Tecnológico de Monterrey

Educational Innovation and Digital Education at the Tecnológico de Monterrey

2023 Report

Index

Editorial

In a constantly evolving world, education currently finds itself at a crossroads. Technological advancements have burst into our lives in ways never imagined, and education cannot stay behind.

Today, at Tecnológico de Monterrey, we proudly present our "Educational Innovation and Digital Education Report 2023", a document reflecting our vision and commitment to educational excellence in the digital era.

Without a doubt, educational innovation is at the heart of our approach. We have implemented advanced technologies, such as Artificial Intelligence and Extended Reality, to enrich learning experiences. Likewise, our teachers have adopted innovative pedagogical methods that encourage active student participation and the acquisition of 21st-century skills, such as critical thinking and problem-solving.

Our mission is to offer innovative education that lives up to the demands of an increasingly interconnected and digital world, thereby empowering our students to be the leaders of the future. Through digital training programs, mentoring, and research opportunities, we provide them with the tools necessary to excel in a competitive and constantly changing world. At the same time, we promote inclusive education that reaches all corners of our society, reducing gaps in access and opportunity.

This report is a testament to our commitment to excellence, equity, and preparing our students for a digital world. It reflects the tireless efforts of our educational community to create meaningful and compelling learning experiences.

Lastly, we cannot fail to mention that in 2023, we celebrated 80 years of existence, and in 2024, we celebrate 35 years of offering digital education. We have come a long way, but we are determined to keep moving forward, innovating, and leading the way in educational transformation.

At the Tecnológico de Monterrey, we believe in the power of education to change lives and shape the future. We are excited about the future and committed to pushing boundaries and exploring new ways of learning. Together, we will keep building a better tomorrow.

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Introduction

35 years of digital and distance experiences

Higher education is experiencing an era of unprecedented innovation. Each new year, we are faced with educational challenges and amazed by the solutions provided by innovative technologies and pedagogies, coming up symbiotically and naturally with a new word in 2023: «techno-pedagogy».

What have we learned from the past, what are we experiencing in the present, and what surprises does the future hold? Tecnológico de Monterrey has always been at the forefront of this constant discovery and adaptation journey. In 2024, with a sense of deep pride and satisfaction, we celebrate 35 years of excellence in digital and remote experiences that

have revolutionized how we teach and learn at our institution.

Throughout the decades, Tecnológico de Monterrey has demonstrated its unwavering commitment to educational quality and the vision of preparing its students for the challenges and opportunities of a constantly changing global and technological world. Our history of educational innovation began in 1989 with the launch of the Interactive Satellite Education System, a program that allowed distance learning using emerging technologies. This milestone marked the beginning of a revolution in education that was pioneering in Mexico and set an international standard for distance and online education.

In these 35 years, we have evolved, learned, and grown in ways we never imagined in our first steps in distance education. We have adopted innovative technologies, transformed our pedagogical methodologies, and expanded our reach to students throughout Mexico and the world. We have provided learning opportunities to people who would have otherwise faced insurmountable barriers to obtaining a quality education.

Today, we can say that our vision of digital education goes beyond the transfer of knowledge; it focuses on the comprehensive development of individuals, the training of leaders, and the promotion of critical skills for the 21st century. Throughout these three and a half decades, we have achieved remarkable successes, faced challenges with determination, and, most importantly, transformed lives.

For all the above, this report is a tribute to our past achievements as well as a look toward the future. It reflects our continued commitment to leading educational innovation, empowering students of all ages and backgrounds, and adapting to an ever-changing world. We celebrate these 35 years with gratitude, and at the same time, we look forward with enthusiasm, knowing that the best is yet to come.

Therefore, we invite you to learn about our initiatives and results achieved in 2023, which will open doors to knowledge and the human flourishing of thousands of our students worldwide. Together, we will continue to build a brighter, more accessible tomorrow for all.

2023 Report: an entire year of educational innovation and digital education

First, we would like to share with you our Institutional Strategy for Digital Education, whose objective is to define the criteria, processes, and enablers (ecosystem) for the deployment of digital education in undergraduate and graduate programs through educational units, courses, programs, and experiences characterized for their quality and innovation, as well as for ensuring added value for learning.

In our constant search to improve the quality of education and the scope of our projects and initiatives, we have compiled significant data and numbers that shed light on the profound impact of educational innovation at Tecnológico de Monterrey. You will also learn about the results of our digital education programs and their influence on continuing learning.

Because educational innovation and digital learning are drivers of transformation in all our schools and programs, our institution is proud to offer innovative educational experiences that transcend traditional boundaries. Whatever your area of interest, we invite you to explore how we redefine education. Discover how we embrace technology, creativity, and a passion for learning, preparing our students for a challenging future.

Likewise, we invite you to learn in detail about our initiatives and drivers of innovative digital educational experiences. You will find a wide range of topics ranging from adaptive learning to the most innovative educational trends. Discover how we harness the power of emerging technologies, create innovative educational spaces, and foster internationalization in our pedagogical practices.

On this occasion, for the first time in our reports on educational innovation and digital education, we invite you to learn how we have incorporated Artificial Intelligence into the educational process, once again reconfiguring the traditional paradigms of knowledge acquisition. We share with you how we use techno-pedagogy with AI to design innovative educational resources and how we prepare our teachers and students for the future through research, case studies, and developing special projects.

Our educational innovation and digital education impact is not limited to our classrooms but extends globally. Learn how Tecnológico de Monterrey has made its mark worldwide through certifications, publications, and recognitions. Our international prestige results from our constant commitment to excellence and significant educational contributions.

In the following pages, we invite you to discover how our vision has shaped the future of education and how committed we are to continue leading the way toward quality, accessible teaching adapted to the demands of a constantly evolving world. Welcome to the report on the educational revolution that we experienced during 2023! Let this be a sample of what happened during an entire year of educational innovation and digital education at Tecnológico de Monterrey, as well as a glimpse and a promise of the exciting challenges and opportunities to come.

Institutional Strategy for Digital Education

Tecnológico de Monterrey, with 80 years of history in higher education, is recognized today as an innovative and cutting-edge institution in Mexico and the world.

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Part of this distinction comes from its constant commitment to incorporating new pedagogical methodologies and innovative technology to enrich its educational model.

Aligned with this vocation, for more than 35 years, Tecnológico de Monterrey has formalized actions to promote digital education in its High School, Undergraduate, Graduate, and Continuing Education educational programs. Several initiatives have been designed and implemented for learning in a distance modality and hybrid and face-to-face programs enriched with technology during this trajectory.

Derived from the institutional experience and the learning obtained during the COVID-19 pandemic, in September 2022, a process to redefine the digital education strategy in the institution for the following years began. The definition, vision, and strategic objectives were generated, and priority projects for the following years were identified.

Definition

At Tecnológico de Monterrey, digital education is the intentional, systematic, and conscious application of innovative techno-pedagogy in the digital learning experiences generated throughout the student's journey. Digital education goes beyond distance courses since it also integrates digital learning experiences in face-to-face courses and at different moments of student life, where students learn using technology.

Vision

Tecnológico de Monterrey aims to be recognized nationally and internationally for its leadership in quality Digital Education.

To achieve this, it must ensure the best digital learning experiences based on the use of technology that offers value to the learning of all students throughout their student life.

Strategic objectives

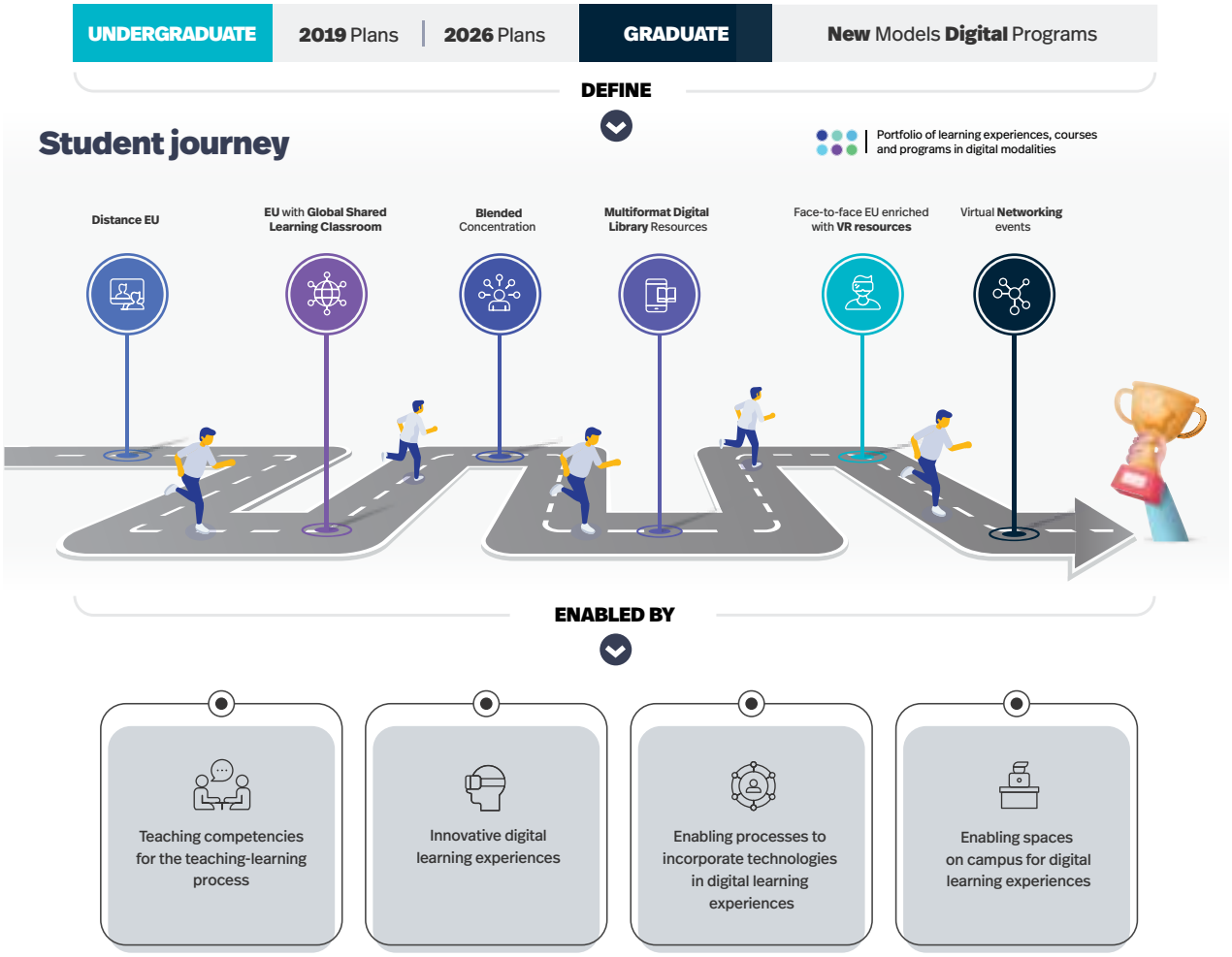
- To be an institution recognized for its quality education.
- Strengthen and grow digital learning experiences within the Tec community.
- Offer a personalized digital learning experience.
- Expand the global presence of the institution.
- Promote inclusion and accessibility.

Priority projects

1. Build a portfolio that integrates learning experiences, face-to-face, mixed and distance educational units (EU)*, as well as academic programs in digital modalities.
2. Support teachers in developing the necessary competencies to deploy the portfolio with the offer of educational units, programs, and digital experiences.
3. Develop innovative educational solutions that ensure deep and lasting learning in students.
4. Design and implement the spaces and processes facilitating this digital education on all institution campuses.

*A educational unit is made up of learning activities with academic credit that a student carries out under the guidance of a teacher, as well as those carried out independently. The educational units with academic credit can be: Blocks, Tec21 Courses and Tec Weeks.

General scope of the Institutional Digital Education Strategy



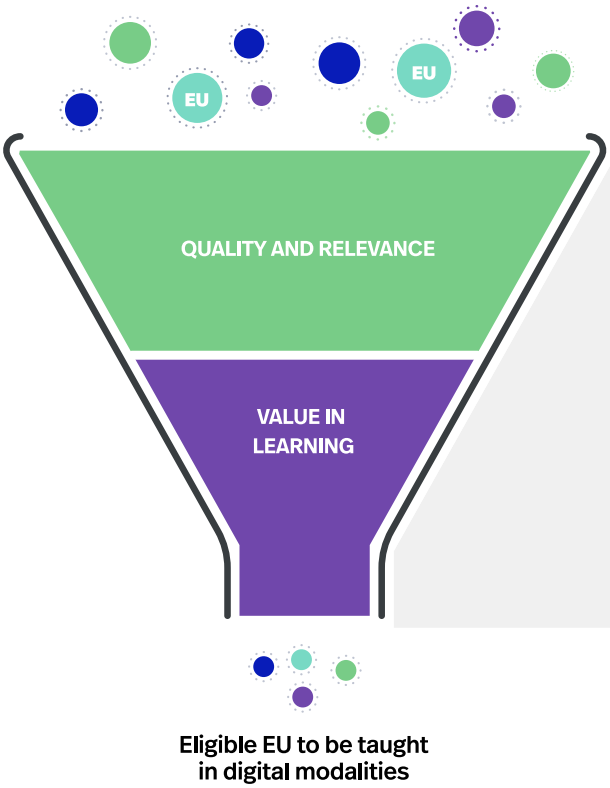
For an adequate deployment of digital education, it is essential to have guidelines, guides, quality criteria, and clear definitions of the digital modalities offered in the institution. The documents developed for this purpose are the following:

1.1 Definition of guidelines and premises that guide the National Schools to deploy Undergraduate and Graduate digital education through digital learning experiences, educational units, and academic programs.

1.2 Framework of eligibility of subjects in digital formats to ensure that the curricular structure and the identification of the subjects that may be eligible in digital modalities are determined in face-to-face programs for their relevance, quality, and value of the modality in the learning of each academic program, both at the Undergraduate and Graduate levels.

Framework for the definition of educational units (EU) in digital modalities

Using this framework, the educational units fit for teaching in a digital modality can be defined at the curriculum design level:



During the design of the curricular structure

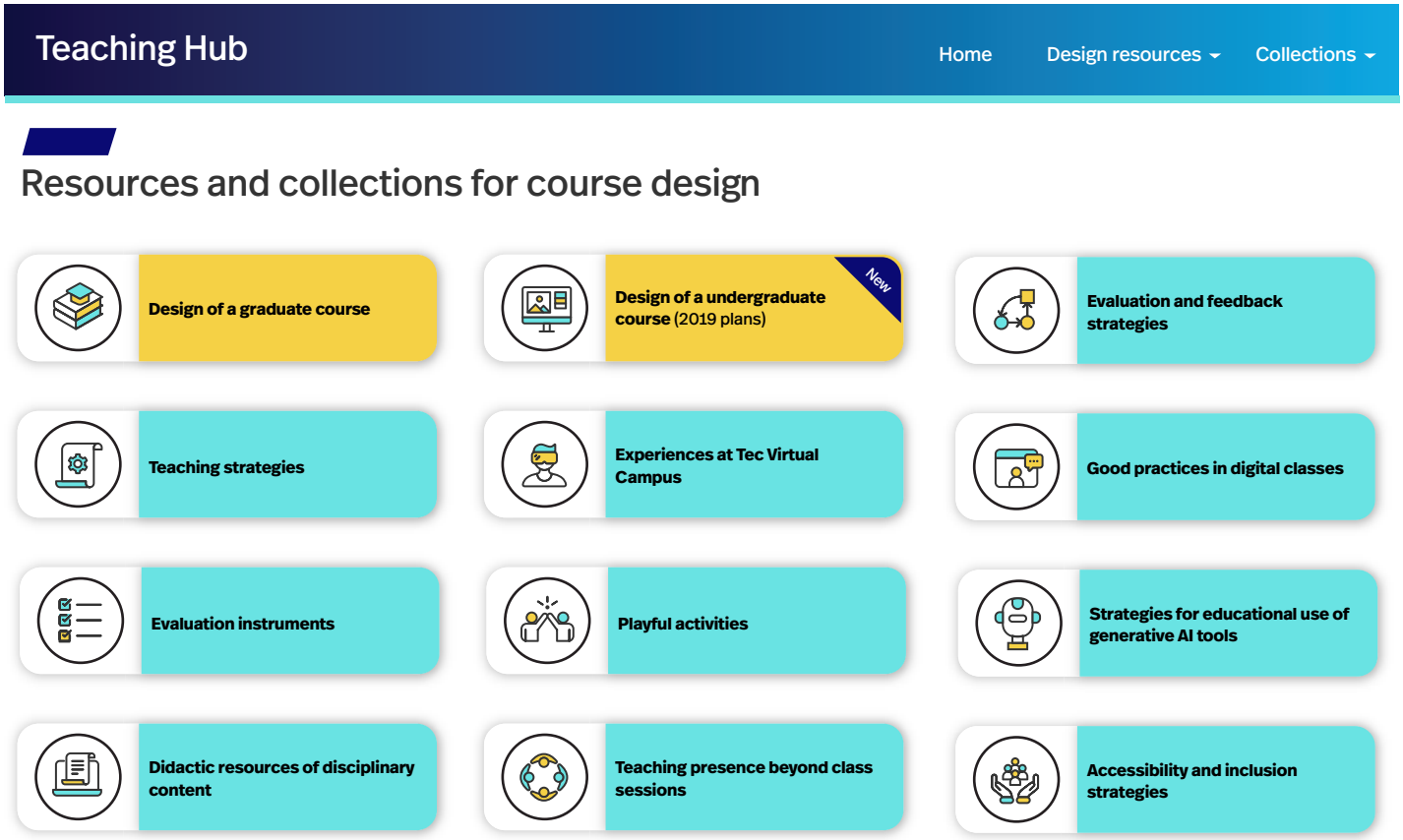
It is established whether or not **the EU is eligible to be taught in digital mode**, without determining whether it will be mixed or distance learning, and whether or not in practice it will be offered in said mode.

1.3 Eligibility framework for digital modality programs is a support tool to determine if a program can be offered in a digital modality, considering its relevance, quality, and value of the modality in said program.

1.4 Criteria to guarantee the planned, conscious, and intentional integration of digital learning experiences within the study plans and throughout the student's journey.

On the other hand, an instrument for evaluating digital competencies was designed and applied to more than 1,000 teachers to determine teacher training needs and integrate them into the faculty's development plan.

The Teaching Hub digital space was created, containing more than 300 innovative teaching resources and strategies for self-managed use by a teacher.



Source: https://tecmx.sharepoint.com/sites/TeachingHub

An analysis of pain points and distinctive elements of the digital modality was conducted, from which a series of pilots and deployments were designed throughout the year, which are detailed in the following pages.

Impact of educational innovation

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4.1 Educational innovation in numbers

As a result of the strengthening of educational innovation and digital education, during 2023 there was an increase of more than 40% in the number of projects implemented by the National Schools, through different institutional initiatives. A total of 446 innovative and digital education projects were registered, with the participation of 670 teachers, and impacting more than 50,000 High School, Undergraduate, Graduate, Continuing Education and LiFE students.

Of the 446 projects developed in distance, mixed and face-to-face modalities, 402 are linked to a training unit, while 44 are related to educational innovation to impact the students' experience positively.

Below are the impact indicators in 2023.

Impact of educational innovation and digital education

446
PROJECTS

201
EDUCATIONAL UNITS

670
PARTICIPANT TEACHERS

53,725
*STUDENTS-COURSE

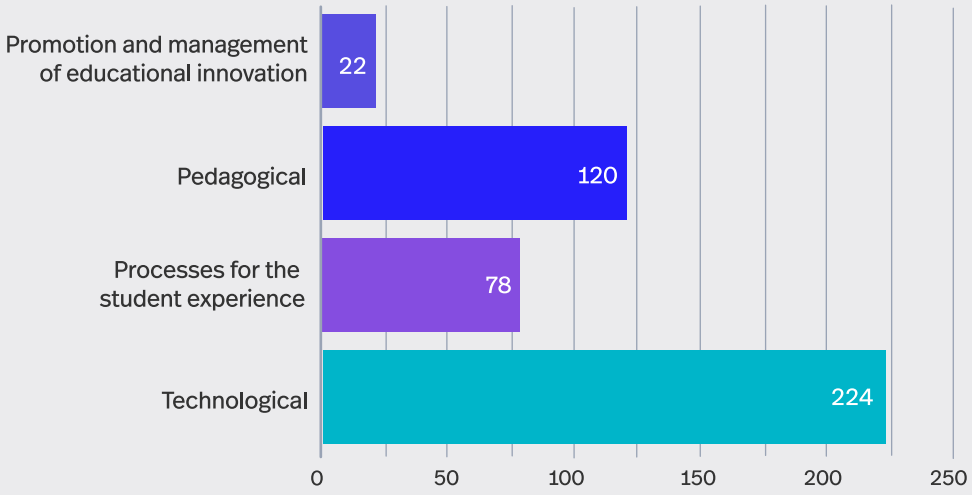
*Students who participated in more than one innovative and digital experience.

Educational innovation and digital education projects for the transformation of the teaching-learning process and educational experience

The incorporation of significant changes in the teaching-learning process of students through educational innovation and digital education initiatives has made it possible to transform pedagogical, technological, and educational experiences. The promotion and management of innovative experiences have also been a priority.

The following graph shows the distribution of innovative and digital projects in 2023, according to educational innovation categories.

Projects based on educational innovation categories

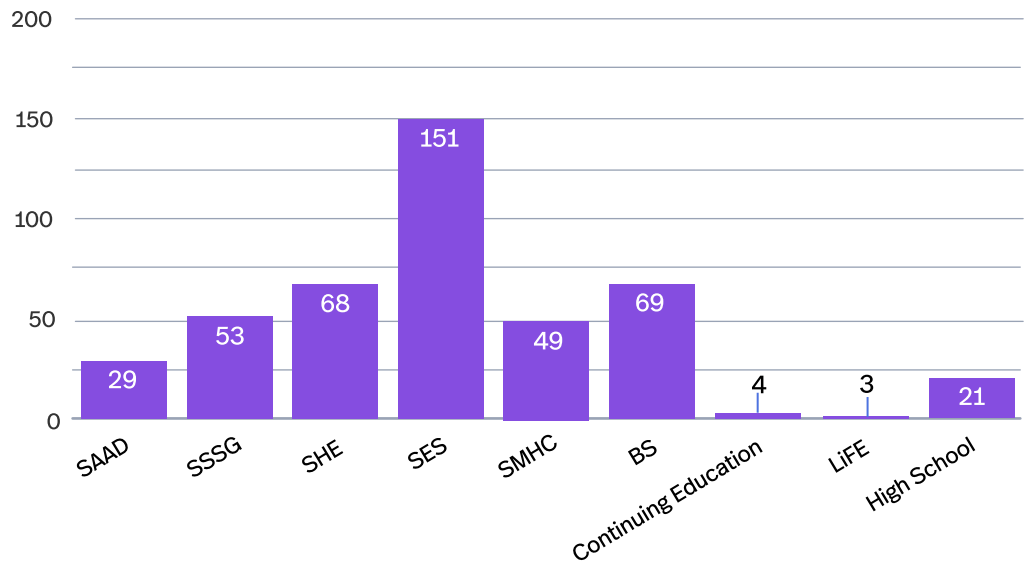


Educational innovation and digital education projects in National Schools, Continuing Education and LiFE

The impact of educational innovation and digital education implemented by teachers at the National Schools, Continuing Education, and LiFE increased the quality of the teaching-learning process for the construction of positive emotions and the enrichment of new learning experiences for Tecnológico de Monterrey's students.

The following graph shows the number of educational innovation and digital education projects developed by the National Schools, Continuing Education and LiFE during 2023. It should be noted that some of the projects impacted more than one school.

