educators' time.

Furthermore, it is necessary to take into account that the role of teachers, faced with an evaluation system that implements AI, acquires new challenges and is essential to guarantee education excellence. As stated by Balla (2023), in this renewed context, teachers should establish educational objectives with rubrics and guidelines that will be used by automatic grading systems. In addition, from a more human approach, they should provide nuanced feedback based on an understanding of the context in which students provide their responses and promote critical thinking in the learning environment.

AI IN RESEARCH

Author: Guillermo Dávila

Scientific research is a systematic and methodical process whose main purpose is to discover, interpret, validate and apply knowledge. By stating that research "generates new knowledge," we refer to the fact that its purpose is to discover—or delve into—facts, data, theories or principles that were not known or were not well established.

The use of the "scientific method" is essential in research because it guarantees that it is carried out objectively and systematically so as to avoid bias and errors. Each area of knowledge has its own theories and methods. In general, we can say that the scientific method is based on observation, definition of the research problem, formulation of hypotheses, experimentation and verification of results. On this path, there are several tasks, such as literature review, selection and analysis of collection techniques and data analysis, among others.

As for the formulation of the research problem, an interesting tool to review is Perplexity.AI. This AI-powered search engine uses natural language processing to answer questions in a structured and generally more accurate manner compared to those provided by natural search engines. It offers related sources of information that can be the first step in identifying existing research gaps and the consequent formulation of questions.

The formulation of hypotheses usually requires an extensive and rigorous literature review. For this reason, it is worth mentioning two tools that, although they are not based on generative AI, are very functional and useful for these tasks, mainly when working collaboratively. Parsifal is an application that works in the cloud and supports the systematic literature review process. It allows you to save search criteria, search and select relevant studies, extract data from both studies and process, among other functionalities. In this way, it facilitates tasks related to the management and reporting of a systematic review. In addition, Zotero is a tool that allows you to store and organize bibliographic references with may functionalities. It has a plugin that takes the paper you select directly from the browser to the workspace. It facilitates the creation of citations and reference lists in a variety of formats, allows to tag and edit papers, and also promotes collaboration, as workspaces can be shared virtually.

Data evaluation and analysis is another part of the research process that presents a number of challenges related to crossvalidation or understanding of complex concepts. Two tools recommended here are SciSpace Copilot and ChatGPT. SciSpace is an AI-based tool that answers questions and explains the scientific papers we read. For example, we can ask it to tell us the scientific gap originated by the paper we have on screen or to detail the method of analysis used, a table or the main three academic contributions. It is the task of the researcher to have the appropriate knowledge to ask pertinent questions and validate the results. On this path, the researcher may need to understand complex knowledge, which can be facilitated by ChatGPT.

For the interpretation and presentation of results, two valid tools are ChatGPT itself and Claude.AI. Both have the ability to receive information about our outcomes, in text fragments or numbers, and identify insights that can be used to develop the contributions of the scientific paper. In addition, both have the ability to contrast results with other sources so that they provide the respective references. Claude.AI has an additional strength since it allows the uploading of scientific papers under analysis. For example, after uploading certain papers, it can be asked to identify insights from them according to a given theoretical or methodological framework which can be expressed in a quote. In addition, these tools facilitate the presentation of results by identifying possible grammatical problems or opportunities for improvement in writing style.

COMPREHENSIVE ANALYSIS OF STUDENTS WITH AI

Author: Percy Diez Quiñones

When organizations began to implement digital technology, they automated repetitive tasks and subprocesses or solved specific problems. Eventually, integrated solutions (LMS, ERP, CRM) have emerged to automate entire processes and even areas of an organization. However, today most organizations have a variety of applications with different degrees of technological updating and obsolescence, different levels of information quality and diverse systems, usually poorly integrated with each other.

In recent years, one of the key paradigms to ensure customer continuity and satisfaction has been customers' experience management (Hinds & Gupta, 2023), whose main tool is Customer Journey. Applied to the education sector, understanding Student Experience as well as modeling and managing Student Journey are a key tool for getting a holistic view of what happens to a student or a set of students. Beyond being a data accumulator, it should be possible to perform analytics to predict, simulate and prescribe specific actions or trigger notifications that make it possible to take preventive action.

CURRENTLY, THERE ARE SEVERAL NEEDS TO BE TAKEN ACCOUNT:

- Understanding of comprehensive and non-transactional business.
- Data-driven guidance of companies.
- Increased use and need for data analytics.
- Use of historical data with near real-time data.
- Reduced costs of moving and transforming data.
- Need for simplified use of AI.
- Visual and natural language user interface.
- Continuous innovation and new capabilities.

THREE TRENDS THAT ADDRESS THE NEED TO MANAGE STUDENT EXPERIENCE ARE:

DataGraph (Govindarajan & Venkatraman, 2022)

- It is a structure in the form of a graph to manage data in which the nodes represent entities which are connected through relationships.
- It can represent any level of real-world complexity and data in motion.
- It allows the development of network analysis and the identification of patterns, outliers, among others.
- It can be built incrementally.
- Queries are more efficient than traditional relational databases.

Digital Twin (Pushkar, 2021)

- It is a digital representation of a real-world entity or system.
- It allows monitoring the real world in a comprehensive way.
- It is built through multiple internal or external, historical or real-time data sources.
- It extends current digital capabilities exponentially; it does not replace them.
- It provides capabilities such as what now, what if and what next.

Artificial Intelligence (Young, 2023) (Gartner, 2023)

- Machine learning for developing forecasting models.
- Simulators to validate multiple scenarios.
- Deep learning to create knowledge through multiple layers of information processing.
- Rules manager.
- Optimization models.
- NLP.
- Generative AI.

HOW WOULD SUCH A SOLUTION WORK?
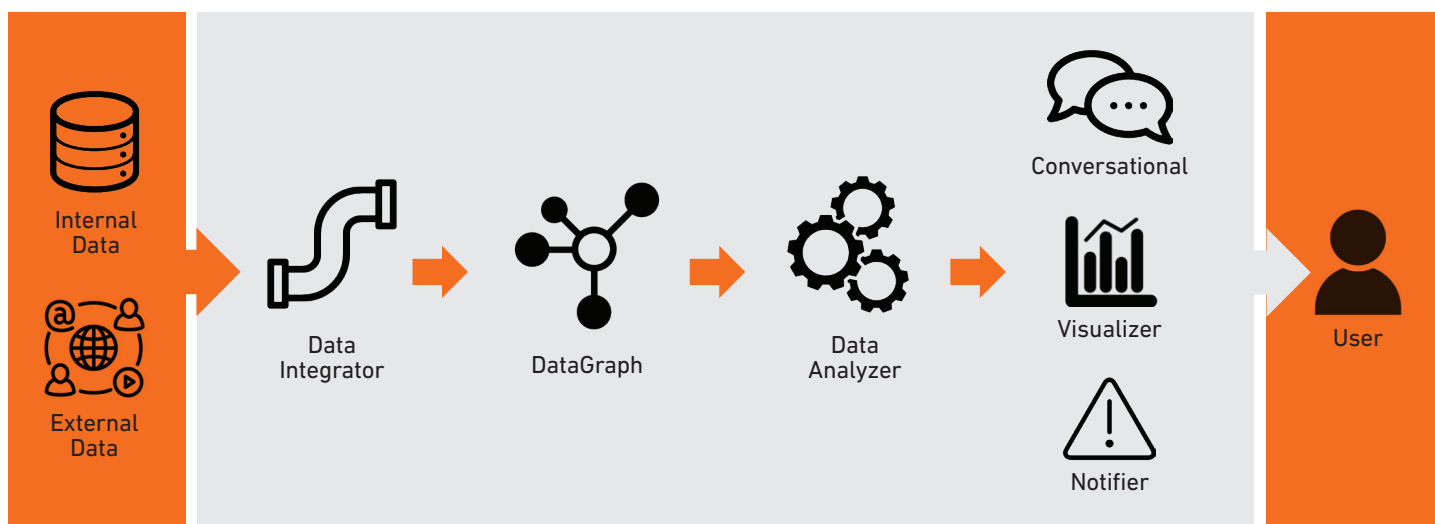
1. A data integrator extracts and moves the data required, which can come from internal university systems or from external sources.
2. DataGraph organizes and stores data in the form of modeling as a replica of the real world. It can grow without problems when new data sources arrive or undergo major changes.
3. A data analyzer performs calculations and analysis by using statistics, algorithms or models to obtain predictions, prescriptions and simulations.
4. Various interaction systems, such as a generative AI-powered chatbot conversational channel can answer queries about data or analytical calculations with the use of natural language.
5. Finally, the interaction with the end user can also create automatic notifications or customized visualizations.