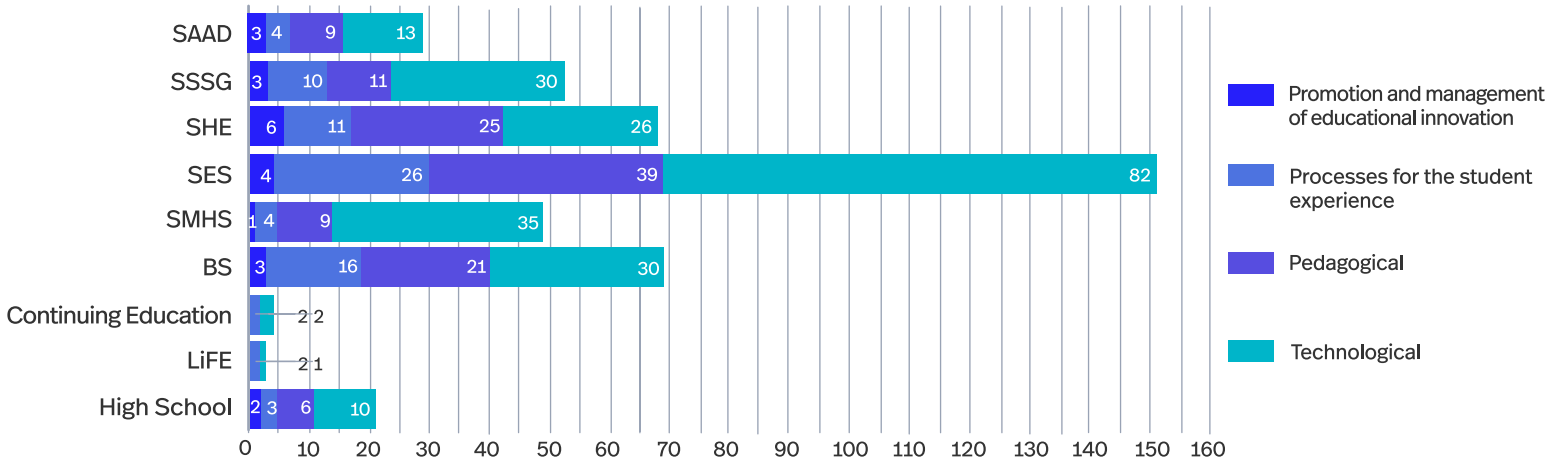
Projects by School, Continuing Education and LiFE



The adjustments generated by educational innovation in the teaching-learning process caused significant changes for the transformation, transparency, efficiency, improvement and quality of the education offered by the National Schools, Continuing Education and LiFE, through the different delivery modalities.

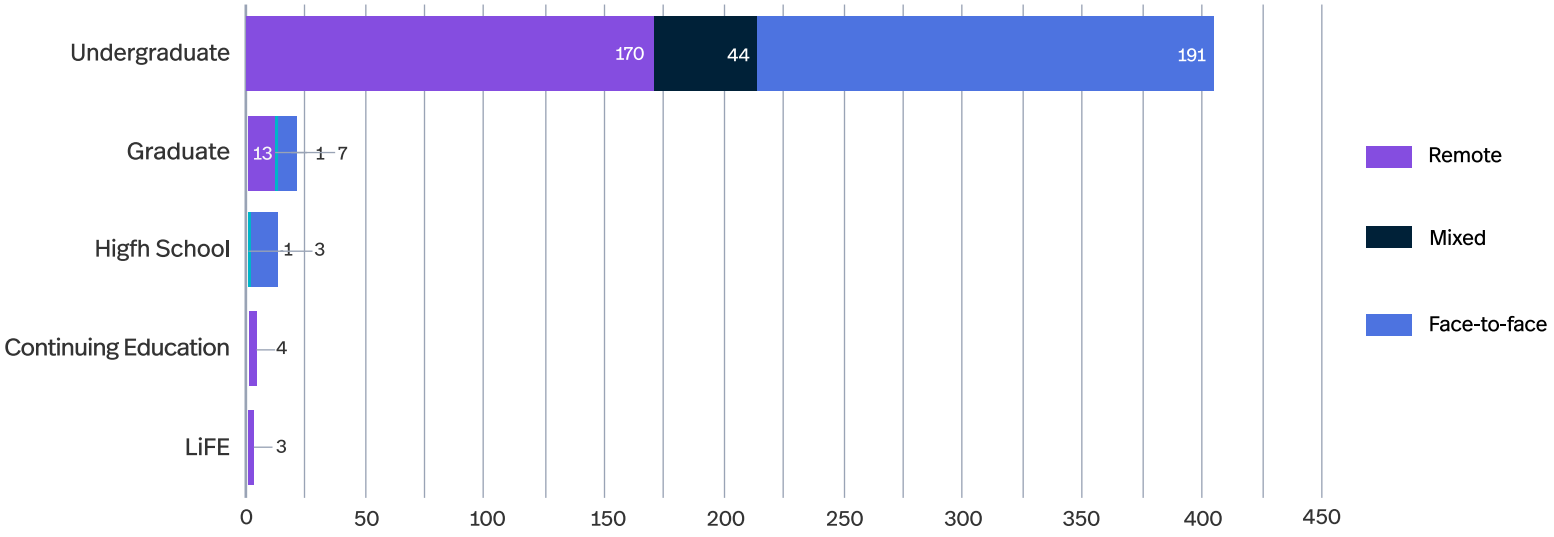
The following graph shows the promotion of educational innovation and digital education by the National Schools, Continuing Education and LiFE, based on the categories of educational innovation during 2023. It should be noted that some of the projects impacted more than one School or institutional initiative.

Projects by School, Continuing Education and LiFE based on educational innovation categories



In 2023, several components of educational innovation and digital education were incorporated into the different academic levels, Continuing Education and LiFE, taught in distance, mixed and face-to-face modalities. The following graph shows the number of projects and delivery modalities.

Projects by academic level, Continuing Education and LiFE, and delivery modality



Impact of digital education

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Digital education at Tecnológico de Monterrey is an institutional strategy that ensures meaningful learning experiences for its students by applying innovative pedagogies that integrate digital media and technologies.

During 2023, different modalities of digital education were taught, opening the possibility of offering meaningful learning experiences in different environments. The impact of these experiences is presented in the following pages.

Delivery format

General way in which a educational unit is offered, taking into consideration the degree to which the use of teaching technologies and strategies impact and transform the different components of the teaching-learning process, as well as the time in which the interaction occurs, between teachers and students, the required infrastructure and the proportion in which there may be variations in these elements throughout the educational unit.

Face-to-face format	Digital format		
Face-to-face EU	**Blended EU**	**Synchronous remote EU**	**Remote asynchronous EU**
Educational unit designed for a completely real-time experience in the same physical space inside or outside the Institution's facilities, in accordance with the policies defined for it. It is enriched with digital learning experiences.	Educational unit designed for an experience that intentionally and interconnectedly combines in-person and remote moments (synchronous or asynchronous) not simultaneously. Integrates technological-pedagogical solutions.	Educational unit designed for a completely real-time experience, through synchronous interaction tools. It integrates technologies and pedagogies under a systemic approach in the teaching-learning process (techno-pedagogical solutions).	Educational unit designed for an experience completely mediated by technology through a digital environment, without the need for real-time coincidence, providing monitoring and support of students through technological means. Integrates technological-pedagogical solutions.

5.1 Digital education in numbers

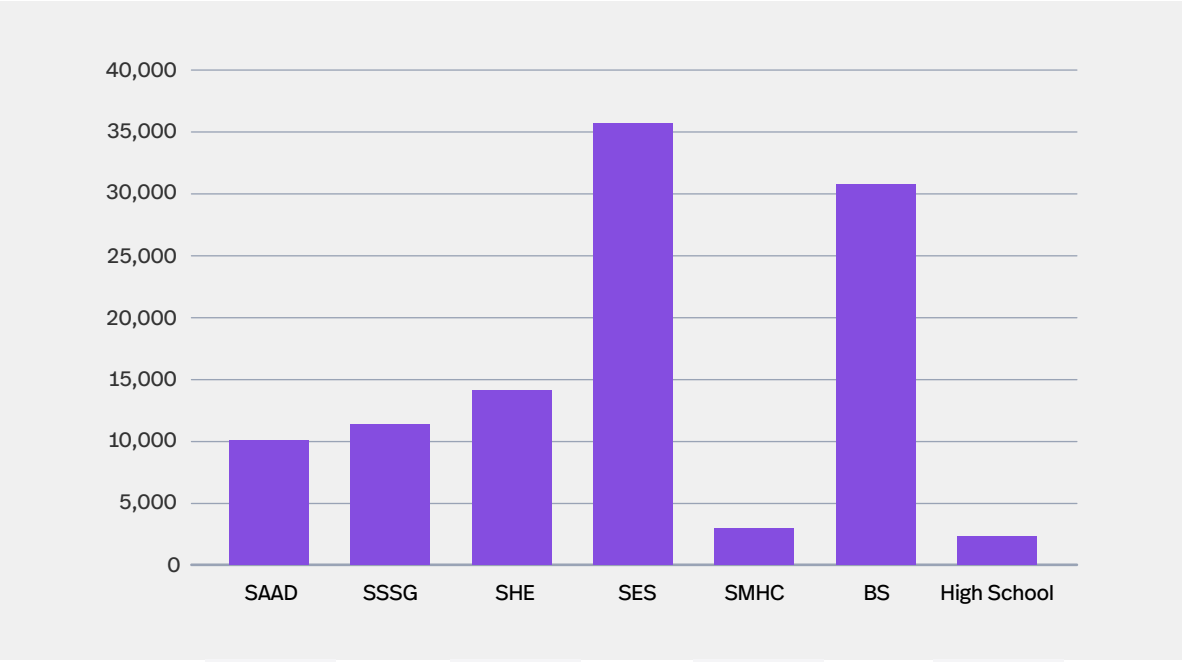
During 2023, the digital education initiative was consolidated as a relevant institutional strategy, allowing meaningful learning experiences to be provided to students inside and outside the classroom.

Below is the students-course list enrolled in groups by digital modalities, according to the different study levels.

	High School	Undergraduate	Graduate	Education for life
Students-course	2,555	86,519	20,067	75,122
Groups	178	3,730	1,077	Not applicable

*Incluye Profesional, Posgrado y Preparatoria

Students-course per school and modality, at institutional level*



	SAAD	SSSG	SHE	SES	SMHC	BS	High School
Face-to-face	52,937	67,377	86,954	276,287	41,555	212,940	376,389
Digital	10,086	12,106	14,247	35,334	3,535	31,278	2,555
% that is digital	16%	15%	14%	11%	8%	13%	1%

***Includes Undergraduate, Graduate and High School.**

1,620
SUBJECTS

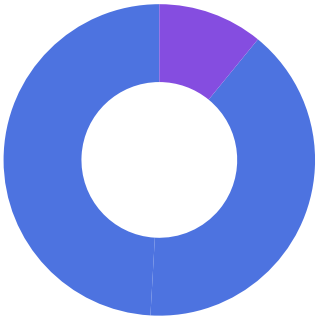
45% of the subjects has a digital version

4,965
GROUPS

50,556 (**91%**) face-to-face
4,965 (**9%**) digital

2,198
TEACHERS

14% of teachers teach courses in digital mode

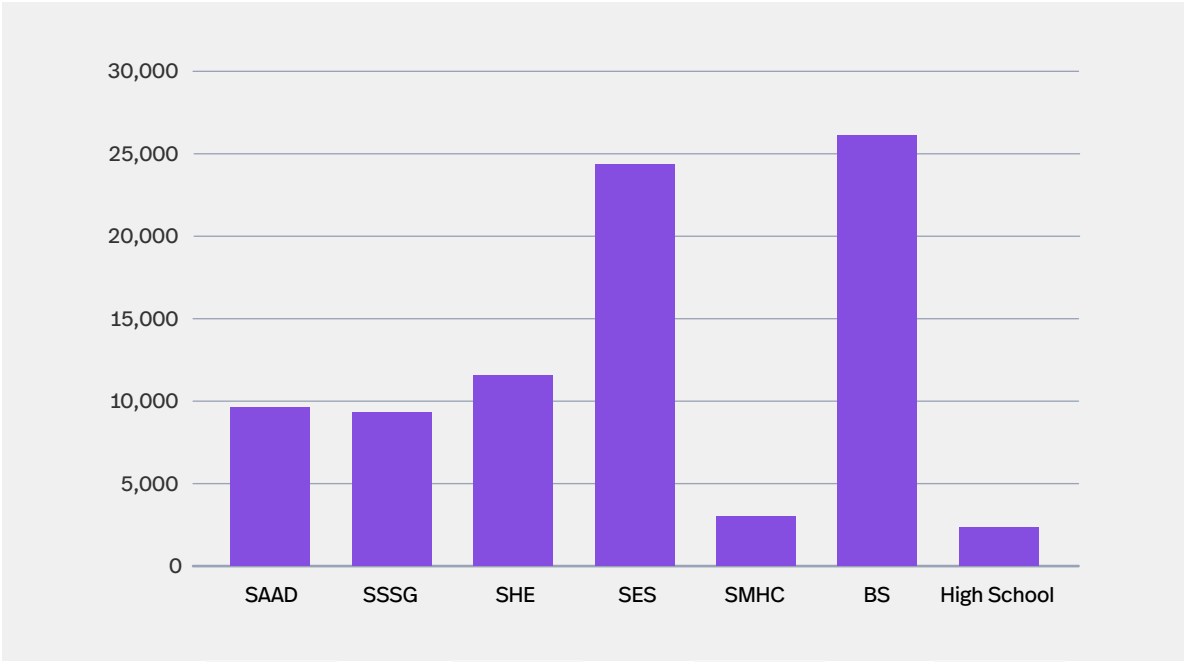


Enrolled students-course

- **91%** face-to-face modality
- **9%** digital

Source: SAP BO DWH Escolar, January-December 2023 period. Data includes Undergraduate, Graduate and High School.

Students-course per School and modality, at High School and Undergraduate programs



	SAAD	SSSG	SHE	SES	SMHC	BS	High School
Face-to-face	52,843	67,003	86,195	272,546	41,093	200,745	376,389
Digital	9,955	9,865	12,081	24,960	3,535	26,123	2,555
% that is digital	16%	13%	12%	8%	8%	12%	1%

Undergraduate

1,108
SUBJECTS

43% of the subjects has a digital version

3,710
GROUPS

32,055 (**89%**) face-to-face
3,710 (**11%**) digital

1,759
TEACHERS

14% of teachers teach courses in digital mode

High School

33
SUBJECTS

11% of the subjects has a digital version

178
GROUPS

14,853 (**99%**) face-to-face
178 (**1%**) digital

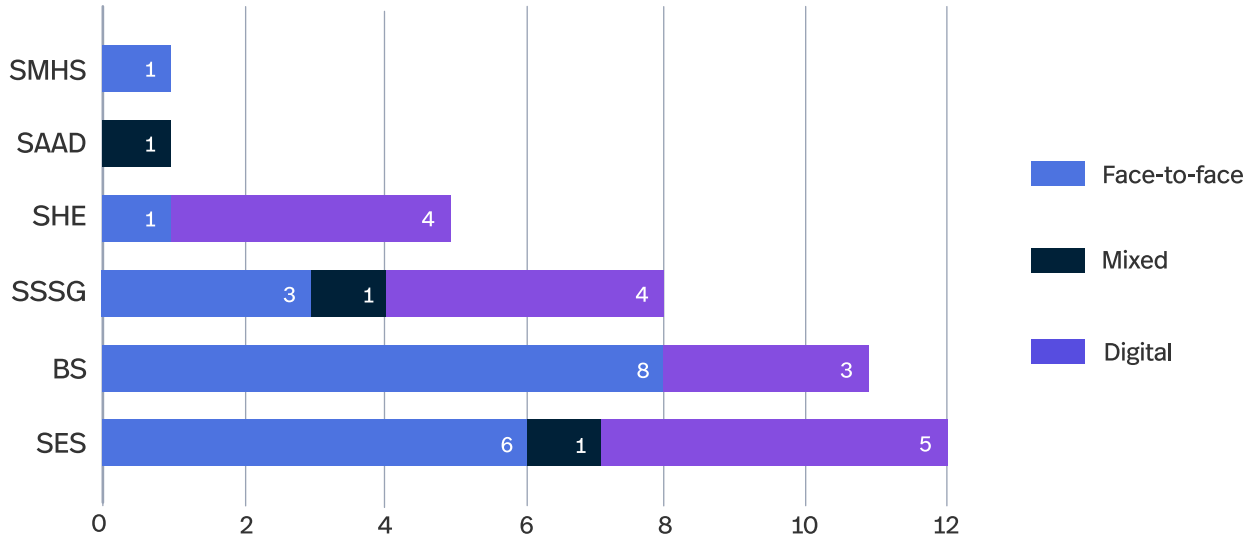
66
TEACHERS

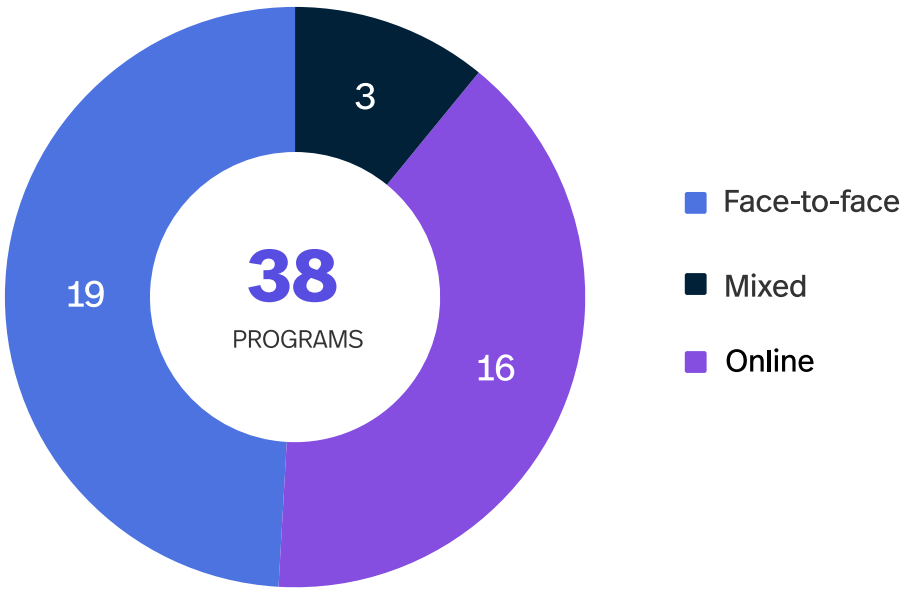
14% of teachers teach courses in digital mode

Source: SAP BO DWH Escolar, January-December 2023 period.

Graduate Programs per teaching modalities

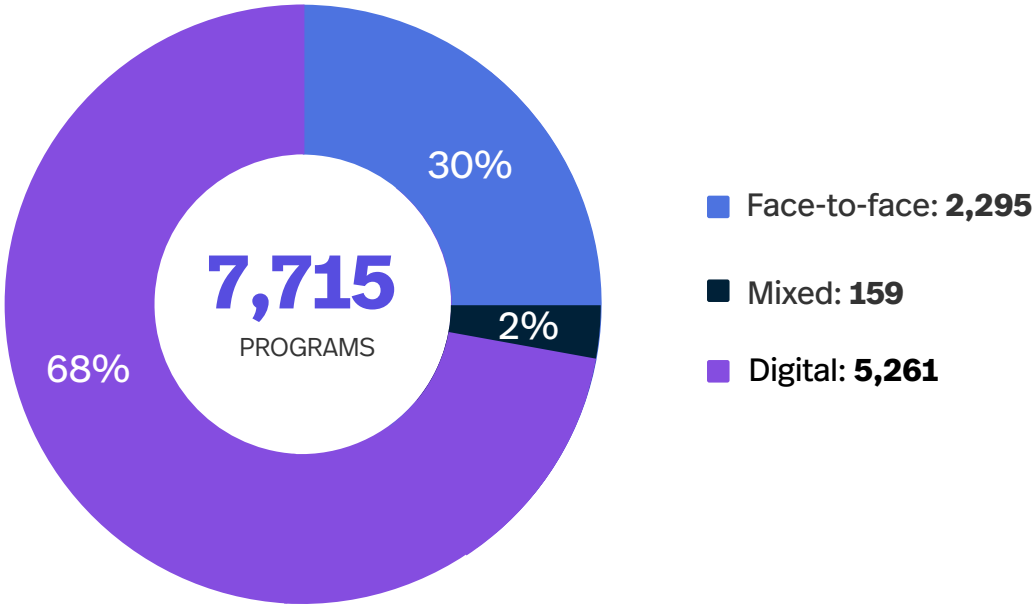
Tecnológico de Monterrey offers a wide variety of complete Graduate programs in digital modalities. In 2023, 38 Master's programs were offered. Below is the distribution per School:





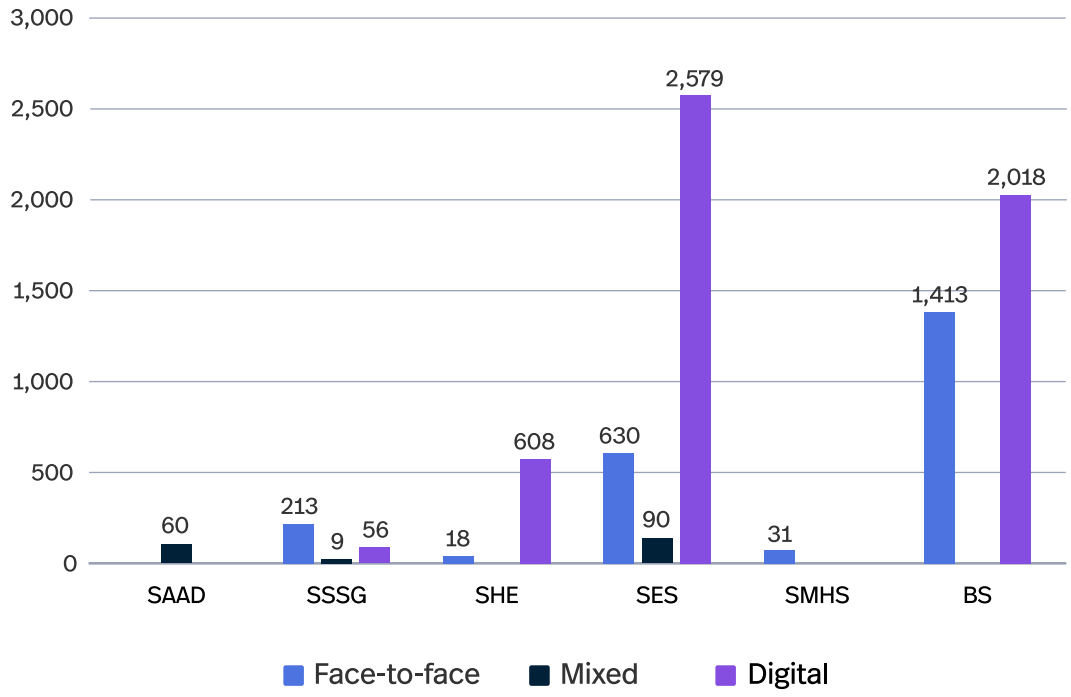
The list of online Master's degrees can be consulted at:
https://maestriasydiplomados.tec.mx/maestrias-en-linea

Distribution of Master's students enrolled in face-to-face and digital programs*



*Data of the student-persons enrolled in each modality.

Students enrolled in Master's programs per School*



*Data of the student-persons registered in each modality and School.

In 2023, 458 students graduated from digital programs, resulting in a cumulative total of 37,956 graduates.

5.2 Education for life in numbers

The Education for Life offer encourages lifelong learning, at any time and in all possible ways, including formal courses or self-taught education. This constant preparation of people is essential for comprehensive development in all aspects of life, and to be able to meet the challenges of ever-changing labor markets. Below are the different programs that Tecnológico de Monterrey offers as part of Education for Life.

Continuing Education

In 2023, the Digital Continuing Education offer was consolidated as The Learning Gate, an innovative, high-impact learning ecosystem, with a flexible and on-demand model.

In March, phase 2 of content production was completed in The Learning Gate, with 270 competencies and subcompetences on the market, conglomerated in 11 learning trajectories on the topics of: Leadership, Data Science, Finance, Marketing and Sales. This portfolio represents +2,000 hours of learning and includes +20,000 learning resources.

In June, TLG Generation and TLG Flex were launched on the market, within The Learning Gate:

- At TLG Generation, the learner has the possibility of having strategic support to promote their development, as well as a generation with whom they can connect and share knowledge. Additionally, the learner has live advisory sessions with experts before each application challenge.
- In TLG Flex, the learner has all the flexibility to advance their career at the pace they consider.

In November, industry badges were added to The Learning Gate's offering, launching the "IBM Data Science Practitioner Certificate", "Microsoft Certified: Power BI Data Analyst Associate" and "Cisco Data Analytics Essentials" programs.

For more information about the new programs, consult the section on innovative and digital educational experiences at the institution, corresponding to Continuing Education.

Below are the most notable numbers during 2023:

- **81%** of the offer of catalog courses in digital format (339)*
- **18%** of the students enrolled in catalog courses are EXATEC
- **55%** of the course offering for companies was in digital format (339)
- **89%** of students enrolled in business courses take them in digital format (94,451)
- **1,261** teachers
- **60,565** certificates granted
- **85** Net Promoter Score (NPS)** in digital catalog courses and **88** NPS in business courses

Notes:
*A catalog course is a course open to the general public.
**Net Promoter Score has a scale of -100 to +100. Source: Planning and Effectiveness Directorate of the Vice-Rector's Office for Continuing Education. Data until December 2023.

MOOC

MOOC (Massive Online Open Courses) are of great importance at Tecnológico de Monterrey due to their strong impact on universal distance education, as a tool for attracting students and as an alternative offer of Continuing Education, accumulating 192,491 enrolled students during 2023. Among the distinctive characteristics of MOOC, their asynchronous format and the possibility that the participant can obtain a verified digital certificate stand out.

Below are the most representative numbers in 2023 for the Coursera, EdX and bootcamp platforms, both from the general public and the Tec community, including students and collaborators from the institution.

Coursera

- **151,153** enrolled students
- **88** active courses, of which **7** are new
- **20** specialized programs
- **105** teachers
- **37.8%** students completing courses
- **4.8** satisfaction index*

Note:
*The satisfaction index is measured on a scale of 0 to 5, where 5 is the highest score. Data up to December 2023.

EdX

- **41,239** enrolled students
- **91** offering options
  - **74** courses
  - **4** micro-masters
  - **13** undergraduate certificates

Source: Department of Alternative Credentials. Data up to December 2023.

Bootcamps

- **99** enrolled students
- **3** bootcamps

Social programs

These programs seek to promote social inclusion and equality through social impact and transformation to improve quality of life, promote the sustainable development of communities, and reduce educational lag in Mexico and Latin America. In this sense, Tecnológico de Monterrey offers the following distance social programs: Prepanet and Virtual Learning Center.

Likewise, in 2023 the alliance between Tecnológico de Monterrey and the BBVA Foundation was consolidated to extend the reach of the "Supérate" initiative, which provides the opportunity to level up knowledge and skills for middle and high school students through a personalized training path.

Prepanet

This is a program that offers online High School education, of high academic quality, focused on people from situations of social inequality. Below are the most representative results of Prepanet obtained during 2023:

- **3,046** students (1,219 new entrants)
- **21,611** students-course
- **31** courses
- **5,944** graduates
- **1,810** undergraduate students who participated as tutors in their social service

Source: National Directorate of Prepanet. Data up to December 2023.

Virtual Learning Center

This social program promotes access to quality education through a virtual learning community; provides training through educational resources and free courses, as well as through the Network of Community Learning Centers (CLC). The CLC are physical spaces where girls, boys, young people and the community in general, mostly from isolated areas, in progress, with limited general resources and lacking educational resources, go to develop skills and abilities to continue with their academic studies, undertake or enter the job market.

Their portal Virtual Learning Center, registered 547,455 visits in 2023, adding a total of 16,673,200 visitors from 2011 to date. The center offers two types of courses: one self-study and another with academic follow-up. In the latter, the student receives support from a teacher and tutor in their learning process. During 2023, 17 teachers and 94 students of undergraduate careers from the Tecnológico de Monterrey participated as tutors, as part of their social service, adding up to a cumulative total of 389 teachers from the institution and 5,777 students to date.

Here are the most representative results of the work carried out in this center during 2023.

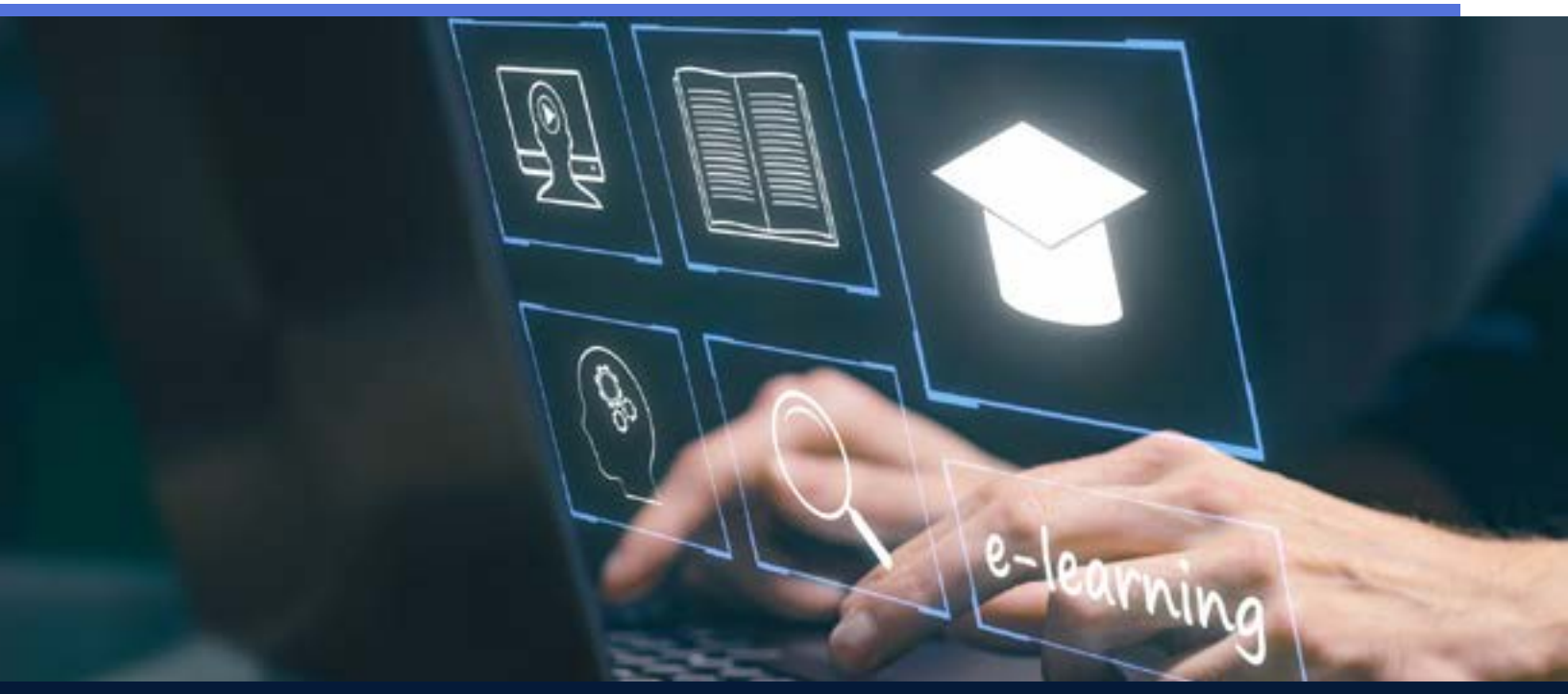
Self-study

- **4,112** students
- Accumulated number of benefited students: **492,315**
- **100** courses
- Accumulated graduates: **1,781**

Academic follow-up

- **120** students
- Accumulated students: **259,613**
- **16** courses
- **43** students completed the program
- Accumulated graduates: **78,023**

Source: Directorate of Education for Development, School of Humanities and Education, of the Tecnológico de Monterrey. Data up to December 2023.



"Supérate" initiative

Tecnológico de Monterrey, in collaboration with the BBVA Foundation, developed this online platform. It was designed as a learning ecosystem that provides the opportunity to level knowledge and skills to middle and high school students based on a diagnosis that identifies areas of opportunity to create a personalized training path.

Its general objective is to reinforce students' academic, psychological, and socio-emotional development in a fun and accessible manner so they can achieve academic success.

The areas of knowledge on the platform are verbal reasoning, mathematical thinking, school persistence, psychological capital and emotional intelligence, and leadership.

The platform has a section for teachers, offering educational resources to reinforce mentoring skills and more information about the content their students will review on the platform. Additionally, it is possible to create groups to monitor the academic performance of a class and have a virtual classroom that allows communication and sharing of additional educational resources for students.

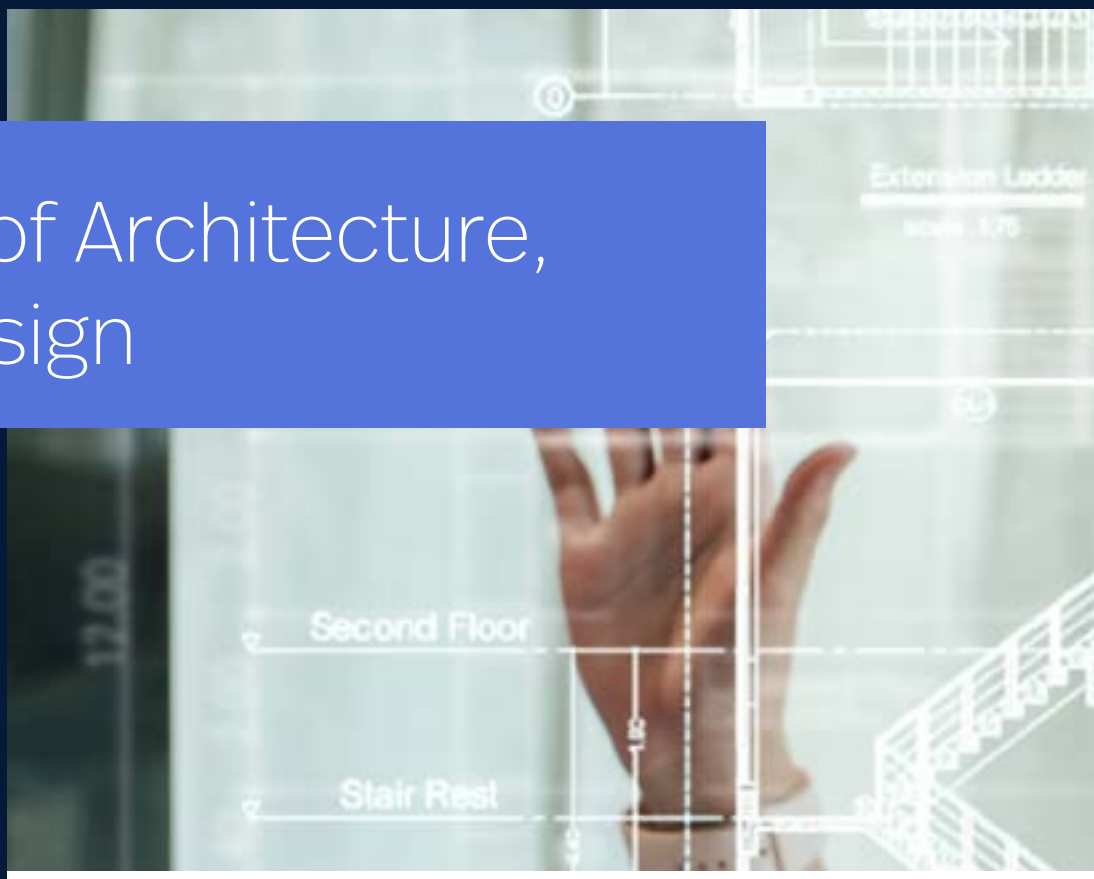
Initially, "Supérate" was focused only on BBVA Foundation scholarship holders, but in 2023 the alliance was formalized with Tecnológico de Monterrey to extend its reach to the community in general. During 2023, the platform impacted approximately 150,000 students.

Source: https://www.superateconfundacionbbva.mx

Innovative and digital educational experiences at the institution

06

6.1 School of Architecture, Art, and Design



Educational innovation and digital education at the School of Architecture, Art and Design

29 Projects

16 Educational units

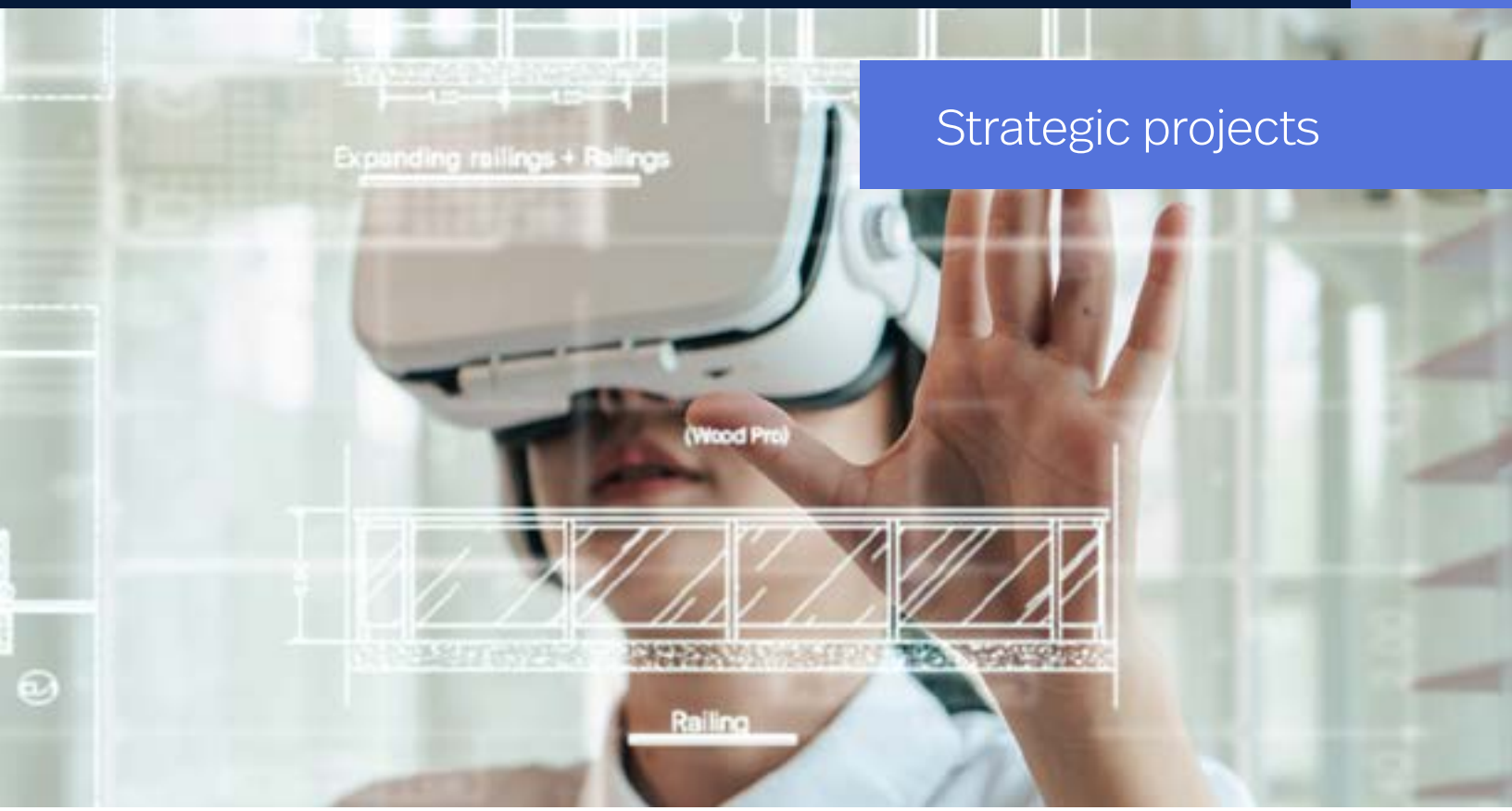
57 Teachers

1,962 Students-course

The four disciplines (Architecture, Art, Design and Urbanism) that the School brings together, are characterized by their ability to propose creative solutions and carry out multidisciplinary projects.

In 2023, the teachers of the School of Architecture, Art and Design generated different strategies inside and outside the classrooms, in different sociocultural contexts and even in the Tec Virtual Campus educational multiverse, with the aim of enriching the students' learning processes.

The following educational innovation and digital education projects show an intersection between the use of various Artificial Intelligence tools and traditional educational techniques. This intersection has allowed us to generate a more dynamic learning ecosystem, as well as overcome some geographical barriers. Thanks to these efforts, it has been possible to offer high-value experiences for students, also enriching them with the involvement of different actors from society in real life.



Strategic projects

Virtual experiences and traditional impact dynamics

Social impact + UN SDG + Active Learning

Development of emerging housing projects for vulnerable groups through a mix of multiple dynamics and approaches (social impact + UN SDG + inspiration + Active Learning + teaching techniques + class dynamics).

The project was developed in the educational unit "Innovation and creative processes".

Impact

243 students from the Mexico City Campus

Designer teacher

Ricardo Aguayo

Tenso structures

Carrying out a "wail" with resources shared by the entire group of students, with the aim of helping them identify the materials used in its preparation.

The project was developed in the educational unit "Modeling of Physics in the built environment: Statics".

Impact

107 students from the Mexico City Campus (August-December 2023)

Designer teacher

Jorge A. Alcérreca

Design, innovation and technological entrepreneurship

Development of products with recycled material for Walmart, in collaboration with the INVOMEX Industrial Group (investor) and REINCO (eco-petrochemical) with a technological and business focus.

The project was developed in the educational unit “Design, innovation and technological entrepreneurship”.

Impact

31 students of the Monterrey Campus (August-December 2023)

Designer teachers

Alejandro Vázquez
Ángel M. Gutiérrez
Hiram J. Uribe
Jorge A. Garza
José E. Grimaldo

XLab | How space can? | Architecture final year project

Developed in the subject “Final degree project”, it questions whether the space should be intervened in the future, under a multidisciplinary vision and exploration of cutting-edge topics through telling complex stories and narratives.

Impact

28 students of the Puebla Campus (February-June 2023)

Designer teachers

Anabel P. Barreda
Daniel Savedra

Creation of a trans-media narrative, building a Goldberg machine

Creation of a Goldberg machine, with the support of the Gadgeteer game and physical resources. From this experience, the students identified the relevance of communication between the physical and digital world, as well as the importance of experimentation and creativity in any discipline and profession.

The project was developed in the educational unit “Immersion and creative experimentation”.

Impact

81 students of the Mexico City Campus (February-June 2023)

Designer teacher

Octavio Méndez

Monographic Comic

The students developed a monograph of an architectural work, narrating and describing it from the format of a comic with the support of software resources.

The project was developed in the educational unit “The conceptualization of space, its theory and its history.”

Impact

46 students of the Puebla Campus (August-December 2023)

Designer teacher

Fernando Curiel

Research Stays

The general objective of the stay was to develop a research focused on studying the use of markers, markers and similar, as a tool to enhance the skills and attitudes of design students.

The project was developed in the “Research Stay” educational units.

Impact

2 students of the Monterrey Campus (August-December 2023)

Designer teacher

Juan C. Rojas

Technological innovation

Virtual Reality "Van Gogh"

Practice in the Mozilla Hubs interaction space. The project was developed in the educational unit "Visual and sound culture".

Impact

75 students nationwide (August-December 2023)

Designer teachers

Alejandro Acuña
Paola I. Gámez
Piedad Martínez

Virtual Reality, Health and Wellness

Immersive educational experience focused on the UN SDG Health and Wellbeing, in which students explore the concept of health, questioning whether physical inactivity can be considered a disease. The resource guides students towards self-reflection, encouraging them to select physical activities to do at home, promoting healthy habits.

The project was developed in the educational unit "Innovation and creative processes".

Impact

331 students nationwide (February-December 2023)

Designer teachers

Esmeralda Niño
Horacio I. Rodríguez
Laura P. Zepeda
Marcela Romero
Marcos G. Gallardo
Martha E. Núñez
Rebeca E. Alvarado
Rocío E. Cortez

Experimentation Class

The Class tool was used to generate an interactive virtual environment. Teachers and students accessed functionalities that enriched the distance educational experience, synchronously. This experience allowed us to use and test innovative strategies such as gamification, through the use of stars visible to all students, providing a playful and motivating touch to educational activities.

The project was developed in the educational units "Innovation and creative processes", and "Conceptualization of space, its theory and its history".

Impact

61 students nationwide (February-June 2023)

Designer teachers

Lilian Salazar
Rebeca E. Alvarado

Hologram teachers

Innovative educational experience based on telepresence that recreates the natural dynamics of in-person environments through the use of technology that simulates a hologram effect.

The project was developed in the educational units “Application of design in entrepreneurial projects” and “Regenerative design”.

Impact

51 students of the Monterrey Campus (February-December 2023)

Designer teachers

Diana L. Riveral
Linda E. Ruiz

Participatory architecture of medium complexity

In this project, questionnaires and Virtual Reality resources were used to improve Architecture projects.

Impact

25 students of the Monterrey Campus (February-June 2023)

Designer teachers

Juan L. Higuera
Luis F. Villarreal

Other successful projects or experiences related to educational innovation and digital education during 2023 are presented below.

Smart feedback

This platform powered by Artificial Intelligence (AI), aims to simulate educational dialogues, fostering a conducive learning environment through emotional recognition and regulation. It begins with a board game that recreates feedback scenarios so that teachers or students identify emotions, reflect on themselves, and develop more meaningful responses. These responses are then input into a natural language processing AI tool. This AI component identifies emotions and transforms them into visual representations of emotional tonality, helping people adjust their speech to align with their preferred pedagogical approach. This innovative platform leverages AI to improve educational dialogues, fostering a more receptive attitude towards learning, through emotional awareness and response refinement. The project started in 2022 and was the best evaluated NOVUS project; currently participates in Reimagine Education. The AI platform has identified 7,309 emotions and the teachers who have used it have improved their students' opinions by 9%.

Impact

445 students of the Querétaro Campus (February-June 2023)

Designer teachers

Eduardo D. Juárez
Ivo N. Ayala
José M. Velázquez
Lilia C. Rodríguez
Mariana Maya

City Lab: the game

Through the design of a board game (in person), we sought to develop in students a better understanding of what urban planners do. The game integrates the representation of different roles within the planning of a city, the development of current problems that cities face, and a bank that allows measuring the economic impact of its proposals. As students get involved in the game, they can better develop the "Social Responsibility" competency. In a second edition, Artificial Intelligence was incorporated to make the role-playing experience more meaningful and allow for a deeper understanding of the complexity of public participation. Both the social responsibility competence and the game experience are measured with validated scales to be able to analyze the results and improve the quality of the experience in subsequent editions.

Impact

295 students of the Monterrey Campus (February-June 2023)

Participating teachers

Ana S. González
Edgar H. Macías
Julia K. de la Garza
Karen Hinojosa
Talía González

Performances Capture with Metahumans - Unreal Engine - Virtual Production

In this project, a monologue developed with the ChatGPT Artificial Intelligence tool was performed. It was produced with the animation technique of capturing body and facial movement with a cell phone camera. Hyperrealistic metahuman characters and scenarios were created with the UNREAL ENGINE video game engine. The students had the opportunity to receive two Master Classes for character development and interpretation through acting.

Impact

45 students of the Guadalajara Campus (August-December 2023)

Participating teachers

Andrés E. Santin
Copatzin E. Borbón
Imelda Asencio
Jesús G. Félix

The Futures Bazaar Mexico

In this workshop, participants developed tangible objects from countless possible worlds. For the first time in all its global editions, The Futures Bazaar México was carried out in a hybrid manner involving more than 150 students, professors and professionals from 7 campuses (Mexico City, State of Mexico, Guadalajara, Monterrey, San Luis Potosí, Northern Sonora and Toluca). The futurist Stuart Candy, and the leader of the Futures Design Lab in Monterrey, Yadira Ornelas, participated as speakers. In each of the participating campuses, teachers from the school supported by guiding the activities that were carried out locally. As part of the results of this experience, more than 50 speculative design products were developed, exploring different possibilities of the future, which invite us to reflect on current practices.

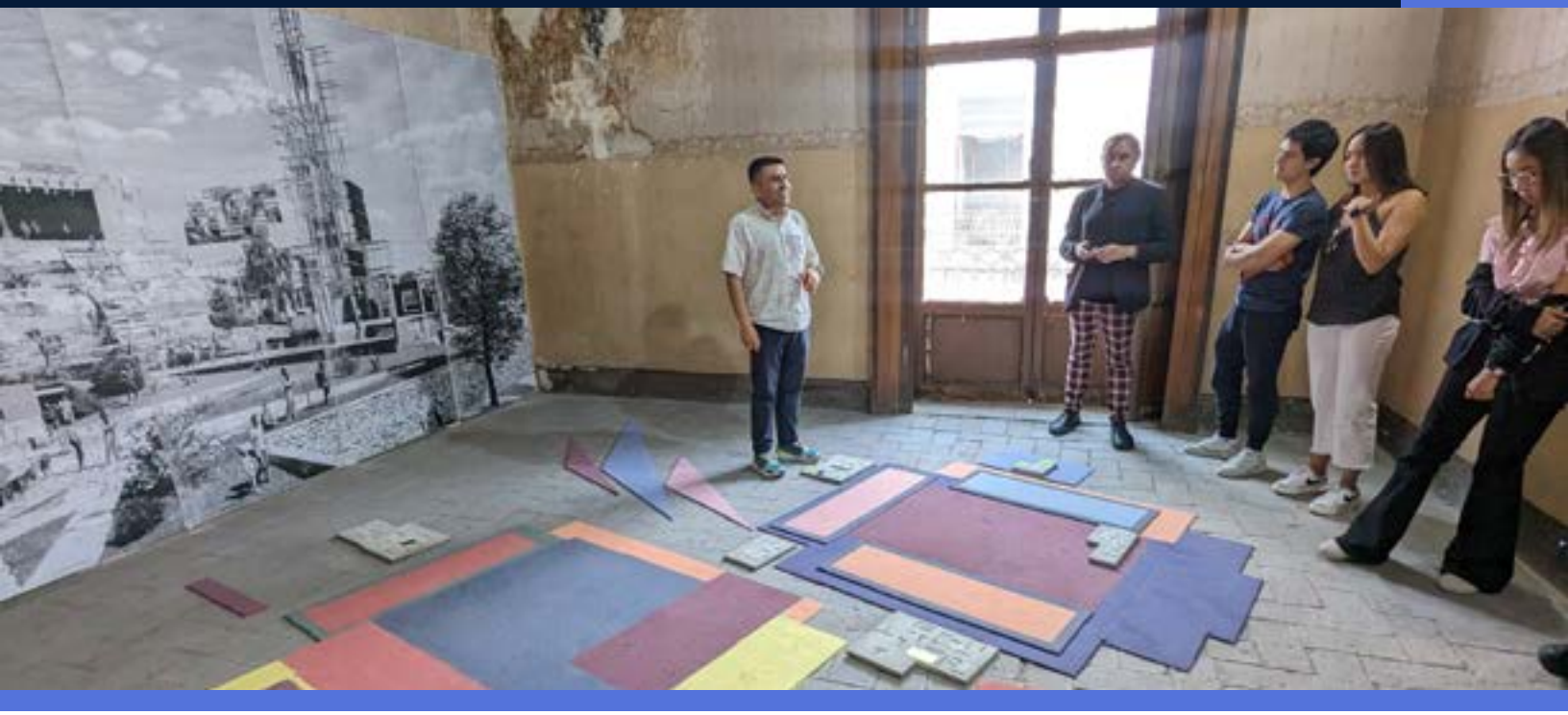
Impact

132 students from the campuses: Mexico City, State of México, Guadalajara, Monterrey, San Luis Potosí, Sonora Norte and Toluca (February-June 2023)

96 external participants (February-June 2023)

Participating teachers

Christiam I. Mendoza
David Sánchez
Edgar P. Martínez
Elva Y. Ornelas
Guillermo Gutiérrez
Inés Álvarez
Lucero D. de la Huerta
Luis A. Gil
Rubén Vázquez
Xóchitl del C. Arias



Xcaret 6.0 Chair

As part of the concentration in Advanced Architecture, the "Xcaret Chair" was held in which students of the Architecture program developed a challenge in collaboration with the training partner and their Design and Innovation department, operated by EXATEC. Considering a hypothetical site and conditions alike, the project seeks to explore ideas for the "park of the future," from which documents, experiments and technologies emerged that allowed new experiences to be visualized.