This is how this type of solution could identify and improve the timely and comprehensive consideration of various pain points that may arise (McKinsey & Company, 2022):

1. Improve student experience and satisfaction.
2. Identify student archetypes to increase personalization and personalized attention.
3. Improve retention of students at academic or other risk.
4. Better distribution of resources.
5. Improvement of faculty experience.

ETHICS IN THE USE OF AI IN UNIVERSITY EDUCATION

Author: Luis Horna

As artificial intelligence (AI) systems become more advanced and integrated into various aspects of daily life, there is a growing need to consider the ethical implications of these technologies. A key ethical concern is to ensure that AI is developed and implemented in a manner that promotes diversity and inclusion and protects personal data.

Ethics in the use of AI in university education refers to the need to ensure that decisions made by AI systems are fair, transparent and accountable. This implies that it is necessary to establish clear ethical principles for the design, development and use of AI systems in university education (ChatGPT, 2023).

AI ethics in education should pursue the ability to use AI properly and cultivate human morality. To this end, the goal is to nurture members of the AI society so that they can think about the purpose, data and application areas, and grow into moral subjects (Kwon, 2023).

Historically, AI systems have shown bias problems leading to unfair or discriminatory outcomes, particularly for minority groups. This can occur if the training data used to develop AI models lack diversity or contain implicit biases. Companies and researchers have an ethical responsibility to ensure that AI training data represent diverse populations and viewpoints (Claude.AI, 2023).

Kwon (2023) argues that, in order to create a trustworthy environment for AI, certain core requirements are needed:

Core Requirement	Details
Human Agency and Oversight	AI systems should empower people to make informed decisions and foster their human rights.
Technical Robustness and Safety	AI systems need to be resilient and secure. They need to ensure a fallback plan in case something goes wrong and be accurate, reliable and reproducible.
Privacy and Data Governance	Besides ensuring full respect for privacy and data protection, data governance mechanisms should also be ensured, taking into account the quality and integrity of the data.
Transparency	The data, systems and AI business models should be transparent. Traceability mechanisms can help achieving this.
Diversity, Non-Discrimination and Fairness	Unfair bias should be avoided, as it could have multiple negative implications from the marginalization of vulnerable groups to the exacerbation of prejudice and discrimination. Fostering diversity, AI systems should be accessible to all, regardless of any disability, and involve relevant stakeholders throughout their entire life circle.
Societal and Environmental Well-Being	AI systems should benefit all human beings, including future generations. Therefore, it should be ensured that they are sustainable and environmentally friendly.
Accountability	Mechanisms should be put in place to ensure responsibility and accountability for AI systems and their outcomes.