Led by the director of the Department of Innovation and Parks, several teams of 6 members developed the project. Between trips, experiences and other learning, protected by an official confidentiality agreement, the chair allowed students to develop the exploration of a real exercise from a multidisciplinary perspective.

Likewise, a contest was held where group mentors guided the student teams. The best ideas and narratives were presented at the Interactive Urban Museum, and the selected ones were presented to the Council of the training partner.

The chair was integrated as part of the different Architecture workshops held over the last 5 years at Campus Puebla, also commemorating the sixth anniversary of these conversations between the training partner and the Department of Architecture of this school at the Tecnológico de Monterrey.

Impact

20 students of the Puebla Campus (February-June 2023)

Participating teachers

Ángel Morúa
Daniel Savedra
Edgar O. Espinosa
Fernando Curiel
José A. Sáenz

6.2 School of Social Sciences and Government

Educational innovation and digital education in the School of Social Sciences and Government

53 Projects

18 Educational units

35 Teachers

6,481 Students-course

The School of Social Sciences and Government has promoted innovative education highlighted by milestones such as Global Vision Tec Week, a space for interdisciplinary dialogue. Additionally, the use of Artificial Intelligence in Law learning and the Global Classroom experience have transformed the way students explore, understand and engage with the world, fostering a global vision and practical key skills. These examples evidence a commitment to academic excellence and bold preparation for an ever-changing world.

Consolidation of Global Vision Tec Week

Global Vision Tec Week was consolidated in 2023, as one of the great educational innovations of the School of Social Sciences and Government. By combining academic talent and the use of innovative technology during a week of online teaching, a bridge has been created between Tec de Monterrey and universities around the world for coexistence and collaboration between students and teachers, as well as for sharing and present the most outstanding features of the Tec21 Model.

In its second year of implementation, the Global Vision initiative offered to students of different professional careers has established itself as a benchmark for innovation at Tecnológico de Monterrey, achieving 4 main objectives:

- Perfect the educational initiative of Tec Week with the experience gained in the first year of delivery.
- Escalate by incorporating new teachers from different campuses who teach the educational unit.
- Make Tec Week known throughout the world, inviting new universities to participate.
- Keep the course updated, allowing for constant interest in the topics and projects handled there.

With daily sessions taught from the Hall Immersive Room, Global Vision Tec Week is a course that revolves or teaches around the topic of inclusion, impacting more than 170 students (national and foreign) connected and participating in each of the sessions.

In the topic of educational innovation, it is as important to be able to execute and implement innovative ideas as it is to consolidate, mature and scale them.

Impact

- **20** Teachers from Tecnológico de Monterrey
- **754** Students of the Tecnológico de Monterrey
- Participating foreign universities:
  - Universiti Kebangsaan Malaysia (UKM)
  - Catholic University of Salta of Argentina (UCASAL)
  - University of Notre Dame
  - Technological University of Colombia
- **7** Teachers from foreign universities
- **400** Students from foreign universities
- **24** Featured guests

"All I have to say is that it was maybe the best activity of the week and absolutely all members of the team were working very well, trying to meet each other and to know about the lifestyle of each one. So, I'm happy with that."

Participant student

Strategic projects

Use of Artificial Intelligence for learning Law

This project was led by the Western Region Law Department. Through Artificial Intelligence, Law students developed activities on the legalization of signatures and the apostille, through the use of ChatGPT and the Fliki software.

With the aim of identifying the benefits and limitations of using ChatGPT, the students designed the presentation script on the topic of legalization of signatures and the apostille, through prompts on private international law, to improve the initial script proposed by ChatGPT. Subsequently, the students used FLIKI, Artificial Intelligence software to create a video about the processes of legalization of signatures and apostille of documents.

To watch the video, click here.

Impact

25 students of the Guadalajara Campus (August-December 2023)

Designer teacher

Pedro A. Elizalde

Global Classroom Experience

Under the “Social learning and collaborative work” strategy, “Economics” students from the Mexico City Campus and the Autonomous University of Barcelona lived an international distance experience within the Global Classroom initiative.

For four weeks, the students developed multicultural work lasting 12 hours, both synchronously and asynchronously. During this time they solved a real problem within public or private environments, which involved the presence of moral risk and adverse selection, phenomena that damage the linkage of agents to institutions and markets, which impacts their development and the growth of countries.

With this experience, the students had the opportunity to experience a different perspective through cultural exchange between two educational institutions, thus allowing them to gain a deeper understanding of themselves and those around them.

In addition to the evaluation assigned by each participating educational institution, each student obtained a digital badge issued by the Vice-Rector for Internationalization of the Tecnológico de Monterrey, in recognition of their work in multicultural teams.

Impact

Students and teachers from the Mexico City Campus, as well as the Autonomous University of Barcelona (August-December 2023)

Designer teachers

Carlos de la Torre
Hugo J. Fuentes

6.3 School of Humanities and Education

Educational innovation and digital education at the School of Humanities and Education

68 Projects

30 Educational units

68 Teachers

5,156 Students-course

At the School of Humanities and Education, educational innovation has become the engine that enriches the teaching-learning process, to offer solid and memorable training experiences to our students. We merge critical humanism with applied technology, using digital culture tools to enhance the development of fundamental skills and competencies in our careers.

This year, we designed and implemented emblematic projects such as the "National Short Film Festival" and the "International Book Fair" in Monterrey, experiences that transcend conventional classrooms and immerse students in enriching environments, encouraging practical application and knowledge sharing. We also carried out cultural documentation experiences and "immersive adventures" of Virtual Reality, which contribute to the dissemination of the cultural heritage of our country; all of this framed by the entrepreneurial spirit and social responsibility.

The School of Humanities and Education recognizes the positive impact of educational innovation on the comprehensive development of our students, as well as the indispensable work of teachers and collaborators, who play a crucial role in the design, development, implementation and evaluation of these experiences, thus contributing to providing training that transcends the classroom and prepares our students to successfully face the challenges of the current and future world.

Through these educational innovation projects, in addition to promoting the enrichment of educational experiences, they also contribute to the construction of a more promising and conscious future.

Strategic projects

The work of those who participate in them is a testimony to the transformative capacity of education when it is nourished by innovation and the richness of the humanities and technology.

National Short Film Festival

In June 2023, the second edition of the "National Short Film Festival" was held at the Monterrey Campus, as a leading national event in the exhibition and awarding of short films made by students of the Tecnológico de Monterrey, belonging to the Preparatoria y Profesional de all regions of the country.

This edition had as strategic allies the Mexican Academy of Cinematographic Arts and Sciences (AMACC), the FEMSA Foundation and DocsMX. Additionally, there was sponsorship from Coca Cola Sin Azúcar, and alliances with Cinépolis, Volaris, Sony and Harman Professional.

Impact

550 students and **57** High School and Undergraduate teachers
150 short films produced, in **7** categories

Designer teacher

Juan C. Olmedo (festival director)

International Book Fair

This is the most important cultural project in Northern Mexico, home of writers, artists and great leaders. It is considered a meeting point and space for discovery, as well as a trigger for curiosity: after all, a destination where culture grows and prospers.

From October 7 to 15, 282,949 visitors to the fairgrounds were registered, and 10,725 participants were registered online and in activities on other campuses. In an environment to stimulate the intellect and awaken the imagination, different experiences were conducted during these days to share moments of creativity, in addition to the love for literature.

Impact

285 students

Documentary about the gastronomic heritage of the Toluca Valley

With the aim of rescuing the cultural heritage, specifically, the gastronomic heritage of the local environment, this documentary was produced that shows the origin, evolution and preparation of a typical dish from Toluca and/or its surroundings.

The students carried out both documentary and field research to know all the details of the selected dish. The documentary includes a description of at least 2 establishments that offer the dish, as well as a description of the dish itself, told by the owners of each establishment. Likewise, testimonies from some of the diners are presented. The above, with the purpose that the viewer knows and enjoys, in a virtual environment, the typical and traditional food of Toluca.

Impact

75 students of the Toluca Campus

Designer teachers

Julia B. Alcántara
Carlos G. Zermeño

Social Entrepreneurship Learning 4 Complexity (SEL4C)

This is a methodology for scaling social entrepreneurship and complex thinking skills, through an entrepreneurial ideation process. The project started in 2022, evolved during 2023 through the development of different activities.

1. Web platform development. Based on the tests of this platform, two international presentations were generated at the 6 Conference On Future Education, held in Kuala Lumpur (July 2023).
2. Signing of two collaboration agreements, one with Fundación Santander to make SEL4C a MOOC, and another with Ashoka and Editorial Santillana to make an adaptation of SEL4C focused on primary education.
3. In the February-June 2023 semester, SEL4C serves as training partner of the "TC2007B Block" of the Mexico City Campus, for the development of a mobile application.
4. Implementation in groups in the Western Region, which allowed validating the methodology and generating academic publications related to this process. The validation was presented at the 15th International Conference on Computer Supported Education, held in Prague (April 2023).
5. In the August-December 2023 semester, SEL4C was implemented within the COIL-Global Classroom project, developed with the University of Concepción of Chile.
6. I work with the UniNavarra University Foundation of Colombia, to train their teachers in the implementation of SEL4C.
7. Two intellectual property registers and development of a new scientific and technological entrepreneurship methodology, with its own intellectual property register.

Impact

100 students from the campuses: Guadalajara and Mexico City

Designer teacher

José C. Vázquez

A journey through Mexico: immersive experiences in Virtual Reality for the study of cultural heritage

The project "A journey through Mexico" has the objective of strengthening the understanding and appreciation of the cultural heritage of Mexico in the teaching-learning process. Through the implementation of immersive Virtual Reality technologies, it is possible to bring students closer to the knowledge of national cultural heritage in an experiential and fun way, allowing them to experience other means of learning.

The results obtained in the educational units "Cultural Heritage of Mexico" and "Cultural Heritage of Mexico", show a positive impact. The average score of the group in the non-immersive activity was 78.17, while, with the implementation of the "A trip through Mexico" experience, the average score increased to 85.73. This indicates that the use of immersive resources, such as Virtual Reality, contributes to a greater depth of content and enhances student learning.

The survey applied at the end of the experience showed that the students positively valued the immersive experience, both in terms of their learning and the use of technology. It was concluded that the integration of Virtual Reality in the academic context generates an experiential relationship between students and their environments, and greater self-awareness of the process experienced during their learning.

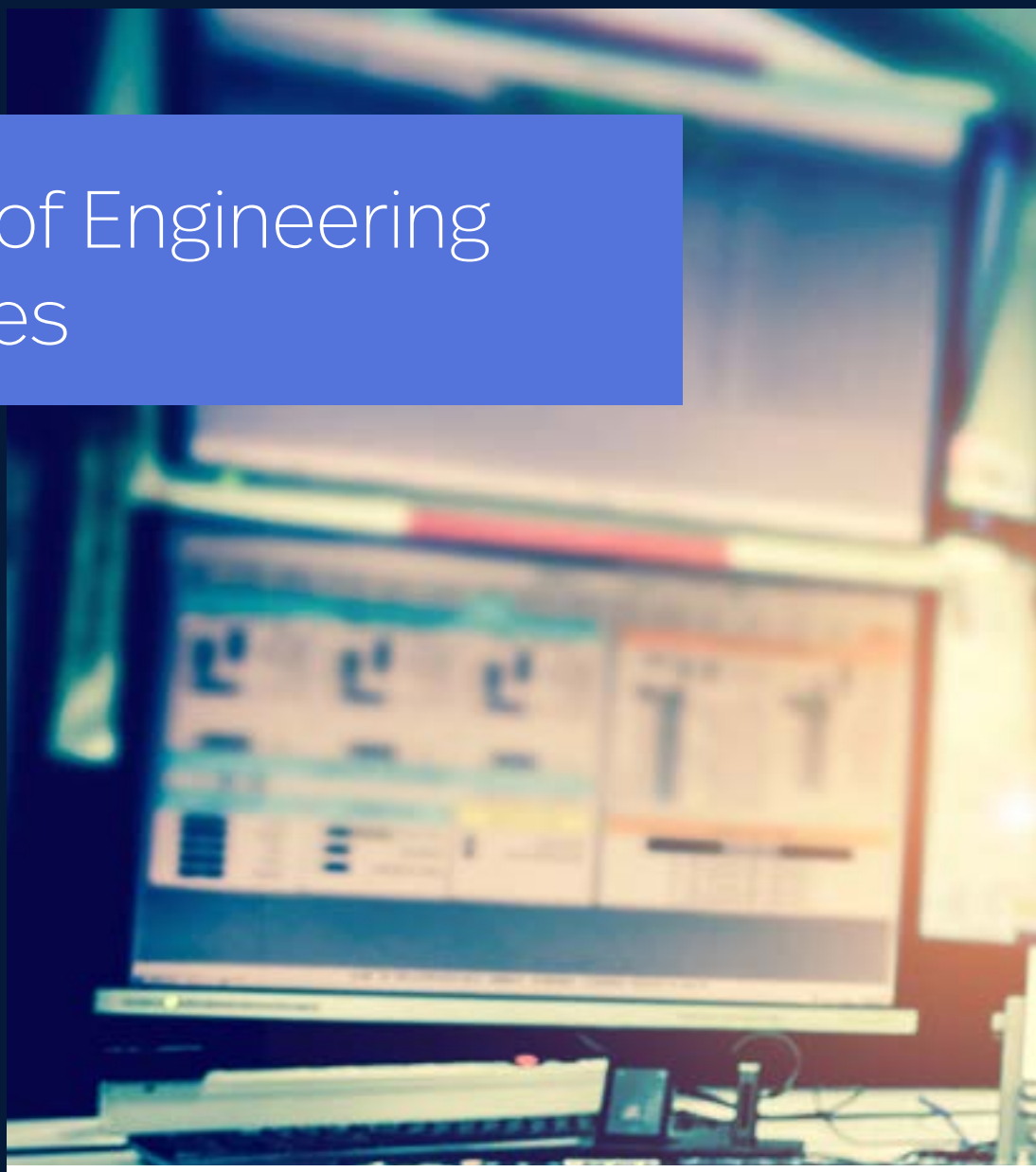
Impact

452 students

Designer teachers

Adela Díaz
Bárbara R. Granados

6.4 School of Engineering and Sciences



Educational innovation and digital education in the School of Engineering and Sciences

151 Projects

74 Educational units

192 Teachers

16,580 Students-course

The School of Engineering and Sciences is convinced of the benefits of educational innovation and digital education in the teaching-learning process, and actively participates in its various categories to provide meaningful learning experiences to its students. Many of these experiences use cutting-edge technology and digital tools to enhance the development of disciplinary and transversal skills, as well as provide a memorable experience.

Among the diversity of projects implemented in 2023, those that integrate Artificial Intelligence, Virtual Reality, 360° Video, Adaptive Learning, Metaverse Tec Virtual Campus, and the topic of sustainability and circular economy, stood out. Relevant projects aligned with institutional initiatives were also implemented: Global Classroom, Hall Immersive Room, Elite Courses, and Professor with hologram effect.

Strategic projects

Artificial Intelligence

Artificial Intelligence (AI) makes it possible to develop innovative teaching-learning projects and experiences. Some of the most representative ones are presented below.

Smart Feedback

This is a platform powered by Artificial Intelligence (AI), whose objective is to improve educational dialogues, fostering a conducive learning environment through emotional recognition and regulation. It begins with a board game that recreates feedback scenarios for teachers to identify emotions, self-reflect, and develop more meaningful feedback responses. These responses are then entered into a tool that uses AI with natural language processing.

This AI component identifies emotions and transforms them into visual representations of emotional tonality, helping people adjust their speech to align with their preferred pedagogical approach. The platform leverages AI to improve educational dialogues, encouraging a more receptive attitude towards learning through emotional awareness and improved feedback. To learn about the Smart Feedback project, you can access the application through the following link:
https://smartfeedback.info

Impact

The project was implemented by the School of Engineering and Sciences, the School of Humanities and Education, and the School of Architecture, Art and Design, from the Guadalajara, Querétaro and Puebla campuses.

1,654 diagnoses of emotional tone were issued in the feedback, to:

- **912** students
- **509** unregistered users
- **230** teachers
- **3** companies

It should be noted that in these diagnoses, **6,074 emotions were identified in total.**

The project was selected as shortlisted in the “QS Reimagine Education Awards 2023”, in the AI in Education category; In addition, there have been 6 publications and participations in international conferences.

Designer teachers

Eduardo D. Juárez
Eduardo E. Larsen
Ivo N. Ayala
José M. Velázquez
Kenneth W. Bauer
Lilia C. Rodríguez
Mariana Maya
Patricia E. Alonso

ChatGPT: interdisciplinary bridge between critical thinking and disciplinary competencies

This project aims to evaluate the effectiveness of using ChatGPT to integrate critical thinking within disciplinary competencies. This approach is achieved by encouraging deep reflection on the course content from the perspective of critical analysis to detect cognitive biases, enriching the design and definition of solutions through various thinking, business and leadership techniques.

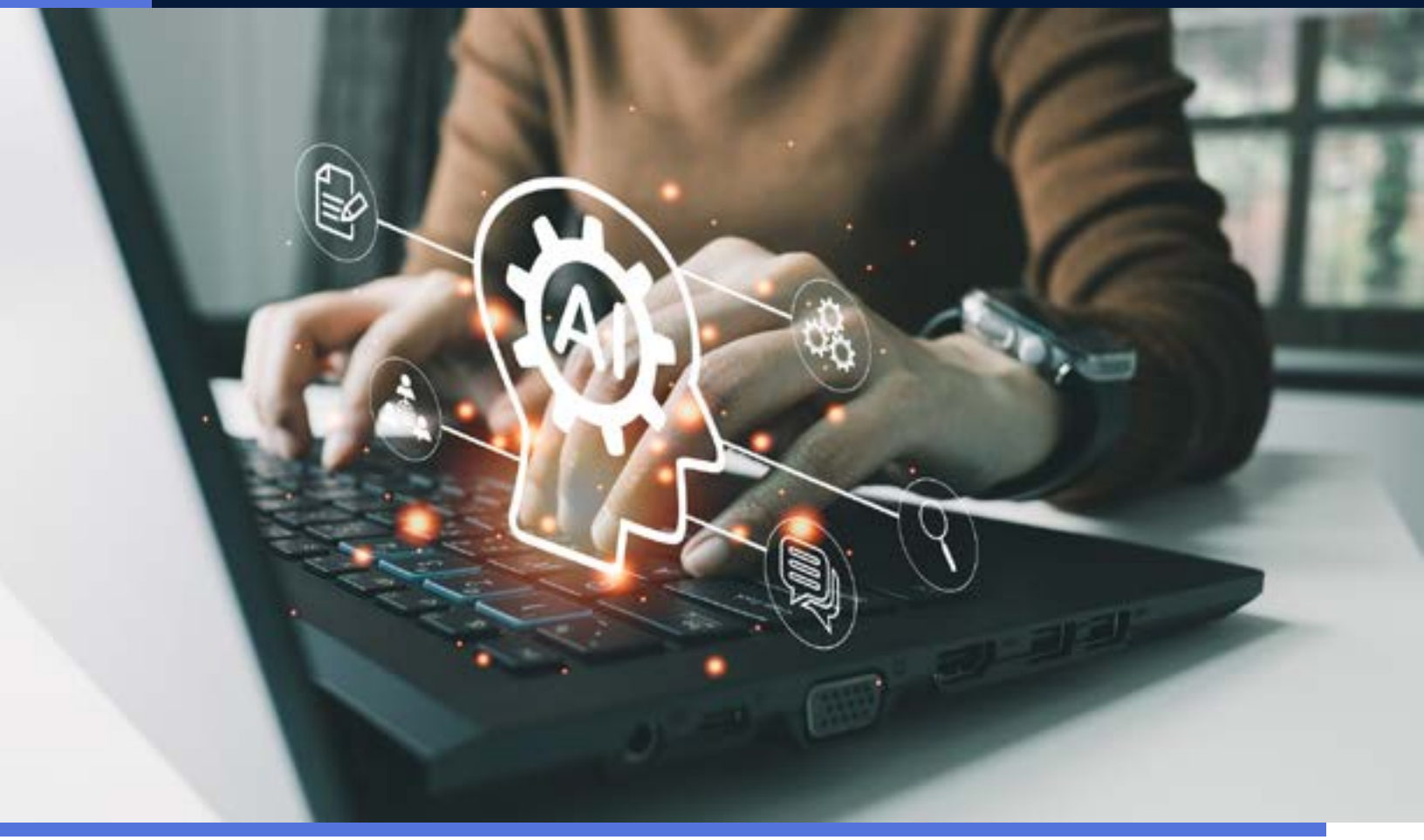
Through structured reflective activities, students are asked to analyze, enrich, select and apply ChatGPT responses. The idea is to use this generative AI tool to go beyond simple queries of disciplinary knowledge, guiding the analysis towards deeper reflection and expanding the spectrum of learning by incorporating knowledge from other different areas.

Impact

1,174 students and **20** teachers (August-December 2023)

Designer teachers

Alberto Aguilar
Ana R. Sanromán
Athena A. Flores
Blanca I. Maldonado
Carlos A. Ventura
Carlos Morales
Carmen D. González
Carmen R. Maldonado
Cosme E. Santiesteban
Enrique A. Sánchez
Faustino Bejarano
Gabriela I. García
Jesús R. Pájaro
Jorge Rodríguez
Juan A. Talamás
Leticia Lozano
Luis I. Bustillo
Luis M. Orona
Manuel Valencia
Raime A. Bustos



Cloud computing and Artificial Intelligence to improve industry 4.0 learning

Traditionally, courses are evaluated with laboratory practices, experimental activities in class, and a final project. However, it has been observed that students cannot justify how they designed from the prototypes to the controller, leaving the operation of the prototype to the trial and error methodology. In this context, an interface was generated that allows detecting which points are omitted during the performance of the practice (information management), as well as exploring more than one solution to the problem (problem solving), and observing the level of interpretation of the results based on graphs or tables (critical thinking), by creating a chatbot. First, the chatbot is trained with a neural network where it is exposed to the correct procedure that the student must perform; then, depending on how far the student moves away from the ideal procedure, the chatbot will begin to generate advice and suggestions, as well as provide support material to successfully complete the practice in question.

Impact

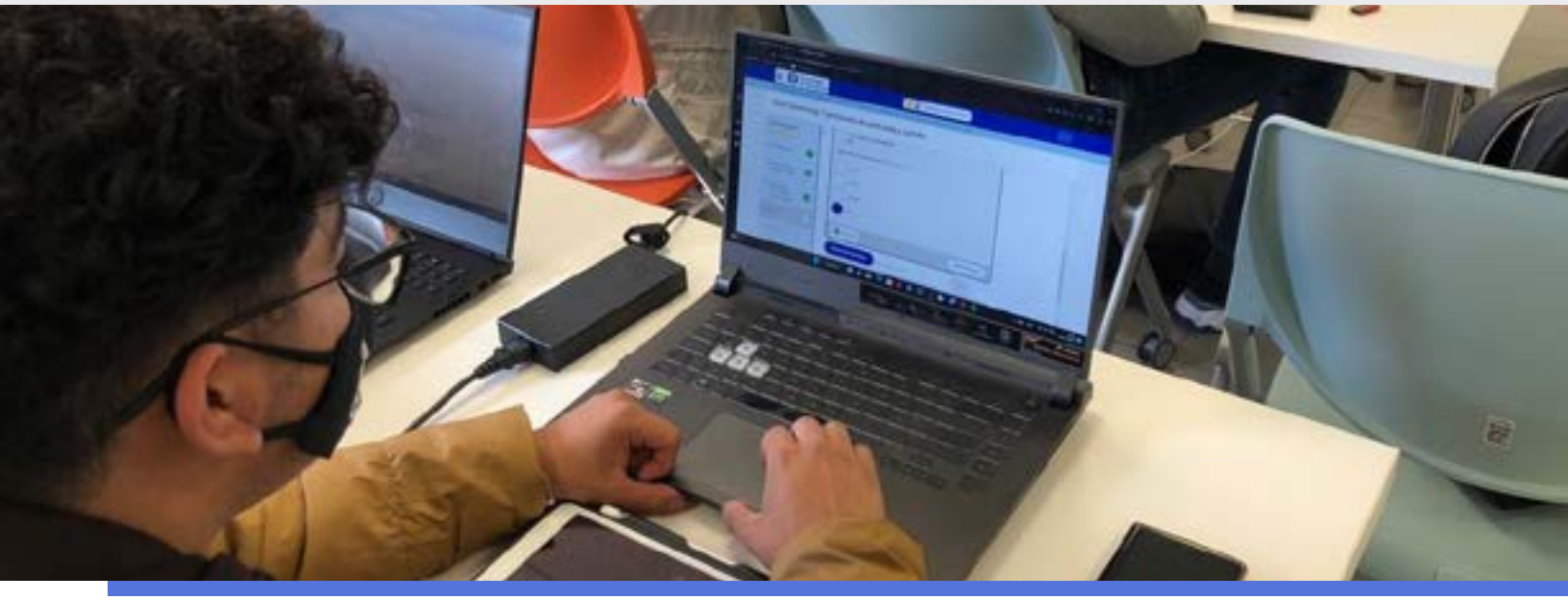
130 students and **6** teachers of the State of Mexico Campus (January-June and August-December 2023)

Designer teachers

Carlos A. Cruz
Héctor Cervantes
Jesús E. Chong

Adaptive Learning

This methodology uses technology to personalize the learning process and its progress, and reinforce concepts and particular needs of the students. Below, a national strategy implemented in various educational units corresponding to the exploration stage in engineering programs is presented.



Adaptive Learning Strategy in Engineering

This strategy aims to personalize the learning path of the students, accompanying them with activities according to the level of knowledge, as well as the need to reinforce the skills and competencies that the educational units develop. This strategy was incorporated into the engineering exploration stage courses, which require high feedback and support in the learning process.

Impact

1,795 students and **90** teachers (February-June and August-December 2023)

Designer teachers

Adriana Cantú
Alejandro García
Antonio J. Sánchez
Cristian González
Delia A. Galván
Diana D. Jiménez
Fabiola Uribe
Isaac Juárez
Ivonne Yznaga
Jorge Álvarez
José M. Pardo
Manuela Ortiz
María de los Á. Constantino
Miguel A. López
Omar Olmos
Oswaldo Monroy
Roberto D. Rodríguez
Rosa G. Paredes
Saúl Montes de Oca
Silvia González
Yolanda Martínez

Sustainability and circular economy

Aware of the need for economic development, and seeking social balance and environmental protection, the School of Engineering and Sciences worked on educational innovation projects focused on the topic of "Sustainability and circular economy." Below are some of the most notable ones.

Circular Economy Interactive Resource

This is a virtual tour of a circular industrial park so that students understand key concepts about the circular economy.

It represents an industrial park that takes advantage of the waste of one company and uses it as inputs for the next, applying the concept of circular economy in its aspect of industrial ecology or industrial symbiosis. The resource is inspired by the Kalundborg industrial park in Denmark and several companies that are located in Mexico and have begun to carry out these practices.

Impact

180 students and **3** teachers on campuses: Aguascalientes, Monterrey and Querétaro (August-December 2023)

Designer teachers

Alfredo Santana
Andreas Koch

Immersive experiences: Steel Giant and Santa Catarina Wind Farm

In the educational unit “Biomimetics and sustainability”, Elite digital modality, 360° videos were used, where students visit:

- The Monterrey Soccer Stadium. Here you can see different spaces, such as the exterior, locker rooms, exit to the court and court. It is very useful for students to understand the different patterns of biophilic design.

- The Santa Catarina Wind Farm. Through this resource, students can experience the sensation of being physically in this place, by listening to the noise that the wind turbines make when they move due to the action of the wind, being very useful for understanding the operation of a park. wind energy and its implications on the surrounding ecosystem.

Impact

575 students and **3** teachers (February-June and August-December 2023)

Participating teachers

Elsy G. Molina
Jorge A. Gutiérrez
Mariana E. Elizondo

Escape Climate Change

The students of the educational unit “Ecological processes for human development” participated in an Escape Room, testing their knowledge and skills to solve puzzles and achieve the designed challenge. At the same time, they reflected on climate change and its social, economic and environmental impact.

Impact

245 students (February-June and August-December 2023)

Designer teacher

Emilio Clarke

Virtual Reality and 360° videos

The School of Engineering and Sciences has developed a wide variety of resources that use extended realities for various applications. Below are some of the most notable projects in 2023.

Implementation of the Virtual Reality resource "Heineken Digital Factory" in the "Design of cyber-physical systems" course

Derived from the Novus-La Triada project "Implementation of extended realities as an engagement strategy", to link disciplinary content and competencies with the work environment, a Virtual Reality resource was developed with the training partner Heineken. This resource seeks to increase the link between the knowledge acquired by students and their environment, with the aim of increasing engagement with their discipline.

The resource was piloted with students from the Universidad de los Andes and the Tecnológico de Monterrey (Campus Laguna, Campus Monterrey and Campus Toluca), prior to its national implementation in the seed course "Design of cyberphysical systems", in January 2023. This resource allows you to view the digital factory of the Heineken brewery, showing the production line scenarios and identifying the operations in which an Industrial Engineer carries out activities specific to their area.

Additionally, this project has generated 2 publications in conferences indexed in Scopus.

Impact

1,749 students and **5** teachers (February-June 2023)

Designer teachers

Ana M. Turcios
Fabiola Lima
María I. Ruiz
Ricardo Ipiña
Vianney Lara

Supermarket “More calories for less”

This Immersive Learning resource using Augmented Reality was created for the educational unit “Mathematics and data science for decision making”. Through this, students can navigate in a supermarket simulating the purchase of products. Once the purchase is made, the student must determine the number of calories they would consume, and how this information could impact their consumption habits, thanks to the analysis based on machine learning carried out.

Impact

6,230 students (August-December 2023)

Designer teachers

Germán Domínguez
Jesús Aguilar

Educational Metaverse: Tec Virtual Campus

Among the transversal skills developed by the students of the School of Engineering and Sciences, is “Digital Transformation” through the use of cutting-edge technologies and the formation of a digital culture. In this sense, in 2023 several projects were developed in Tec Virtual Campus, the educational metaverse of the Tecnológico de Monterrey. Some of the most notable projects are mentioned below.

Use of the metaverse for teaching Industrial Engineering

The digital transformation in education has accelerated with new generations of digital native students. Online learning has become an essential part of the learning experience, especially in higher education. The use of the metaverse in an educational context is gaining more and more strength, since it allows the creation of 3D virtual spaces where students interact with others through avatars, overcoming the limitations of time, space and training in the educational process. In addition, it allows individual, asynchronous and self-directed learning, making it a very attractive space for students.

Reimagining the teaching-learning process by implementing a virtual space for students to learn “Science, Technology and Engineering” (STE) has been a challenge for teachers. In this project, a virtual laboratory was designed and built within the Tec Virtual Campus metaverse to be implemented in some educational units of the Department of Industrial Engineering. This virtual space includes 2D and 360° videos of productive practices and processes, in addition to some webinars classified into four thematic areas, allowing the student self-directed, fun and more immersive learning.

To learn more about this educational experience, check out this video.

Impact

50 students of the Guadalajara Campus (February-June 2023)

Designer teachers

Abraham González
Araceli Zavala
Jonathan Cuevas

Exploration block in Elite Mode: Intelligent logistics networks

This block is an asynchronous online course, with the capacity to serve up to 150 students per group. It incorporates activities using the Tec Virtual Campus metaverse of the Tecnológico de Monterrey, as well as resources with Artificial Intelligence.

It uses ChatGPT to design a concept map of a logistics network, so that students learn how to use a forecasting method. The final presentations of the challenge took place at Tec Virtual Campus.

Impact

220 students and **120** teachers (August-December 2023)

Participating teachers

- Design, coordination and implementation:
  José A. Ramos
  Rafael E. Bourguet
  Víctor M. Rayas

- Implementation:
  Andreas Koch
  Araceli Zavala
  Gerardo Galaviz
  Gerardo A. Silveyra
  Jesús B. Rodríguez
  José L. Ceciliano
  Rodolfo Mendoza
  Rodrigo Mercado
  Sergio A. Medina

6.5 School of Medicine and Health Sciences

Educational innovation and digital education in the School of Medicine and Health Sciences

49 Projects

19 Educational units

91 Teachers

11,205 Students-course

Educational innovation in the area of Health is transforming education through the integration of innovative teaching strategies, person-centered educational management, and the digitalization of different elements of the teaching-learning process. The latter has been characterized by the promotion of the use of mobile devices, the influence of telepresence in formats such as "telehealth" and the arrival of Artificial Intelligence.

At the School of Medicine and Health Sciences campuses, teachers actively participate in initiatives with the fundamental objective of transforming the educational experience to accompany students on their journey of personal transformation at the university. This involves the way of organizing activities for educational purposes, using some educational tools, and evaluating the impact they have.

One of the main challenges is to maximize the use of all the resources that Tecnológico de Monterrey provides for the use of its educational community, for example, to have global classrooms where it is possible to connect people located in remote places, illustrate abstract concepts more effectively, or to demonstrate clinical cases considering the principles of patient safety and quality.

In 2023, the experience of the "Challenge-Based Learning" strategy translated into the implementation of innovative strategies for the School of Medicine and Health Sciences. Various emerging technologies were used, such as access to digital resources with content in various formats, access to digital laboratories, and use of augmented or mixed reality. One of the processes with the greatest impact was the documentation of the evaluation of knowledge and skills in a systematized manner through enablers such as Learning Management Systems (LMS), which allow the application of online exams, the delivery of evidence from the students, the assessment of these using different instruments, as well as ensuring the development of competencies.

In all pilot projects and implementations, teacher participation was invaluable in achieving the desired results.

Strategic projects

Immersive learning with mixed reality in Dentistry

In this project, sixth semester students prepare their preclinical work scenario in a dental simulator in the following way: they put on the mixed reality glasses and begin to perform an endodontic procedure while following instructions from their virtual teacher, as well as obtaining additional information at each stage of the procedure.

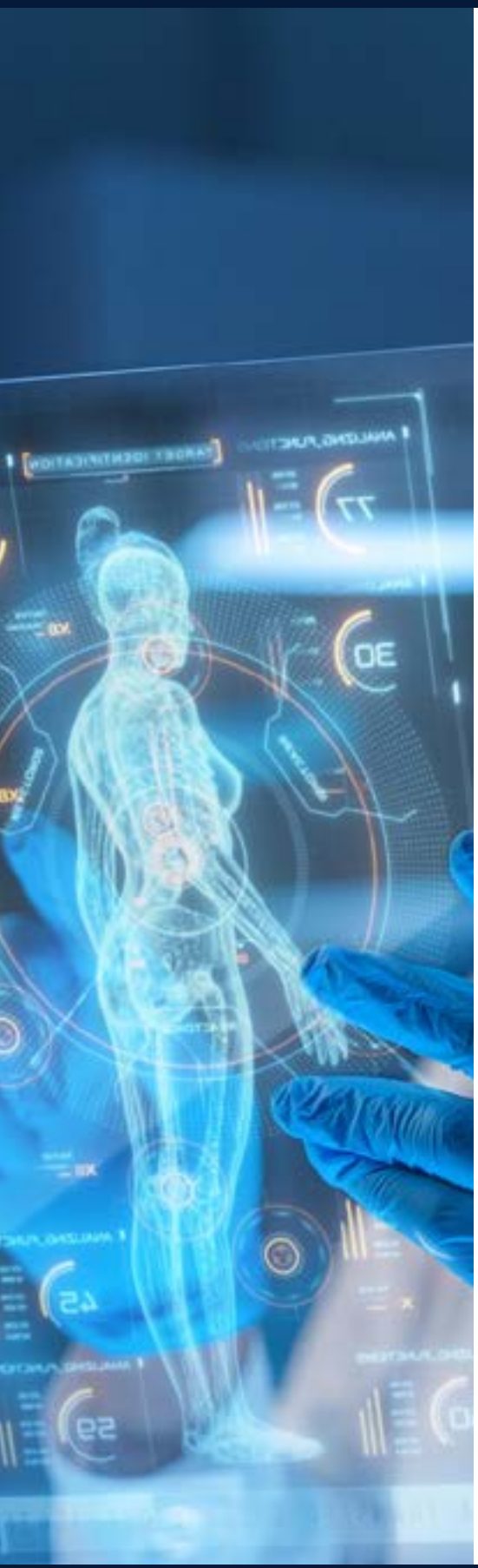
One of the challenges that students face is that they have a total of two hours to carry out the process in a self-managed manner, which consists of more than 16 steps.

Impact

70 students and **30** teachers from the Monterrey Campus (January-June 2023)

Designer teachers

Carlos Presa
Karen Reyes
Regina García



Digital resources in the “Physician and Surgeon” program

Through the AMBOSS portal, students of the Medical Surgeon career have access to educational resources in various digital formats. In this way, they can put together study plans according to their educational units, or use the resources to prepare for the closing stage exams or IFOM.

Licenses are assigned to students from the fourth semester until they complete their curriculum subjects.

Impact

700 students **100** teachers from the campuses: Mexico City, Guadalajara and Monterrey (February-June and August-December 2023)

Centralized national assessment

In the School of Medicine and Health Sciences, the theoretical evaluation of knowledge is carried out centrally. The coordinators of educational units and teachers make a great effort in building banks of reagents and versions of evaluation instruments period by period. The psychometric analysis carried out is reported to each academy for their reflections and improvement processes.

Currently, the programs include: Medical Surgeon (MC), Bachelor of Biosciences (LBC), Medical and Dental Surgeon (MO) and Bachelor of Clinical and Health Psychology (LPS), and teachers from the Chihuahua, Mexico City campuses collaborate, Guadalajara, Monterrey and Querétaro.

Online evaluation through the Canvas platform is used semiannually in more than 8,500 online exams, corresponding to the undergraduate programs of the School of Medicine and Health Sciences.

Impact

2,100 students **+150** teachers from the campuses: Mexico City, Chihuahua, Guadalajara, Monterrey and Querétaro (January-June and August-December 2023)

6.6 Business School

Educational innovation and digital education in the Business School

69 Projects

32 Educational units

202 Teachers

7,998 Students-course

It is a challenge to precisely define what educational innovation entails, especially with regard to improving the teaching-learning process for students. The Institute for the Future of Education defines the term «educational innovation» as “the contemplation of various aspects: technology, didactics, pedagogy, processes and people; involves the implementation of a significant change in the teaching-learning process.” Furthermore, within that definition, it adds that “it must incorporate a change in materials and methods” (IFE, 2017).

For its part, the National Polytechnic Institute (IPN), states that “for educational innovation to occur, a relationship with the triad is required: teacher, students and content, and that to be considered Educational Innovation there must be an improvement in strategies. didactics, incorporation of technological tools and resources and teaching practice” (Educational Innovation, IPN, 2021).

At the Business School, the educational innovation strategy focused on observing, evaluating and providing feedback on the transversal and disciplinary competencies selected from the eight programs in their intermediate evaluation and final evaluation stages. This in order to standardize efforts in the different programs, on all campuses, and collaborate between teachers, training partners, external evaluators, technology support and content creation.

Furthermore, the evaluation of competencies through a system allowed the Business School to make improvement efforts for the following generations, in order to strengthen the development of these competencies.

During 2023, the Business School successfully developed several projects and experiences directly related to educational innovation and digital education, thus offering added value to the educational experiences of the students. Some of these projects are described next.

Strategic projects

Simulcases

Development of a simulator that facilitates timely feedback to students by a teacher. This is measured through a feedback survey applied to teachers.

There is a repository to record the progress of the development of skills in students, so that they can be seen in the assessment of the eighth semester.

Impact

1,500 students (February-June 2023)

Designer teachers

Claudia Ramírez
Edith Tirado
Luz del C. Díaz
Mariel Carreño
Martha E. Moreno
Verónica Baños

Assessment

Final evaluation through the use of situational scenarios and interviews to observe the key performances associated with the professional competencies of eighth semester students, recognizing their graduation profile and focusing on the integration and synthesis of their learning. This was achieved through:

- Ensuring the disciplinary and transversal graduation profile of the school's academic programs through a formative evaluation by teachers and external evaluators.
- Providing timely feedback to the student and documenting recommendations from internal and external evaluators for continuous program improvement.

Impact

3,000 students, **120** teachers and **240** external evaluators (February-June 2023)

Designer teachers

Jorge Ordoñez
Laura Zapata
Martha Moreno

Next are some of the strategic educational innovation and digital education projects developed by the EGADE Business School in 2023.

National meeting of the Master Business Analytics (MBD) program with gamification and Augmented Reality

The national MBD meeting was held at the EGADE San Pedro, with an attendance of 63 students from the EGADE San Pedro and Santa Fe. Its objective was to generate a feeling of belonging to strengthen relationships between colleagues and promote networking through two innovative and memorable experiences carried out during the event.

The first experience took place during the breaks of the event, where the students formed teams and participated in a rally. The dynamic consisted of providing a series of clues to solve puzzles and identify objects with QR codes that displayed the challenge information through Augmented Reality. The second experience took place during networking; It consisted of the students facing various challenges with activities in a game format, for their integration.

Impact

63 students (February-June 2023)

Designer teacher

Abhishek Shashikant Nayak

Video games in the classroom as a strategy for the development of transversal skills

During 2023, EGADE designed and implemented various academic experiences integrating the strategy of using video games.

Impact Challenge by Oxxo

This experience was offered in virtual mode as part of the activities of the "EGADE Action Week" event, where 23 students from EGADE San Pedro, Guadalajara, Santa Fe participated, through a national call, and online mode, integrated in 8 virtual teams.

A challenge was co-designed with Oxxo, based on three Sustainable Development Goals (SDGs). For two weeks, students from different academic programs generated solutions using the Design Thinking methodology, modeling prototypes in the Minecraft video game. This helped foster their creativity and generation of disruptive ideas, by presenting them in a format different from the everyday and traditional.

Entrepreneurial mentality

During Professor Jairo Orozco's MBA class at EGADE San Pedro, 36 students integrated into a team developed an entrepreneurship proposal. To present the prototype they used the video game Minecraft as an innovative tool. The students had basic training and were provided with support manuals with the Design Thinking methodology, as well as the use of Minecraft.

Negotiation

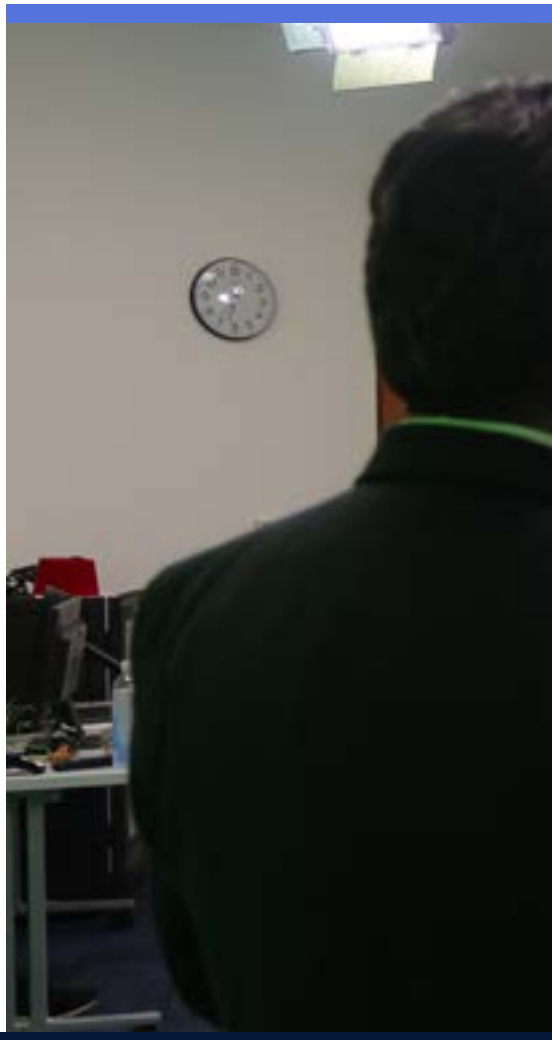
Design of a recreational activity using the video game Overcooked in Professor Luciana Manfredi's MBA class, at EGADE San Pedro. With the participation of 32 students, two teams were formed: players and evaluators. In different rounds, the team of players was observed by the team of evaluators to identify the level of skill management, such as: teamwork, communication and decision making. At the end, a group reflection was carried out to analyze the performance of the students.

Impact

23 students and **3** teachers from EGADE San Pedro, Campus Santa Fe and Campus Guadalajara

Designer teachers

Eduardo E. Aguiñaga
Eric Porras
Eva M. Guerra
Jairo A. Orozco
Luciana C. Manfredi
Ricardo V. Úbeda



Virtual Connection Room (VCR)

In July 2023, the Virtual Connection Room (VCR) was inaugurated, a new space at EGADE San Pedro that seeks to enhance the interaction and dynamics of teachers with students in a virtual format.

The room has advanced audiovisual technology to design experiences in real time, through six screens in which more than 50 students can be viewed in the same space. The teacher can control its presentation and interact with the students, as well as have automatic monitoring. This room designed by Educational Innovation of EGADE San Pedro, has a system for transmission with a production level of high demand.

Impact

100 students and **5** teachers (July-December 2023)

Participating teachers

Claudia M. Quintanilla
Federico Trigos
Horacio Arredondo
Jorge E. Velarde
René Cabral

6.7 High School

Educational innovation and digital education in High School

21 Projects

11 Educational units

30 Teachers

763 Students-course

As part of the educational innovation strategy in High School, in 2023 the piloting of transdisciplinary projects focused on the concepts of Sustainability and Identity.

As an example of the above, the implementation of the teaching strategy of "Project-Based Learning" allowed our students and teachers to address a real and contextualized problem, drawing on different disciplines to understand all the dimensions of a problem, and thus in a Possible solution.

On the other hand, the "Algorithmic Biases" project focused on the uses of Artificial Intelligence from different perspectives of daily life, as well as the challenges it poses to develop algorithms that generate biases in decision making. This approach strategy from different disciplinary areas allowed students to be made aware of different approaches from which the uses and biases involved in the use of AI can be understood. In addition, a multi-campus class was piloted where students from 13 campuses participated virtually in the Tec Virtual Campus educational metaverse through the teaching of the "Communication and Art" class.

All of the previous learning experiences have proven to have a powerful impact on the experience and training of our students.

Strategic projects

Interdisciplinary projects on the topics of Peace and Sustainability

An interdisciplinary pilot project was designed and implemented with the themes of Peace and Wellbeing (second semester), and Sustainability (third semester). This project involved five subjects: Spanish, Social Sciences, Mathematics, Science and Technology. The project replaced the core activity to evaluate the development of disciplinary competencies.

Through this experience, the students developed training and disciplinary skills through an interdisciplinary project connected to a real problem, thus forming a bond within their school community and outside of it.

In the August-December 2022 semester, the topic of Sustainability was piloted on three campuses (Cuernavaca, State of Mexico and Eugenio Garza Sada), a single group per campus; In the January-May 2023 semester, the topic Peace and Wellbeing was presented on the same three campuses, but with all their second semester groups; and finally, the topic of Sustainability was presented on seven campuses (Cuernavaca, Cumbres, State of Mexico, Eugenio Garza Sada, Guadalajara, Irapuato, Valle Alto), in the August-December 2023 semester.

The Sustainability project asked the students to solve the following challenge: How can you reduce your ecological footprint and that of your community by 10%? For its part, the Peace and Wellbeing project had the following challenge: How can you be an agent of construction of Peace and Wellbeing in your community and beyond? Through inquiry, prototype design, peer and expert feedback, the students presented to their community a specific problem they chose, as well as their proposed solution.

This project had the intention of developing learning and skills such as critical thinking, collaboration and personal and social responsibility, through the “Project Based Learning” technique, but in an inter and transdisciplinary way to address a real problem and complex, as are climate change and peace. To learn more about the Peace and Wellbeing project, you can consult this publication.