IMPACT OF AI ON TEACHER TRAINING
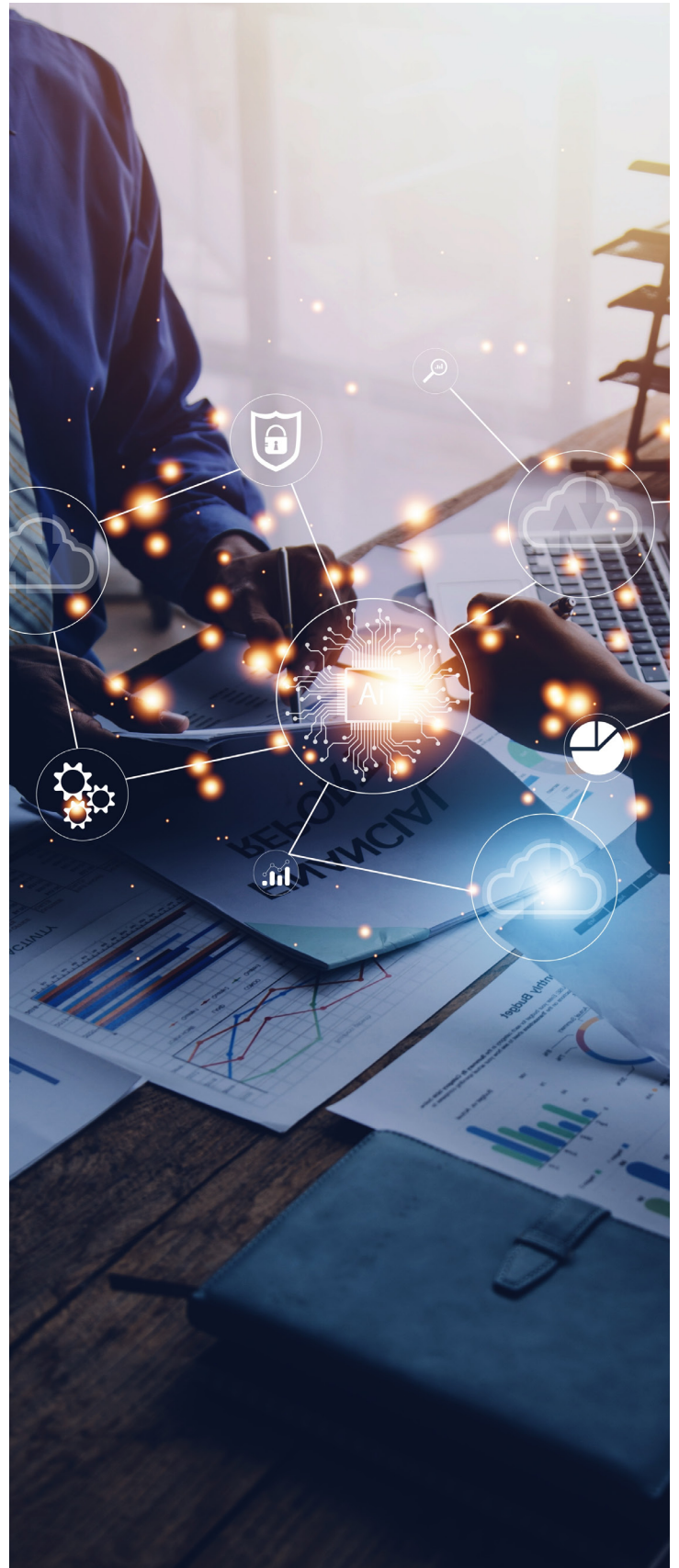
Author: Ángel Agüero

Adapting teachers to new technologies is a process that, in many cases, will begin with an artificial intelligence (AI) literacy, which can continue with training in the use of fundamental tools in the academic discipline.

Thus, a continuous development of their digital skills will start so that they may be transferred to the training process. To this end, some factors should be considered:

• Prospective analysis of AI progress.
• Criteria for evaluating and choosing the right tools, without ignoring data science applications, which are so important in everyday professional life.
• Academic discipline: professional experiences, labor demand.
• Methodological aspects.
• Curriculum design.
• Research, among others.