Impact

1,200 students and **180** teachers from the campuses: Cuernavaca, Cumbres, State of México, Eugenio Garza Sada, Guadalajara, Irapuato and Valle Alto

Interdisciplinary Identity Project

A pilot interdisciplinary project with the theme of Identity was designed and implemented (first semester). This project involved six subjects: Spanish, Social Sciences, Mathematics, Science, Mentoring and Technology. The project replaced the core activity to evaluate the development of disciplinary competencies. In the August-December 2023 semester, it was piloted on five campuses (Mexico City, Eugenio Garza Lagüera, Puebla, Sonora Norte, Santa Catarina), with only one group per campus.

The Identity project aims to provoke an exploration of the concept from 5 different spheres: biological, historical, digital, personal and cultural identity. Through various guiding activities, students learn about issues from their past and reflect on their present and, with that information, create an artistic work in which they express their findings about their identity.

Impact

140 students and **36** teachers from the campuses: Mexico City, Eugenio Garza Lagüera, Puebla, Santa Catarina and Sonora Norte (August-December 2023)

Intercampus class in metaverse

Students from 13 high schools of the Tecnológico de Monterrey took the "Communication and art" class of the Spanish subject, through the Tec Virtual Campus platform and another metaverse, involving innovative tools and an avant-garde environment to carry out their activities.

Impact

26 students from the campuses: Mexico City (headquarters), Obregón City, Chiapas, Cumbres, Esmeralda, State of México, Eugenio Garza Lagüera, Hidalgo, Saltillo, Santa Catarina, Santa Fe, Sinaloa and Valle Alto (August-December 2023)

Participating teachers

Artemisa Sangermán

Algorithmic biases (Artificial Intelligence)

Within the framework of the "International Day of Access to Information", PrepaTec teachers and students had the opportunity to learn basic concepts of Artificial Intelligence (AI) and algorithmic biases, to reflect on the impact that AI already has on their lives, and the way in which the future is changing from different disciplines.

Starting from the topic of algorithmic biases, case studies were designed from each of the PrepaTec academies. The cases addressed the biases that Artificial Intelligence could present if it were allowed to make decisions about Health, Public Policies, Urban Planning, Education, Literature and Economy. The students answered reflection questions about the previous biases, discussed them in class, and finally shared their experiences.

The students learned the basic terms of AI and the way it analyzes data and makes decisions. They played with the Most Likely Machine digital resource in one of their subjects, and thus understood the problem of algorithmic biases and the influence of people on the decisions made by AI.

Impact

+180 teachers (August-December 2023)

6.8 Continuing Education

Educational innovation and digital education in the Vice-Rector's Office for Continuing Education

4 Projects

4 Teachers

272 Students-course

During 2023, the Vice-Rector for Continuing Education focused its educational innovation efforts on the consolidation of "The Learning Gate" training program.

This project was launched on the market in 2022 as a minimum viable product with flexible learning paths in the areas of leadership and data science. In 2023 it offered new learning routes and modalities, new functionalities for experience, as well as a didactic strategy for knowledge transfer.

Likewise, another of its innovative strategies was the use of generative Artificial Intelligence in the design of a training program to develop new skills in continuing education facilitators.

Consolidation of "The Learning Gate"

As part of the educational innovation actions implemented during 2023 in the "The Learning Gate" program, the following 8 new flexible learning routes were designed and produced, in the areas of Marketing, Sales, Finance, Project Management and Operational Excellence:

Area	Flexible learning paths	Competencies/ Subcompetences	Learning hours
Marketing and Sales	Marketing starter	4/12	120
	Digital Marketing Strategist	4/14	140
	Strategic Sales Leader	4/12	120
Finances	Financial Professional	7/15	150
	Finance specialist	6/17	170
Project Management	Project Manager Professional	4/15	150
	Agile Project Leader	3/13	130
Operational excellence	Operational Excellence Team leader	6/17	170

As shown in the table above, this program offers 278 products between learning routes, competencies and sub-competencies. While some of the new routes have only recently been launched, more than 700 students have already signed up. Likewise, the production of 3 more routes began in the areas of Project Management and Operational Excellence, and 5 more in Digital Transformation.

Likewise, with the purpose of adapting to the preferences and learning styles of the participants, the following two new modalities were introduced to help improve the completion rate:

TLG-Gen	TLG-Flex
For those who prefer to learn in community: ■ Join a generation. ■ Move forward together with the same order and rhythm. ■ Receive live coaching sessions with the teacher in each module.	**For those who prefer maximum flexibility:** ■ Customize your route according to your interests and priorities. ■ You decide when and at what pace. ■ Your success partner accompanies you to ensure your own success.

On the other hand, new functionalities are incorporated into the ecosystem to improve the user experience through:

- A more intuitive interface for the participant.
- Improvements to the navigation of the teacher evaluating the challenges to ensure that the evaluation and feedback process is developed in an agile and timely manner.
- Tools for easy and timely monitoring of the progress of each participant to facilitate the support of the success partner at key moments, and thus ensure the successful completion of the training process.
- "Recent Activity" section to facilitate access and consultation to recently reviewed resources.

Finally, the design of an "Autonomous Domain Integrating Project (ADIP)" was incorporated to ensure valuable results at the conclusion of the learning routes, which is essential for the significance of a continuing education program. The PIDA allows the participant to develop and accredit the autonomous capacity to give results by applying what they have learned in their daily life.

At the end of the training route, the participant:

- Defines a specific improvement objective, a success indicator, and a goal.
- Autonomously proposes a work plan (2 to 3 months) to achieve it based on what has been learned.
- Executes the work plan.
- Generates valuable results.

For their part, the teacher:

- Validates and approves the work plan.
- Provides follow-up and intermediate coaching.
- Evaluates the development and final result of the project, and provides feedback.
- Accredits the autonomous capacity of the participant to provide results.

The ADIP is incorporated into "The Learning Gate", LiFE programs and some Virtual Classroom programs to ensure the generation of valuable results.

Generative Artificial Intelligence for continuing education facilitators

During August and September 2023, a new training program was integrated to capitalize on generative Artificial Intelligence to support teachers in the different functions they perform in a continuing education program.

This initiative was developed as a pilot plan for a group of 12 continuing education teachers, who will support the process of replicating it to the entire community of continuing education teachers on the following topics:

- Trend research
- Thematic content development
- Image development
- Production of learning resources (videos, podcasts, etc.)

Educational experiences with Artificial Intelligence

07

Artificial intelligence (AI) is a field of computing focused on creating systems and programs capable of performing tasks that normally require human intelligence. These systems are designed to learn, reason, make decisions, solve problems and recognize patterns in a similar way to what a human mind would do, although using algorithms and computer processes.

AI covers a wide range of applications, from voice and image recognition programs, to recommendation systems, autonomous driving, natural language processing, medical diagnosis and much more. It uses techniques such as machine learning, neural networks, fuzzy logic and data processing to simulate human intelligence at different levels and contexts.

Generative Artificial Intelligence

Generative Artificial Intelligence refers to a subfield of AI focused on the creation of systems capable of generating original and novel content, such as images, text, music or even videos, that have characteristics and structures similar to those created by humans.

These systems use generative models, such as generative neural networks (GANs) or language models, to produce new content from existing data sets. It can be applied in various fields. In the educational field, it can be used for different academic purposes to offer tools and resources that complement the work of teachers, while enriching the experience of students.

Some examples are:

- Creation of content, activities and evaluations to make the design process more efficient.
- Virtual assistants to support teaching.
- Personalization of instruction, which allows feedback to be provided in real time, as well as making it easier for teachers to prepare teaching content or evaluate academic performance.
- Simulations and learning environments to provide enriched educational experiences with the use of immersive technologies.
- Generation of educational materials accessible to a broader audience, including people with disabilities.
- Administrative efficiency for the automation of routine tasks and application of predictive analysis for resource management.

Projects with AI at the Tecnológico de Monterrey

The rise of Artificial Intelligence technologies, and in particular generative intelligence, has been a watershed in the development of new applications that use these technologies. Considering the relevance of this issue in the educational sector, Tecnológico de Monterrey launched several initiatives described next.

TECgpt

It is an ecosystem of tools around generative AI to create specific purpose models that can be consumed directly, or exposed in other enablers, all under a private, secure, managed and customizable environment, for exclusive use of the Tec community.

Operating efficiency

Models that help automate repetitive tasks and focus human intervention.

Advanced analysis of survey comments, evolution of TECbot conversational flows, recommendations for interaction in care processes, and automatic code generation.

Teaching-learning support

Models that help accelerate and enhance teaching and learning work.

Support in the generation of content, class projects, automatic evaluations, generation of exam proposals and analysis of academic content.

Operating efficiency

Models that help accelerate and enhance research work.

Support in hypothesis generation and experimental design, text mining and pattern detection, translation and communication.

Intelligent search for knowledge

Models that allow the search for information, using GPT technology to consult knowledge bases generated from institutional content.

We are sure that the creation of components with GPT technology and Generative Artificial Intelligence will be the key to the development of smarter technological enablers that are adaptable to the needs of users in the institution's academic community.

Offers:

- Privacy
- Security
- Flexibility
- Connectivity

Provides mechanisms to:

- Generate educational content
- Improve virtual assistance and attention
- Promote automatic feedback
- Encourage personalization of learning
- Implement idea enhancers
- Stimulate innovation

TECgpt Portal

In September 2023, the Vice Presidency of Digital Transformation launched the TECgpt Portal for the academic community of Tecnológico de Monterrey. This is a platform developed to make available to the Tec community different specific purpose models based on generative AI functionalities, using GPT technology in a simple, customizable and secure way, being the first university in Mexico and Latin America to apply it privately.

Virtual assistant with generative AI

Project in piloting phase with the objective of creating an intelligent academic virtual assistant that functions as a support tool in the learning process for students with areas of opportunity in the disciplinary concepts of Physics, in the educational units “Modeling of movement in engineering” and “Principles of conservation in engineering”, at the Professional level.

Among its features is the use of GPT technology and the integration of curated content to ensure quality in the assistant’s responses.

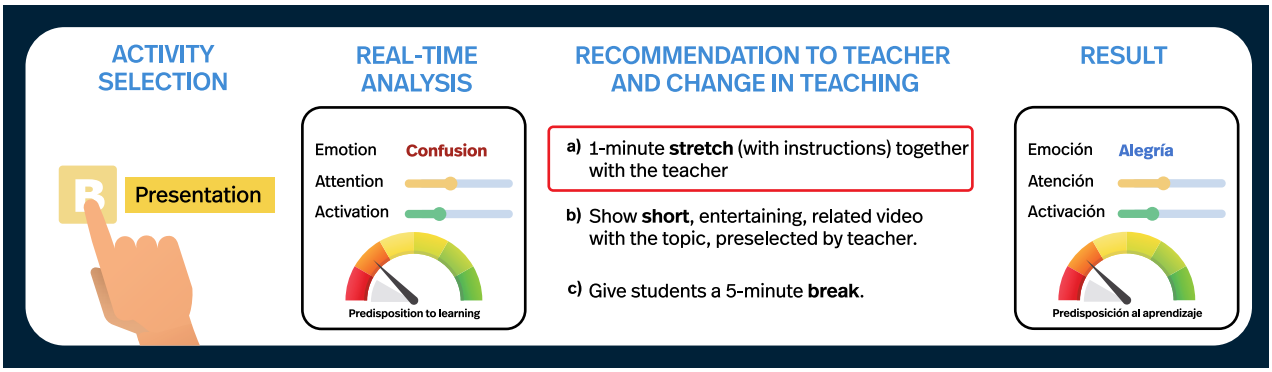
With the support of 3 teachers, and through a content curation process, 119 disciplinary concepts grouped into 15 different topics will soon be integrated, which are part of the academic aspects most requested by students in these educational units.

AI CASTLE: Artificial Intelligence Model for the Analysis of Cognitive-Affective States for Teaching and Learning Enhancement

Project in development phase to identify the cognitive-affective state of students during class, through face analysis with the help of Artificial Intelligence, and generate proposals for teaching strategies so that teachers guide the group towards an optimal state for learning.

The project seeks to develop:

- Real-time dashboard of the group's cognitive-affective states, with didactic recommendations to increase predisposition to learning.
- Pedagogical model for applying this innovation in the different learning modalities of the institution, considering at least one live use model and one prospective one.
- Integrative report of the cognitive-affective response of the students to the teaching intervention, as an input to optimize the didactic strategy in the educational units.



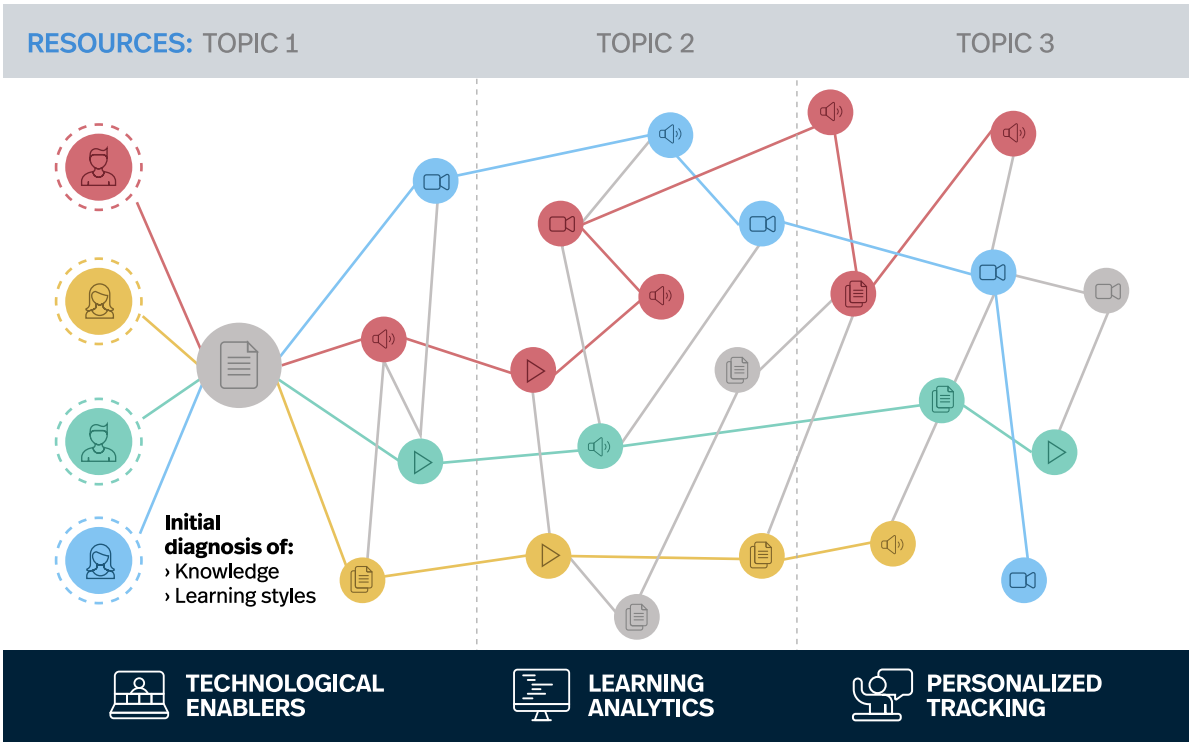
Representation of group status dashboard and teaching recommendations (for illustrative purposes only)

In the first phase of this project, the parameters for identifying cognitive-affective states will be determined during the various moments of class, measuring factors such as emotional states, attention and physiological activation in some groups of in-person and digital modalities.

Once the analysis parameters are adjusted to the population of Tec de Monterrey students, the implementation of the technology in various learning modalities will be piloted, with the intention of analyzing the potential of its adoption by the teachers of the institution. Although one of the main goals of the project is to provide the teacher with a tool to make teaching decisions based on concrete data, it is also expected that the information obtained by the software will generate relevant data for the analysis of teaching processes in the classroom.

Adaptive Learning

The implementation of the Adaptive Learning strategy has continued in coordination with the School of Engineering and Sciences. An Artificial Intelligence engine is used that allows each student to have a personalized route, since special content is presented when they need it. In turn, teachers have the opportunity to consult the learning analytics before going to class to be able to adapt their teaching according to the needs of the group.

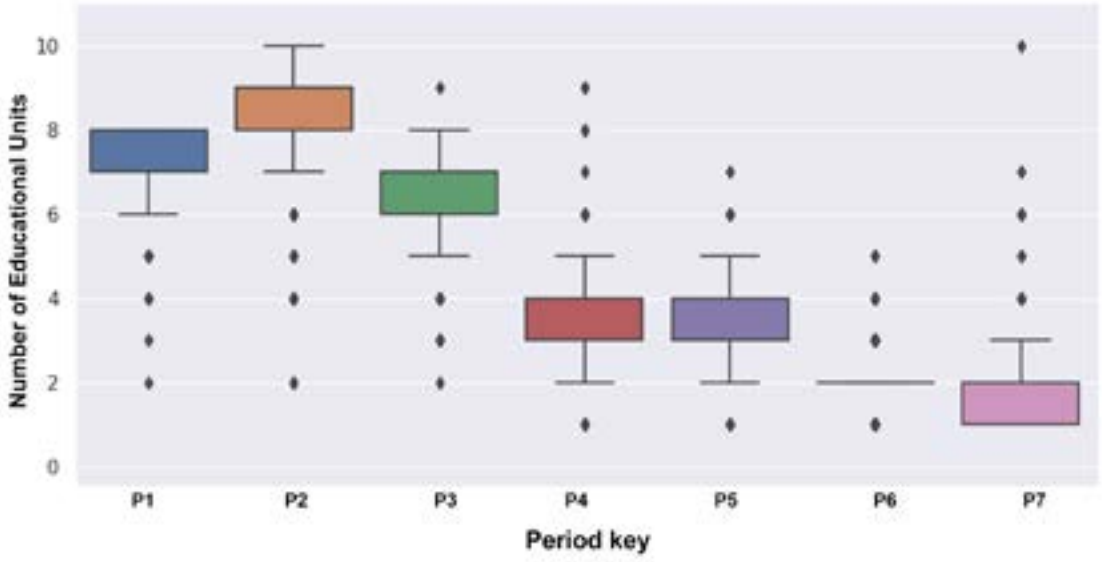


Analytics for personalization of learning

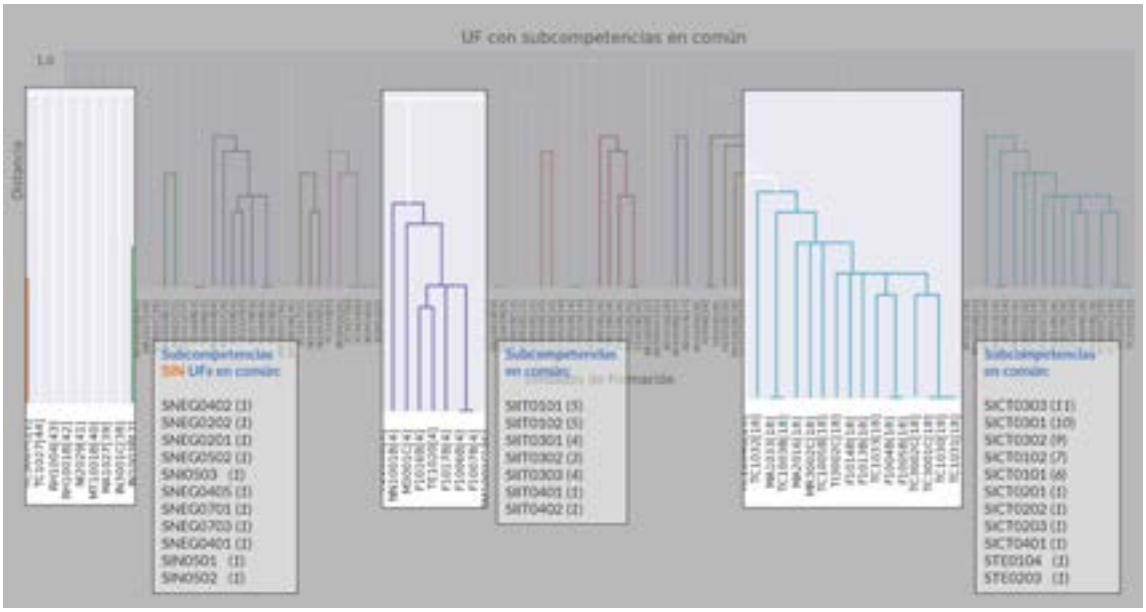
In order to identify the patterns and differences between the courses and sub-competencies, as well as the progress of the cohorts in meeting the established objectives, in 2023 various studies and analyzes of the educational units of the 2019 plans were carried out (Tec21 Model), using statistical techniques considering data from 4 years and more than 900 first generation students from different Schools and Programs.

In the first phase, the following analyzes were carried out:

- Relationships between block and subject variables, such as the final grade and the level of subcompetences, among others.
- Grouping of educational units according to common sub-competencies throughout a program, through a hierarchical clustering analysis.



Analysis of the evaluation model to measure the relationship between the degree of achievement of the subcompetence and the final grade



Cluster analysis of sub-competencies by educational unit, throughout a program

These analyzes generated more than 50 views. In a next phase, the impact and results of the Tec21 Model plan will be analyzed, together with the Academic Vice-Rector's Office and functional experts, to support decision-making in the continuous improvement of study plans. This phase will be a bridge to predictive analysis, where areas of improvement and recommendations will be sought to optimize the performance of students and teachers.

Assessment automation

The use of automation tools for evaluation and feedback, supported by Artificial Intelligence, aims to reduce the time dedicated by teachers to evaluation without compromising quality, allowing them to dedicate that time to other essential activities in the educational process. Simultaneously, students experience an improved perception of their classes by receiving feedback more quickly. This agility in feedback not only contributes to a dynamic learning environment, but also enables students to address and correct their errors in a timely manner, thus fostering a continuous cycle of improvement in their academic performance.

In terms of the pilot project, it seeks to optimize the evaluation of academic activities, especially in STEM disciplines. By allowing the simultaneous grading of specific questions across all activities, the initiative aims to accelerate the identification and classification of items, which will contribute to more efficient and uniform evaluation.

The execution of the pilot will be carried out during the winter period of 2024, as well as in the period from February to June 2024, through an initiative in conjunction with different areas of the Tec. It is expected to provide a solid understanding of the feasibility and the potential benefits of this initiative, paving the way for future larger scale implementations in the educational field.

Application of AI in digital education

Currently, the application of generative Artificial Intelligence tools is being contemplated: ChatGPT and Dall-e, from OPEN AI.

A pilot was carried out in the February-June 2023 semester, in online digital modalities educational units, ELITE and FIT, to evaluate the impact of Artificial Intelligence as a support resource in the teaching-learning process.

Teachers from different disciplines incorporated AI into learning activities with an ethical approach. The pilot received pedagogical support with a support plan for teachers, involving the areas of Pedagogical Design and Architecture, Digital Education, and with support from the Academic Integrity Program. This intentional experimentation with AI strategies allowed us to establish recommendations, based on findings, about the correct and ethical use of these tools for their future implementation in education.

The following participated:

- **20** Groups
- **6** National Schools
- **28** Teachers
- **3,338** Students
- **24** Campus

Learning enriched with Artificial Intelligence

What do the students think?

79% consider it useful

81% believes that it allows the activity to be carried out with greater speed

70% expresses that it contributes to creating one's own interpretation of the concepts that were addressed in the activity

Comments

"I liked that tools like these are integrated into the academic program instead of prohibiting them, since their existence is inevitable and I think it is better to learn to use them responsibly."

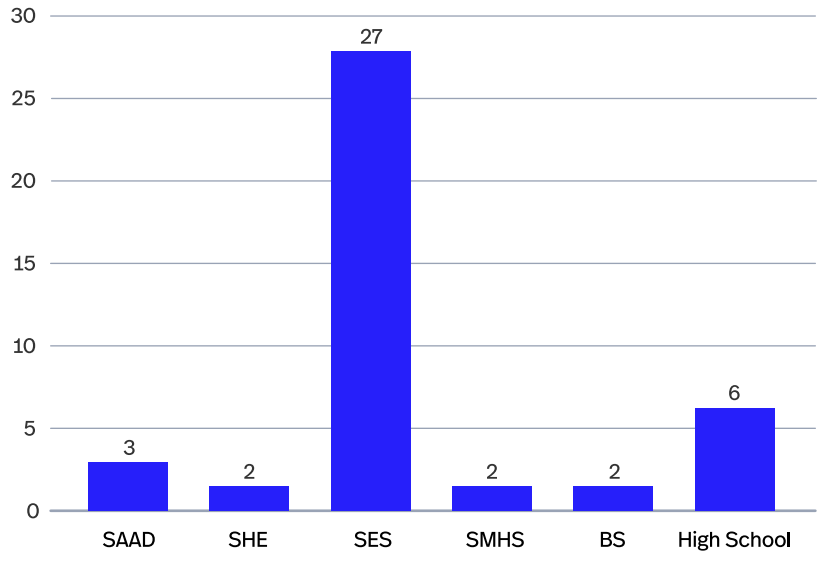
"...I believe that the correct use of AI makes activities more efficient."

"I was able to generate critical thinking from the information provided by artificial intelligence, understand the information and the topic."

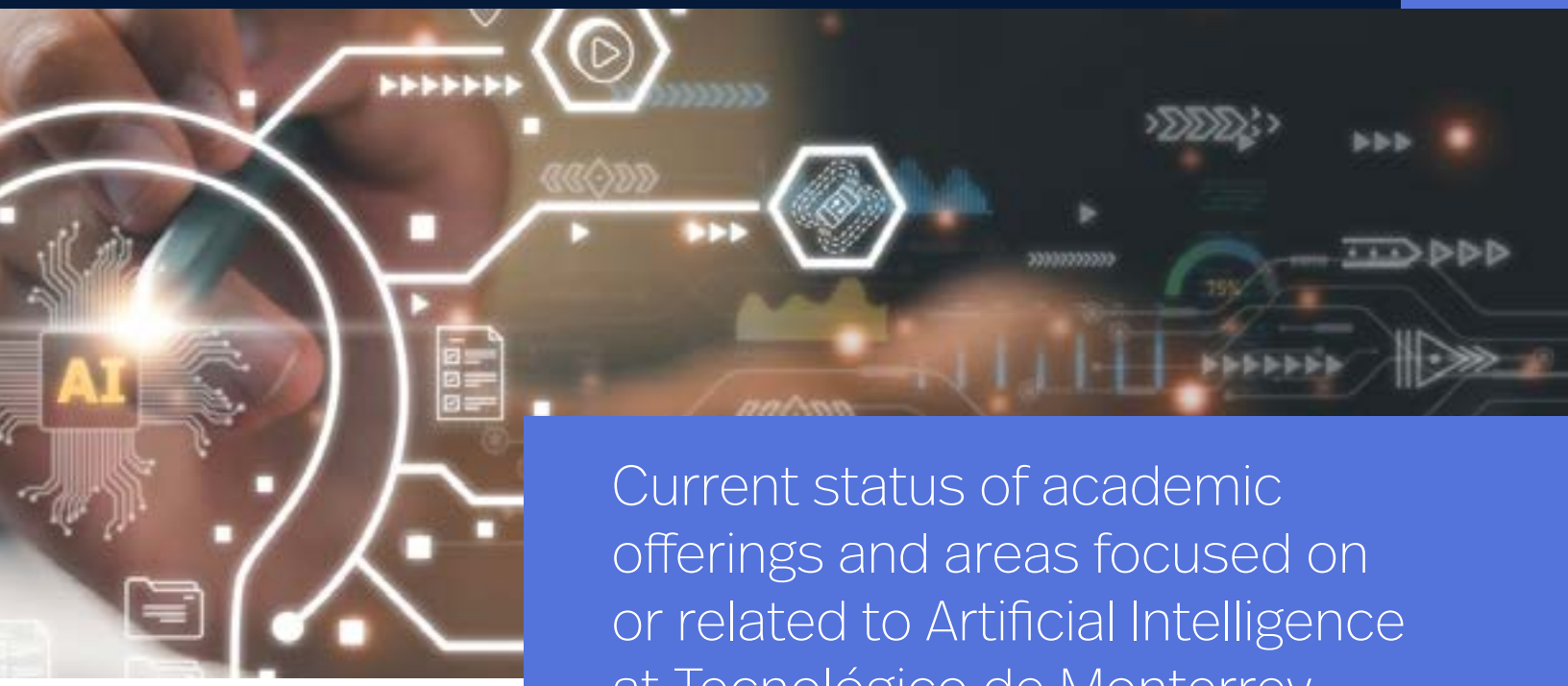
Innovative and digital experiences, related to the use of Artificial Intelligence in Schools

AI plays an increasingly important role in higher education, improving the quality of teaching, personalizing learning, facilitating educational management and opening new possibilities for research and access to education to a broader spectrum of people. For this reason, all the National Schools of the institution have implemented the application of technological tools based on Artificial Intelligence in their educational units. Below is the total number of projects deployed in each of them during 2023.

Educational innovation projects with AI-based technologies in Schools



For more details on these projects, consult topic 6 of this report: Innovative and digital educational experiences in the institution.



Current status of academic offerings and areas focused on or related to Artificial Intelligence at Tecnológico de Monterrey

Undergraduate*	Graduate	Areas
■ Data Science and Mathematics Engineering ■ Robotics and Digital Systems Engineering	■ Master in Applied Artificial Intelligence ■ Specialty in Applied Artificial Intelligence ■ Master in Cybersecurity ■ PhD in Computer Science	■ Artificial Intelligence Hub ■ Data Science Hub ■ Advanced Artificial Intelligence Research Group

*In some cases, the entire program is not focused on AI, only some courses.

In addition to the above, the professional careers are:

- Data Science and Mathematics Engineering
- Robotics and Digital Systems Engineering
- Bachelor's Degree in Digital Art

Initiatives and drivers of innovative digital educational experiences

08

8.1 Adaptive Learning

It is an educational strategy that uses technology based on data analytics to adapt education and create a personalized learning route whose contents were previously designed by the teacher, so that it is effective and efficient for each student, based on their level of knowledge. performance, their profile and their learning needs. This allows the teacher to identify gaps in the group's understanding to establish improvement actions and adjust their educational practice, thus optimizing the performance of their students. With the proper application of this strategy, it contributes to achieving academic success in key educational units for students who begin their journey in the Tec21 Model.

The Vice-Rector for Educational Innovation and Academic Regulations designed a pilot for 4 educational units of the School of Engineering and Sciences in the areas of Mathematics, Physics and Computing. In conjunction with the Academic Vice-Rector's Office, the strategy for incorporating a leveling topic in the pilot educational units was defined, where students who require it can practice the topics of prior knowledge through personalized routes, which allows the group to level their base knowledge, thus allowing the teacher to focus on the new content.

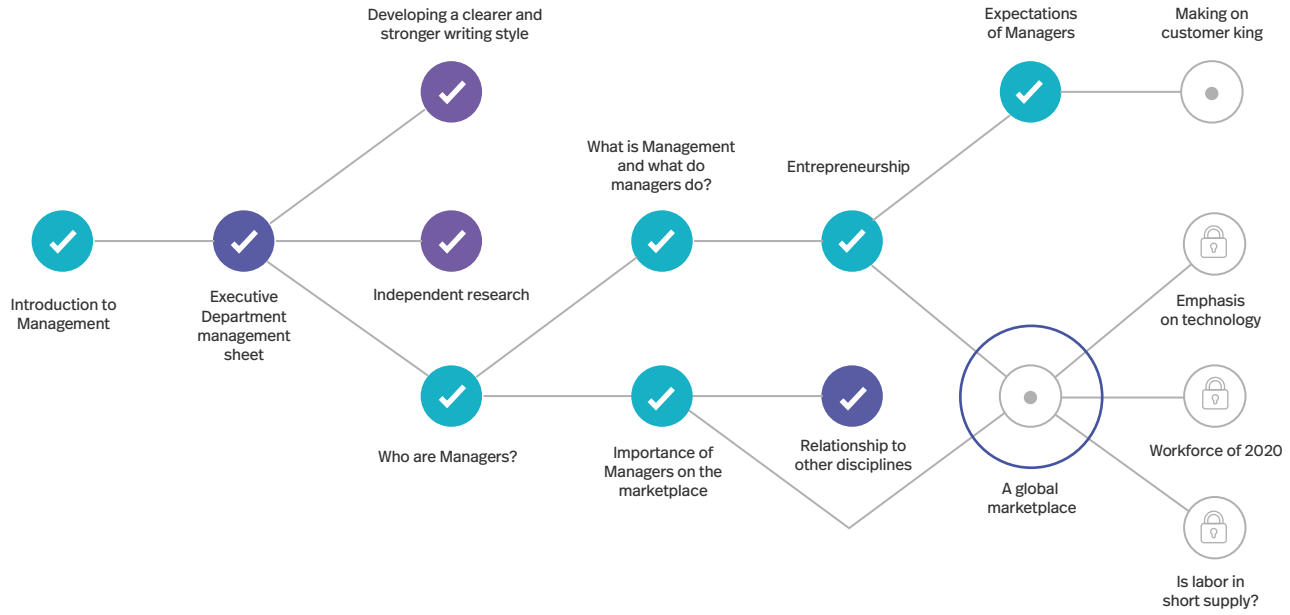
Students and teachers from 13 campuses participated in the pilot: Aguascalientes, Mexico City, Juárez City, Obregón City, Chihuahua, State of Mexico, Laguna, León, Monterrey, Puebla, Querétaro, Sinaloa and Tampico, as well as Digital Education students, for a total of 1,102 students and 58 teachers in 4 educational units. Additionally, the pilot had the support of the Institute for the Future of Education, with the objective of conducting research that measures the level of improvement in student learning by applying this educational strategy; Subsequently, the research results will serve for continuous improvement.

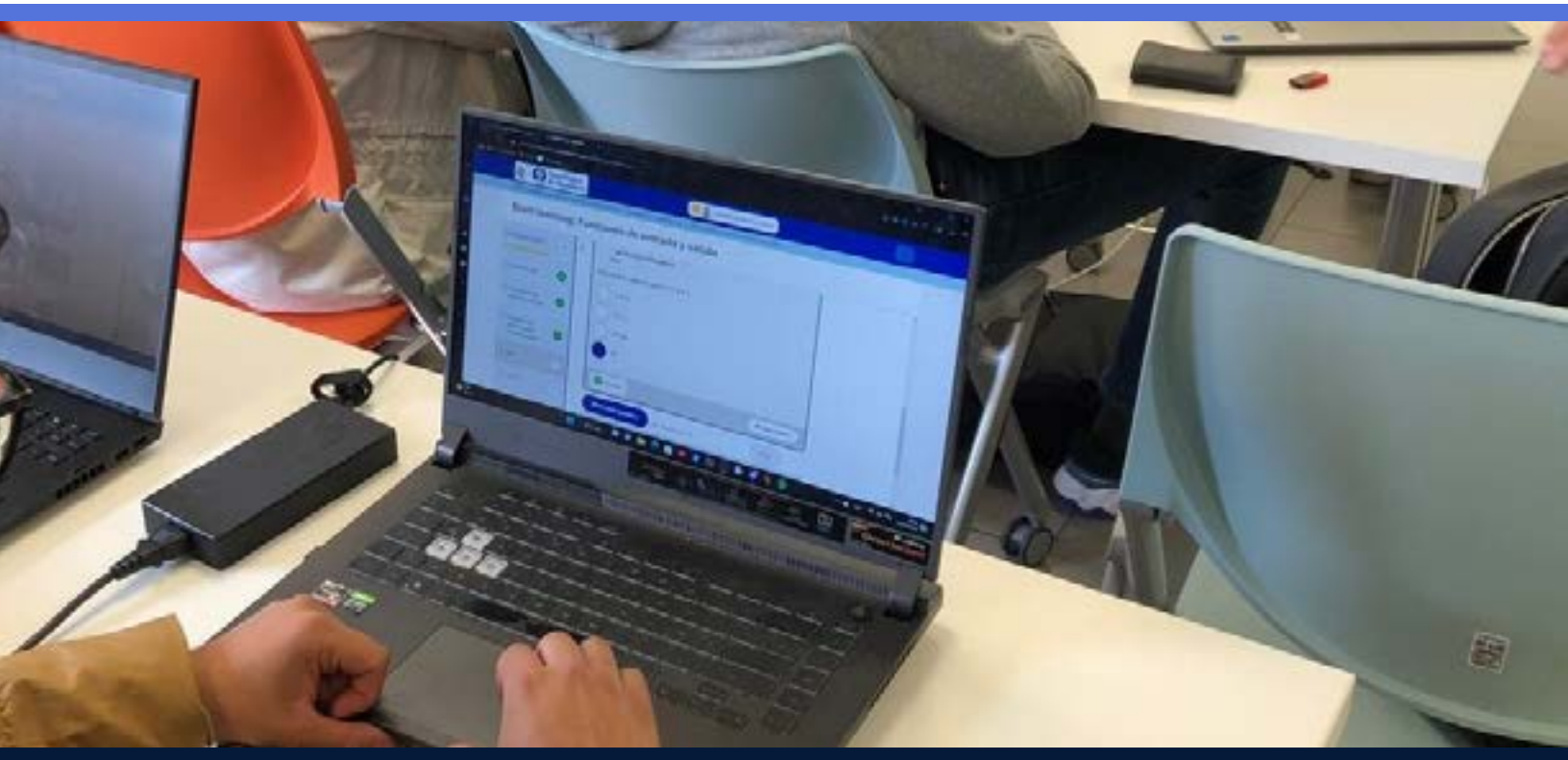
Impact:

1,102 Students

58 Teachers

In 2023, other courses were taught where the Personalized Learning strategy with adaptive bases was applied, through CANVAS as a technological platform, in which learning routes were designed emulating an adaptive platform. A total of 797 students and 23 teachers participated in 2 educational units.





8.2 Immersive Learning with Extended Reality

Impact:

33,677 Students

936 Teachers

Innovation Strategy where the learning experience happens in Extended Reality environments such as Virtual Reality, Augmented Reality and Mixed Reality, supporting the teaching-learning process to develop and evaluate knowledge, skills and competencies in an experiential, active and immersive way.

Strategic projects

Immersive learning laboratory applied to Health Sciences: Dentistry Project

Students from the Dental Surgeon program at the School of Medicine and Health Sciences carried out a practice in March 2023 using the Mixed Reality resource. This exploratory pilot complemented a final evaluation of the preclinical practice of the Endodontics area. With a HoloLens device, the doctor obtains an immediate visualization of the patient's information, superimposed on the patient's reality directly with a vision of the clinical scenario; Likewise, the medical student can obtain a better understanding of complex anatomies or procedures, allowing him/her to execute therapeutic tasks with improved and immersive guidance.

Impact

18 students from the School of Medicine and Health Sciences

Designer teachers

José C. Presa
Karen L. Reyes

Path 2: Lean Six Sigma Methodology: MEASURE phase

This path is within the Lean Six Sigma Green Belt Certification. Its main purpose is to familiarize participants with the tools used in this phase and their expected results. In this collaborative environment, they were able to work together with their teacher and the rest of the group, sharing learning, ideas and answering questions interactively. Through an immersive and collaborative approach, the students were able to apply the tools learned and advance in the continuous improvement of their Six Sigma projects.

Impact

350 students of the School of Engineering and Sciences

Designer teachers

Froylán Franco
Ivonne Abud

Heineken digital factory: Use of extended reality as an engagement strategy to link content and skills

This learning experience with Extended Realities from the School of Engineering and Sciences was launched for the first time nationwide in January 2023. This resource allows you to view the digital factory of the Heineken Brewery, showing the scenarios to view them in a 360 environment. as well as knowing the production lines in which an Industrial Engineer carries out activities specific to their area.

Impact

1,749 students of the School of Engineering and Sciences

Designer teachers

Ana M. Turcios
Fabiola Lima
Luis A. Ramírez
María I. Ruiz
Ricardo Ipiña
Vianney Lara

Challenge with Mixed Reality: Seminar on Innovation in construction

Impact

100 Continuing Education students

Designer teacher

Francisco S. García

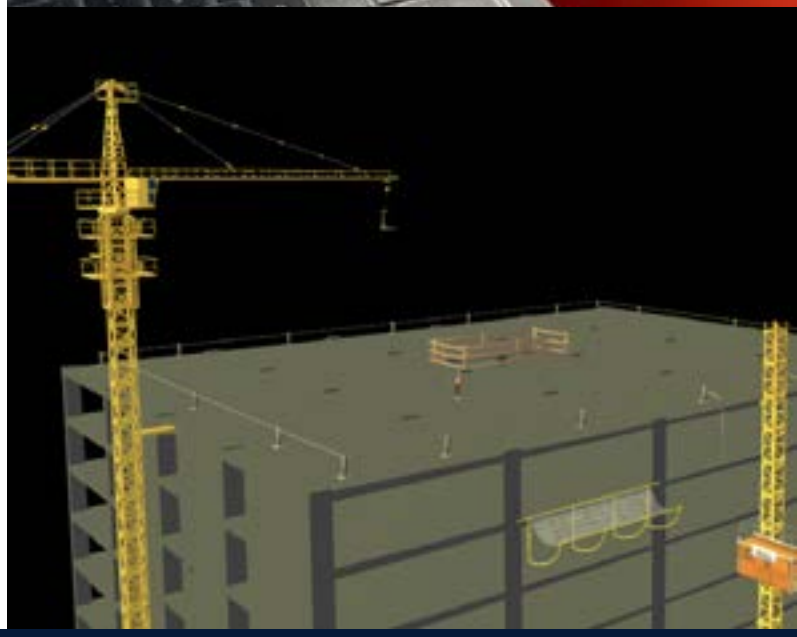
For the Seminar on innovation in the construction of Continuing Education, 2 experiences with Mixed Reality were developed that are described below.

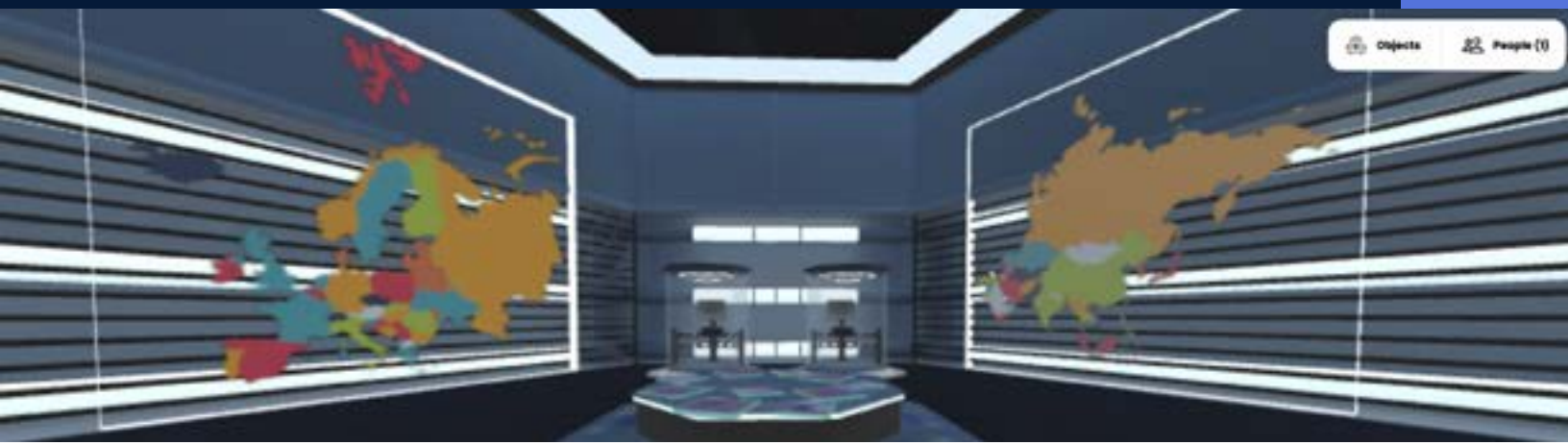
Immersive experience of innovative construction strategies

Educational challenge focused on the construction industry, which uses Mixed Reality technology to address problems related to the optimization and leveling of concrete components. In this innovative way, the student designs a solid technical solution supported by justifications thanks to immersive practice, presenting it in a sketch. The activity encourages creative thinking and problem solving in the context of construction.

Safe immersion for occupational risk analysis

Participants immerse themselves in an educational challenge focused on occupational risk management in construction using Extended Reality technology. In this way, participants can prioritize the identified risks and discuss the importance of prevention, situational awareness, teamwork and regulatory compliance.





Virtual Reality Space, teaching-learning space: Escape Room “Future Exploration”, strategic business prospective, strategic thinking

The “Future Exploration” Escape Room seeks to become a new form of teaching-learning of the concepts, principles, currents, methodologies and tools of strategic foresight, through the design of a virtual collaborative learning space based on the solution of conceptual challenges. , where the student reinforces content through active learning. The integral experience is conceptualized as a space trip that consists of three moments: takeoff, stay at the space station and landing. The space station is made up of four themed rooms, where each one constitutes its own Escape Room with particular challenges.

Impact

711 students of the School of Government and Social Sciences

Designer teachers:

Guillermo Gándara
Pamela Rodríguez

To know the published articles referring to this topic, please consult Appendix 1: Publications on educational innovation..

Immersion in the metaverse to create stories, “Audiovisual narrative”

As avatars that tell their story in the “Audiovisual Narrative” educational unit, the students enter the metaverse and in 30 minutes they bring the avatars to life, assign them a name and develop stories based on their characters. This activity develops creativity and storytelling skills.

Impact

25 students of the School of Humanities and Education

Designer teachers

Manuel H. Ayala
O. Nathaly Garza

8.3 Curriculum and Alternative Credentials

In addition to the granting of professional titles, certificates, diplomas and academic degrees, Tecnológico de Monterrey considers two types of credentials in its educational model and offering: Curricular Credentials and Alternative Credentials. According to previously established design and operation guidelines, they are awarded to Undergraduate, Graduate and Continuing Education students.

Undergraduate Curriculum Credentials

The Tec21 Educational Model for Undergraduate allows the formation of solid and comprehensive skills that help its students to solve, in a creative and strategic way, the challenges of the present and the future. One of the institution's commitments is to recognize and make evident the comprehensive development and achievement of the competencies associated with the graduation profiles of its students. To make this possible, the institution defined the guidelines for the issuance of Curricular Credentials, as well as the design premises of Alternative Professional Credentials for their offer in the medium term, thus managing to offer its students the opportunity to enrich their professional profile. which in turn will allow them to accelerate their insertion into the labor market.

Through the Center for Evaluation and Alternative Credentials (CECA), a service area belonging to the Academic Vice-Rector of the institution, the management and deployment strategy of these credentials was defined.

To achieve the above, a work plan was carried out with all the areas involved in communicating and enabling the issuance of credentials. With the objective of managing the achievements of students' skills, the "Institutional Achievement Manager" was developed internally.

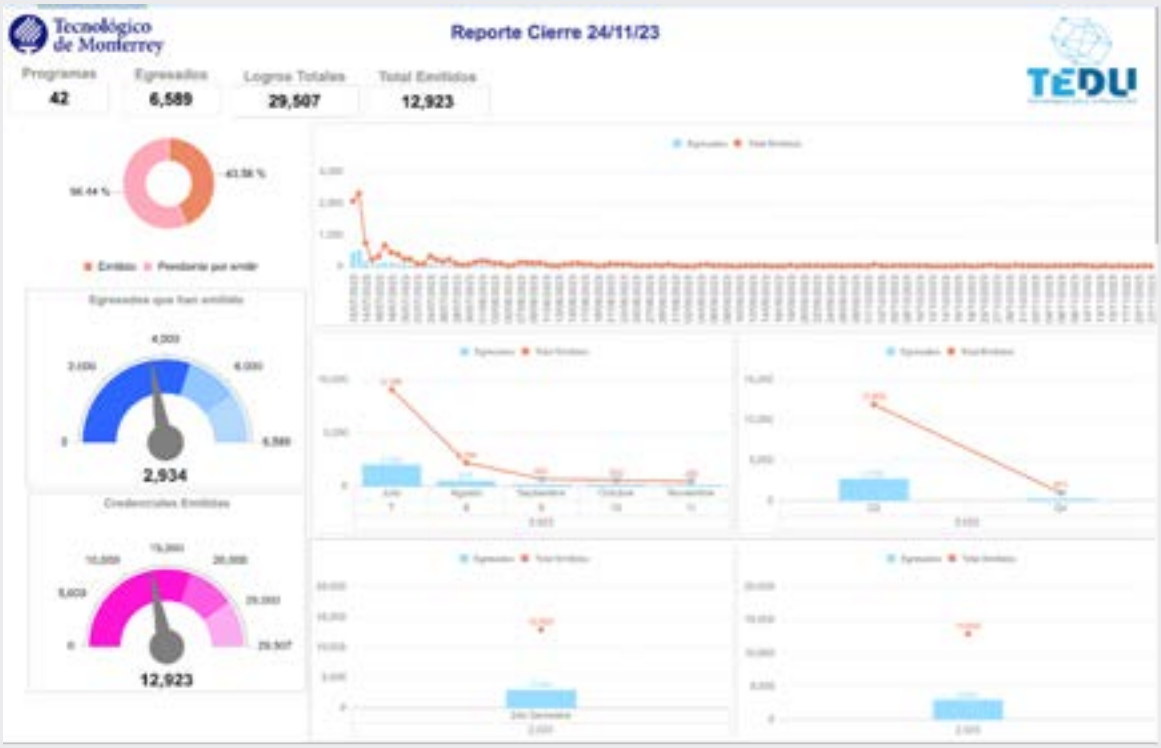
Through this enabler, the mapping of all the competencies declared in the graduation profile of each of the study plans was carried out. According to the record of the sub-competencies achieved by the students, the "Institutional Achievement Manager" identifies the curricular competencies that a student acquired according to the requirements previously defined in the tool, thus managing to program the issuance of the acquired Curriculum Credentials.