Therefore, it is necessary to provide high-level guidance to teachers with a focus on the partnership between teachers and AI since this integration will take advantage of the strengths of both, which was experimentally proven (Rodríguez-Triana et al., 2023). It will also be important to meet some institutional requirements (Tritscher et al., 2023), such as:

• Clear vision of AI tools.
• Proactive, reflective and critical approach in the use of AI tools.
• Workshops and training in AI.
• Exchange of experiences.
• Technical support.
• Ensuring technical requirements.
• Financial support.

INTEGRATION OF SCIENTIFIC RESEARCH IN TEACHING

Author: Ángel Agüero

Scientific research is one of the fields in which artificial intelligence (AI) plays a prominent role; therefore, in order for professors and universities to acquire better international ratings, research in AI and in the different disciplines that use AI is paramount.

Quacquarelli Symonds (QS) is one of the international institutions that annually produces a ranking of the best universities in the world, where research, through the number of citations received by institution, is weighted with 20% of the overall evaluation (Quacquarelli Symonds, 2023).

	2024
Academic reputation	30 %
Employer reputation	15 %
Faculty student ratio	10 %
Citations per faculty	20 %
International faculty ratio	5 %
International student ratio	5 %
International research network	5 %
Employment outcomes	5 %
Sustainability	5 %

In the same manner, leading global accreditation institutions, such as AACSB and EFMD, consider research as one of the main contributions of professors. Therefore, university institutions are called upon to do more research in the programs they teach, for

which it is necessary to break traditional research paradigms with the ethical application of AI in the research process and by analyzing the use of AI in professional activities.

The following chart shows the number of publications on AI between 2017 and 20121 by scientific field.
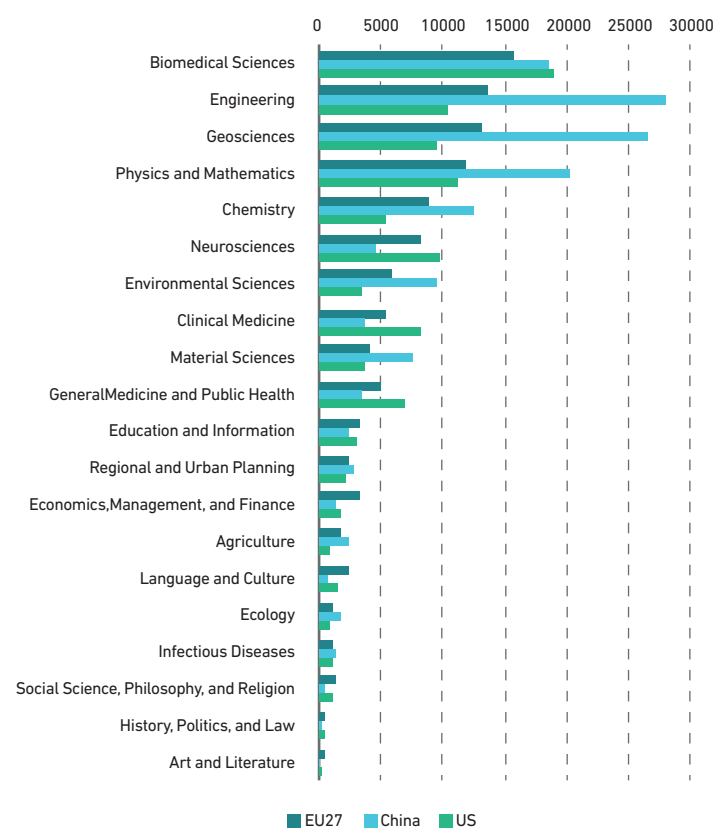
Source: European Commission, Directorate-General (DG) for Research and Innovation. Calculations based on Web of Scientific Data.

REALISTIC LEARNING EXPERIENCE WITH AI

Author: Carlos Torres

In recent years, we have witnessed the remarkable development of technologies and, although many are promising and of interest to the educational sector, we can select three of them that play a disruptive role in education as they allow us to create immersive experiences and bring a real-world experience into the classroom:

- **Augmented reality (AR)** is the real-time use of information in the form of text, audio, graphics and other virtual enhancements integrated with real-world objects. Thus, its differentiation and value lie in the user's interaction with the real world (Gartner Information Technology, 2023).

- **Virtual reality (VR)** is the use of computer technology to create a simulated environment which can be explored in 360 degrees. It places the user inside the virtual environment to provide an immersive experience (Ontario Institute for Studies in Education, 2023).

- A **simulation** is an instructional scenario where learners are placed in a world defined by the teacher to represent a reality within which students interact. The teacher controls the parameters from which this world operates and varies them to help the students achieve the desired learning (University of New South Wales, 2023).

It may seem a simplistic vision that we are about to present, but the ultimate goal of the educational process is the successful completion of the student's learning. Therefore, the technologies are not introduced into the educational process to technologize or automate it per se but to enhance the learning experience and take it to new levels:

- Recent technological developments, in particular augmented and virtual reality, have enabled teachers to take advantage of the interactions that these technologies provide in order to teach more effectively since it is possible to create realistic experiences of the environment where the knowledge under study is to be applied (Capone & Lepore, 2020).

- A simulation is a form of experiential learning. It is a strategy that fits well with the principles of student-centered and constructivist learning and teaching; i.e., it gives students the power over what they learn and how they learn, allowing them to build their understanding of what they are learning through their experiences and interactions, rather than just receiving information (University of New South Wales, 2023).

In order to achieve this goal, teachers around the world use AR, VR and simulation to develop academic activities and experiences. In addition, the development of artificial intelligence (AI) has provided them with tools that allow them to improve their academic designs and teaching scenarios. The term extended reality (XR) has been coined to make reference to scenarios where realism surpasses conventional models, enabling new and enhanced learning opportunities.

Specifically, generative artificial intelligence (GAI) enhances the results of AR, VR and simulations due to its ability to create dynamic content that adapts to individual students' needs and preferences through realistic environments that replicate those in which the student will develop. The main contributions of the GAI are summarized as follows (Thompson, 2023):

- **Personalization:** According to individual students' learning style, timeliness of content, level of knowledge, rate of progress, etc., all carried out in real time.

- **Adaptive Learning:** Through the analysis of students' responses, progress and achievements, and the presentation of challenging content but appropriate to their level.

- **Real-Time Feedback and Assistance:** GAI can provide preliminary guidance on the aspects to be improved, as well as suggested methods to do so, always in real time.

- **Continuous Improvement:** Provides information on which topics are more difficult or transforms an initial content, from textual type to, for example, video sequences that are more effective in the learning process.

- **Accessibility and Inclusivity:** GAI can adapt the content for students with diverse needs; this includes those with disabilities. Inclusive learning environments where students can truly advance their learning are created and promoted.

Perhaps the best way to assess the impact of using AR, VR, simulation, GAI or other immersive technologies in order to leverage realism in education is to present success stories of application.

- **HEA₃RT:** It is an advanced simulation lab that has enabled the creation of a user-centered ecosystem open to innovation, with the ability to rapidly create any real-world clinical space, monitored by sensors and video. It allows for extensive learning before moving to live clinical trials (Stanford Medicine Healthcare AI Applied Research Team, 2023)
  (https://med.stanford.edu/healthcare-ai/simulation-lab.html)

- **CLEVR:** It is the Massachusetts Institute of Technology (MIT) lab that has been deployed to create immersive learning experiences based on VR that can be used in classrooms (such as those available at the University of Lima). For example, Cellverse, an educational game using immersive 3DVR, has been designed to help students learn cellular biology (MIT Scheller Teacher Education Program, 2023)
  (https://education.mit.edu/project/clevr/)

- **xREAL Lab, at The California State University:** It is an example of the groups of extended reality labs that this institution has deployed and is presented as an interdisciplinary technology innovation hub that allows students, professors and industry partners to use leading-edge technologies to design and create immersive learning experiences for an improved teaching and learning process (The California State University, 2023)
  (https://www.csusb.edu/xreal-lab)

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