Example of a disciplinary competency Curricular Credential badge

Each Curricular Credential of disciplinary competence is represented in cyberspace by means of a digital badge that can be shared through different digital media, such as LinkedIn, Facebook, among others. To safeguard the validity and authenticity of the credential and its insignia, high security technology is used for its issuance. To track the issuance and publication of credentials, special boards were enabled where the total number of credentials granted, issued and published on different social networks can be identified.

The first two 2023 generations of the Tec21 Model, a competency-based educational model, were made up of 8,158 graduates, who were notified of a total of 44,715 achievements; of these, 15,899 already have the digital badge issued by the new professional.

The activation of the monitoring boards allows defining communication and support strategies for new graduates, now members of the EXATEC community, about the value contribution of these credentials, and how they provide them with a unique profile that will undoubtedly support them to accelerate their process of entering the labor market.



Example of the monitoring board for the issuance of Curricular Credential badges for disciplinary competencies

Example of the dashboard tracking social media platforms through which badges are shared

Example of dissemination and delivery of badges

Alternative Credentials at the institution

Alternative Credentials recognize specific learning achievements, skills and competencies obtained through training experiences independent of the formal Professional titles and academic degrees from Tecnológico de Monterrey. During 2023, this strategy has been deployed at different academic levels and areas of the institution through various projects, such as those presented below.

In **Undergraduate**, in addition to the issuance of the first Curricular Credentials, the Alternative Credentials strategy was deployed through an offer of Digital Continuing Education Seminars. Through these, students who were candidates for graduation could credit one or two Tec Weeks, according to their needs to meet the graduation requirement. At the end of the year, 102 students obtained their Alternative Credentials, 79 of them took 1 seminar, and 22 students took 2 seminars and one of them took 3 seminars, thus achieving a total of 126 accreditations.

In **Postgraduate** studies, the offer of programs such as Certificates and Flexpaths that are part of a catalog of Alternative Credentials increased. This allows students to have more opportunities to obtain credits that can be credited as subjects in a Graduate program. The possibility is also opened for international students to access them. To facilitate this accreditation process for Postgraduate students, a special app was enabled on the miTec institutional portal.

In **Continuing Education**, 1,481 programs were taught in the Virtual Classroom and LIVE modalities, to 39,337 participants. Together with all modalities, in The Learning Gate and language programs, 124,265 digital badges were awarded.

In addition, the new Alternative Credentials model was designed that begins in January 2024. The programs will be segmented into two categories: optional mastery programs and programs with evidence of mastery. The latter will grant Alternative Credentials called “Certificates” and “Certifications”. Certificates will be awarded for having demonstrated evidence of mastery of key knowledge and competencies, as described in the table below.

Program type	DURATION	DOCUMENT	BADGE
Microcertificate Recognizes mastery of knowledge and skills of a **specific competence**, demonstrating through knowledge tests and correct application **in their own reality**.	20 to 49 hours	**Microcertificate**	 Bronze
Competency certificate (silver) They recognize the mastery of knowledge and skills of the **competencies necessary for a specific function**, evidencing through knowledge tests and correct application **in their own reality**.	50 to 95 hours	**Certificate**	 Silver
Competency certificate (gold) They recognize the mastery of knowledge and skills of the **necessary competences for a professional profile**, demonstrating through knowledge tests and the correct application **in their own reality**; and/or through the accumulation of microcertificates.	More than 96 hours	**Certificate**	 Gold

Participants who, in addition to having demonstrated the competencies associated with a certificate, develop an integrative project and generate satisfactory results in their environment based on learning, will be granted another type of Alternative Credential: Certification.

Program type	DURATION	DOCUMENT	BADGE
Certification They recognize the ability to perform a specific function or professional profile. It includes the mastery of knowledge and skills of the competencies associated with a certificate, as well as **the ability to use them autonomously to provide valuable results in their own reality** through an Autonomous Domain Integrating Project (ADIP).	Certification hours + At least 40 hours for execution of the ADIP	**Certification**	 Gold

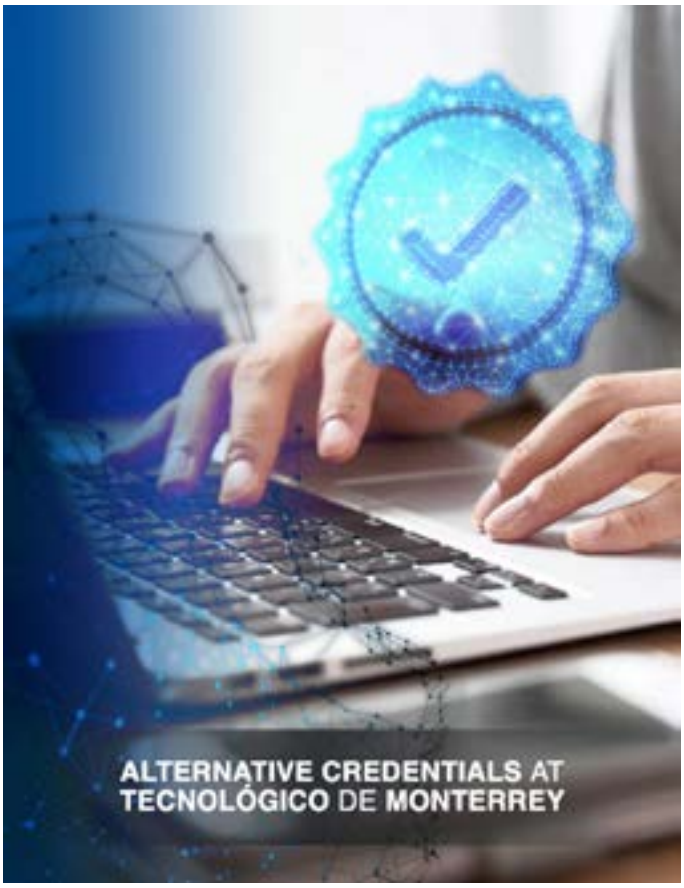
Given the quality standards of the evaluation process, some of the Alternative Continuing Education Credentials that meet certain pre-established guidelines may accredit Graduate subjects.

With these new Alternative Credentials, the employability of the participants is supported and better responds to the need of recruiters to reliably assess the competencies of the candidates and their transformative potential in the organization.

Through the Institute for the Future of Education, and in conjunction with the Directorate of Educational Innovation and Digital Learning, the MOOC "Alternative Credentials: the future of certifications" was created, which is designed mainly for teachers and educational personnel in university and/or business environments, who have an interest in identifying and applying training and skills credentialing. This course offers an introduction to Alternative Credentials and their application in universities through the Coursera and EdX platforms.

Alternative Credentials Institutional Framework

The Vice-Rector's Office for Educational Innovation and Academic Regulations, with the support of the Undergraduate, Graduate and Continuing Education areas, published the document "Alternative Credentials at Tecnológico de Monterrey", which highlights its importance as a new form of demonstration of knowledge, skills and competencies, also sharing the institutional framework defined by the Academic Vice-Rector's Office through the Center for Evaluation and Alternative Credentials with the collaboration of the different Schools and Vice-Rector's Offices. For more information, download the document through the following means:



Alternative Credentials issued by Continuing Education	
2021	257
2022	6
2023	106
2024	2,083
Total	**2,452**

Spanish version

http://bit.ly/Credenciales-Alternativas

English version

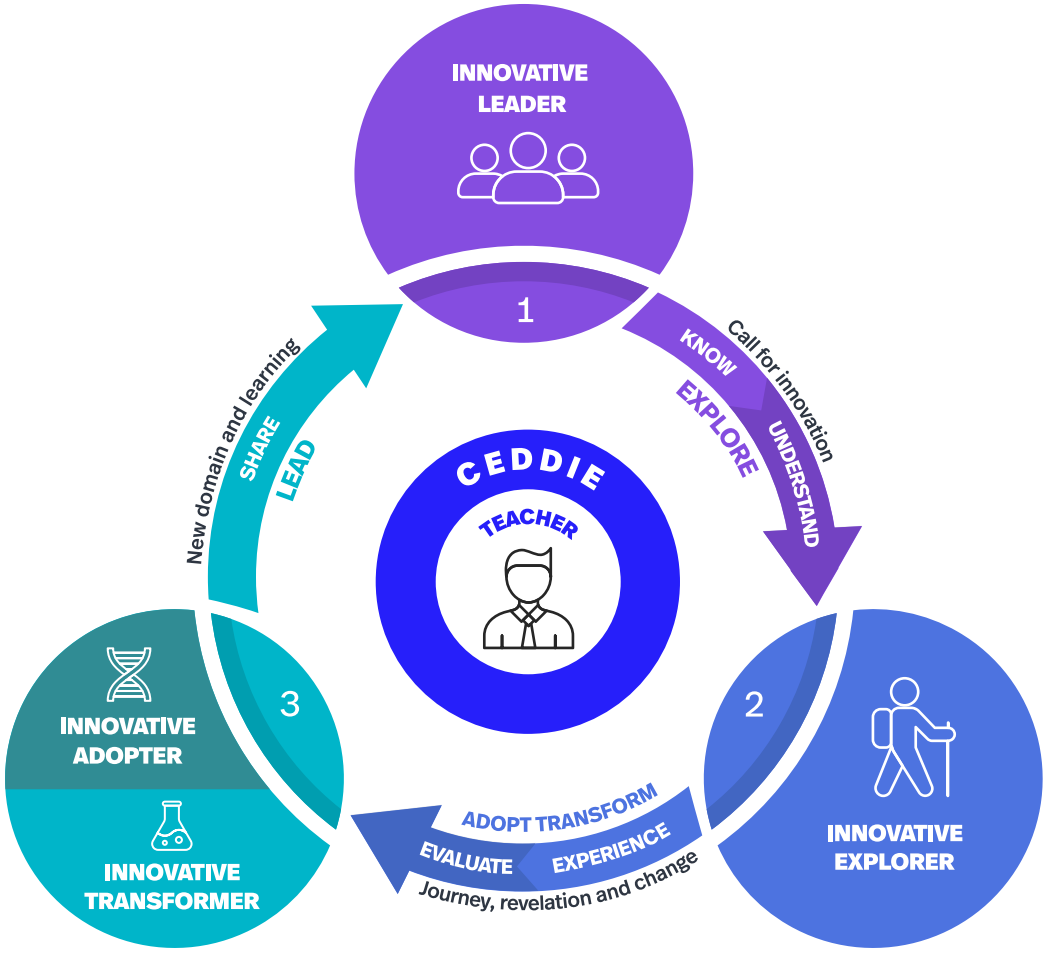
https://bit.ly/Alternative-Credentials-Tec

8.4 Teacher development and educational innovation

CEDDIE
INNOVATE | INSPIRE

The purpose of the Center for Teaching Development and Educational Innovation (CEDDIE) is to promote and facilitate educational innovation generated by teachers, through its model of development and recognition of teaching, intellectual vitality and service. With the aim of inspiring teachers to innovate in their educational practice, this center has a solid educational innovation process.

To innovate in education, teachers promote improvements in teaching and learning from their experience in the classroom, through an ecosystem that encourages the generation of ideas, collaboration and dissemination.



Educational innovation ecosystem at CEDDIE

The year 2023 has been special due to the rise of generative Artificial Intelligence (AI), as it has provided new opportunities to experiment in search of alternatives to address challenges in education. To facilitate the design and incorporation of educational strategies based on Artificial Intelligence, activities were carried out with the following purposes:

- Make known its potential and scope.
- Use tools to impact teaching and learning.
- Use tools to guide the implementation of AI for the design of learning and teaching experiences.

Artificial Intelligence for teaching and learning

To facilitate the incorporation of Artificial Intelligence in teaching practice, different strategies were carried out, among which the following stand out:

Talks and podcast to spread, inform and share best practices

As part of the strategy of using Artificial Intelligence to teach and learn, talks were held with expert teachers and pioneers on the subject, on various perspectives; Through these, 2,090 teachers were impacted. In these dialogue spaces, teachers and experts had the opportunity to interact both to increase knowledge of AI and to explore its uses in the educational field.

As part of the dissemination of this relevant topic, two episodes have been published on the Sintonía CEDDIE podcast, listened to date by +450 people.

Workshops to facilitate the use of AI in teaching practice

The National Teachers' Meeting (RNP) 2023 was an opportunity to offer workshops on the use of AI. The course offering on Artificial Intelligence in education included 7 workshops (eleven sessions in total), attended by 2,074 teachers. Likewise, during the summer a Discipline Update Course (CADi) was offered on "Use of Artificial Intelligence in Teaching Practice".

Bootcamp "Building the learning of tomorrow"

The objective of the practical activity of the Bootcamp was to learn strategies to incorporate Artificial Intelligence to improve teaching and learning, with the aim of leading participants to the design and implementation of their own strategies in their courses.

3 editions were offered in which +130 teachers participated. The experience was led by educational innovation leaders at CEDDIE.

During the summer, the CADi "Use of Artificial Intelligence in Teaching Practice" was taught, in which around 50 teachers learned about strategies for using Artificial Intelligence in their teaching practice, also carrying out rapid implementations.

To experiment and recover learnings on the use of AI to improve the learning experience

Implementation pilots of AI tools and strategies are carried out to generate learning of best practices; 8 teams of teachers participated with support.

Recognition of pioneer implementers of Artificial Intelligence

During the second semester of the year, the "AI Pioneer" badge was awarded to teachers who implemented Artificial Intelligence implementations in their teaching practice. To date, +150 teachers have been recognized.

Badge sample 2023

Promotion of educational innovation

I. Dissemination and training activities: workshops and talks

To teach how to use new innovative educational tools and strategies, there is a continuous offer of workshops, in addition to disseminating innovative practices carried out by teachers, which can be adopted by interested colleagues. During the year, +260 activities were carried out that managed to impact +4,200 teachers. 2 of the talks were given by international experts.

II. Festival "Learning from our educational innovation experiences"

For the second time, the space was enabled to share, celebrate and recognize the experiences and educational innovation projects carried out by our teachers.

Teachers from Tecnológico de Monterrey were invited to participate in the Festival "Learning from our educational innovation experiences." This year, the call aimed to identify innovative projects and implementations in the following thematic lines:

A. Pedagogical transformation. The project or initiative refers to the application of new methodologies to promote a change in the teaching-learning process, such as the deployment of new didactic practices, learning strategies and means of delivery.

B. Technologies for education. It refers to the incorporation and/or implementation of technologies applied to the transformation and improvement of educational experiences.

C. Management of the student's experience. The project or initiative implements processes for the student experience and proposes efficiencies in the design, operation or administration of educational experiences, such as the link with training partners.

Projects that stood out in any of the following criteria were recognized:

- They impact the transformation of the teaching-learning process.
- They transcend and have the potential to detonate and undertake new projects.
- They explore new technologies, pedagogies or emerging educational strategies.
- They multiply, involving other actors in the development of ideas.

The virtual exhibition featured 95 projects carried out by 183 teachers. 10 projects that stood out in some of the categories considered were recognized, and two projects that stood out in all of them.

Recognition ceremony

III. New educational innovation platform

The new educational innovation platform was released that offers teachers a space that integrates documentation initiatives (Registry i), obtaining funds (NOVUS) and evaluation of educational innovation (Scale i).

The documented calls that were followed up in this space were:

- NOVUS 2023 Call
- Hackathon 2023
- Festival "Learning from our educational innovation experiences"
- Monitoring evidence of educational innovation for the classification process

The evaluation process of the innovative practices that teachers register gives a high chance that the proposals will be accepted in various calls, including NOVUS and the teaching classification process.

This year, 808 experiences and projects were documented on the platform; 261 corresponding to the NOVUS call and 547 for the calls for recognition of educational innovation.

Access to the platform is found in MiTec and is identified as "my educational innovation". Upon entering, the platform recognizes the teacher's academic profile.

mi Innovación Educativa

Image my Educational Innovation

IV. TEC DU HACK: hackathon for the generation of innovative projects and proposals

In the month of January, the first national hackathon was held to generate innovative solution alternatives, according to the educational challenge of recapturing the attention of students in a creative and meaningful way, in a post-pandemic world. For two days, the participating teachers devised solutions, received advice through interaction with experts and workshops on new trends, with the support of 7 speakers. At the end of the event, the solutions were presented in pitch format, choosing the most viable and innovative ones with the aim of granting them special recognition and support for their implementation.

The categories of the proposals were the following:

- Pedagogies or emerging technologies
- Emotions in the educational environment
- Physical or virtual environments
- Wellbeing perspective
- Social responsibility

34 proposals were generated, prepared by 120 teachers, from 21 campuses.

Winners:

- First place: Campus Sonora Norte, with the project “ELO Model for Humanities and Sciences classes”
- Second place: Mexico City Campus, with the project “Metacognition with social responsibility”
- Three projects received third place recognition: Campus Monterrey, with the “AdapaIA” project; Campus Estado de México, with the “RecargaTEC” project; and Campus Querétaro, with the “ExplorAR: Observe, Learn, Live” project.

V. Tec Virtual Campus and promotion of the use of the VR zone

The use of the virtual reality environment was promoted through the use of the educational metaverse of the Tecnológico de Monterrey in Virbela. The activities were taught mainly by teachers and experts in different topics.

Likewise, as part of the promotion of VR zones, 315 activities were carried out that involved 114 teachers and 7,932 students.

VII. Promotion of teaching participation in institutional initiatives

As every year, CEDDIE disseminated its initiatives and offered advice for the participation of teachers in educational innovation calls, such as NOVUS and IFE Conference (formerly CIIE).

To promote the participation of teachers in NOVUS, 7 workshops were given, with the attendance of 100 teachers.

For its part, to promote the participation of teachers in the IFE Conference, personalized and team advice was provided.

VIII. National CEDDIE site 2022-2023

The CEDDIE website (ceddie.tec.mx) continues to be continually renewed, offering support to teachers in their educational innovation process.

During 2023, important implementations were made to improve the teaching experience.

Through the CEDDIE site, innovation is promoted at different times throughout the educational cycle:

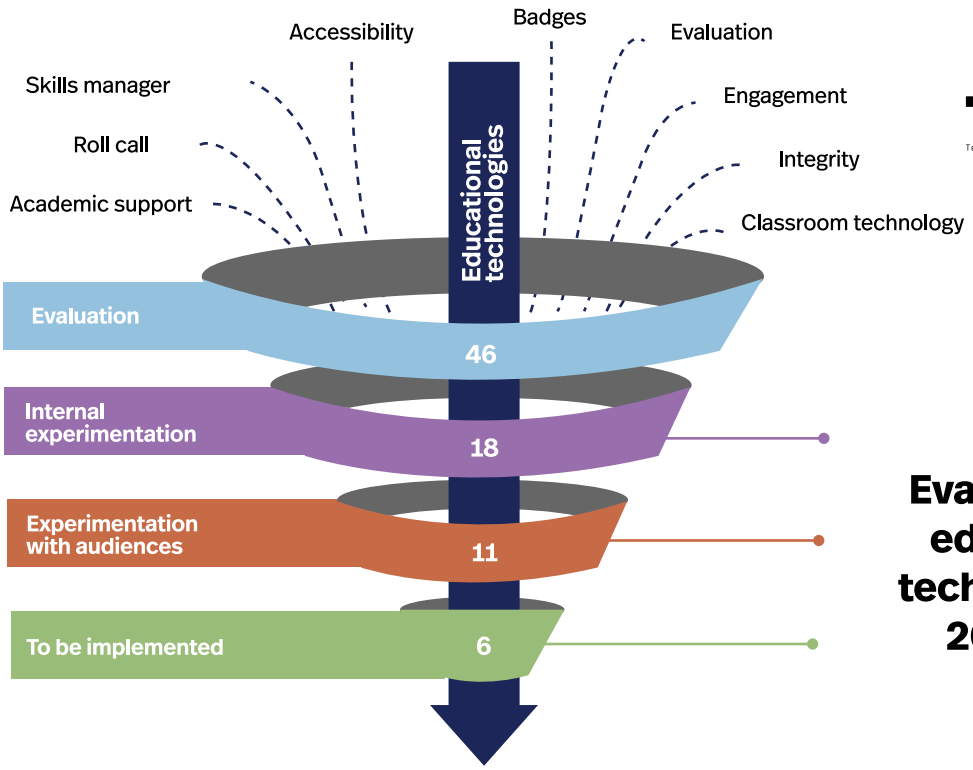
- Promotion of tools, conferences and innovation methodologies (news section).
- Dissemination of the Festival "Learning from our experiences of educational innovation", during the RNP.
- Dissemination of the podcast program "Sintonía CEDDIE", which helps delve deeper into the main topics of management and academic innovation.

Dissemination of the "CEDDIE Teacher Wellbeing" program, in support of the national well-being program, through 4 focus areas that directly impact the experience of teachers: (A) Emotional balance in the classroom, (B) Management of stress, (C) Optimal use of time, and (D) Financial forecasting.

Screenshot of CEDDIE Site, October 2023

8.5 Educational technologies ecosystem

With the objective of keeping Tecnológico de Monterrey at the forefront of educational technologies to improve the experience of its teachers and students in the teaching-learning process, 46 educational technologies were evaluated in 8 categories; 11 were piloted and 6 are close to being implemented and integrated into the institutional ecosystem. Some of the categories of these technologies are: Technologies for engagement, evaluation, competency management, academic support and authenticity detection.

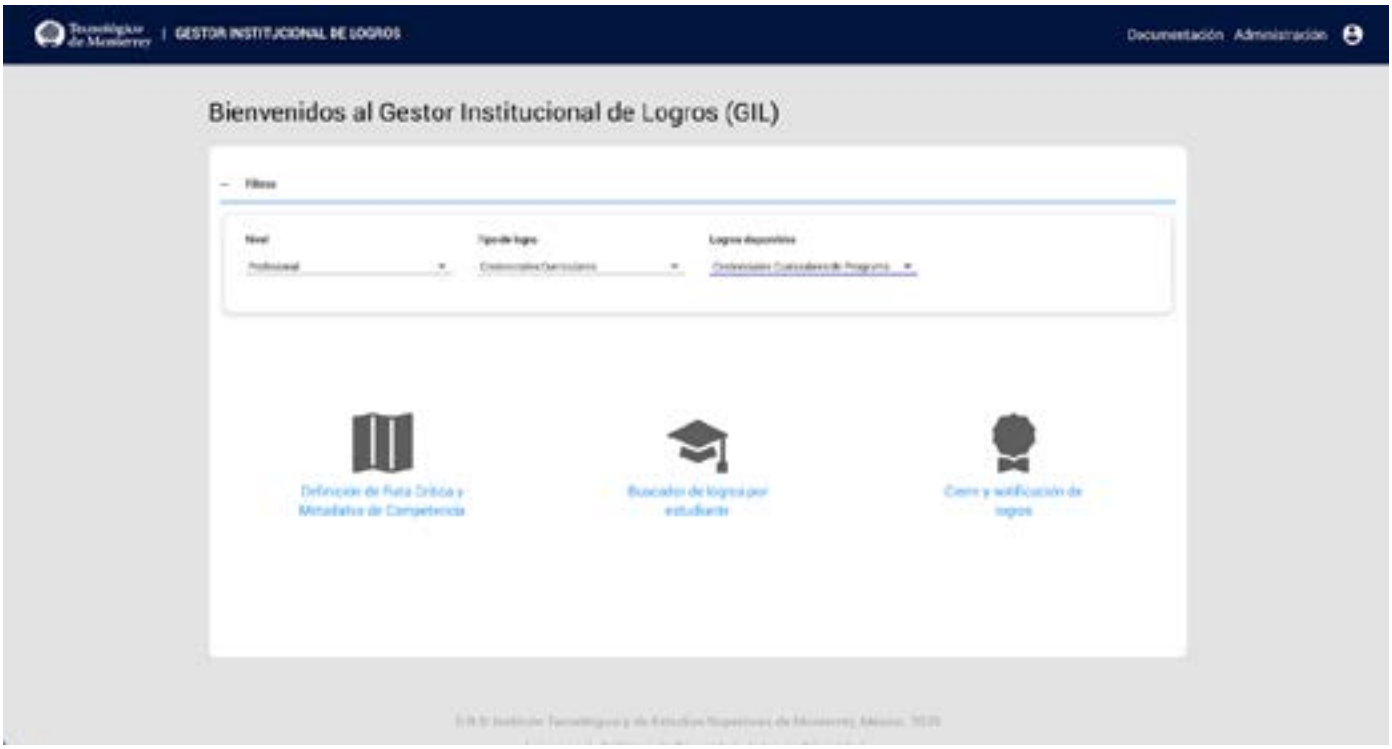


Evaluation of educational technologies 2022-2023

One of the most significant additions to the ecosystem was the design and enablement of a solution for the Curriculum Credentials strategy offered to students of the first generation of the Tec21 Model. It is detailed below.

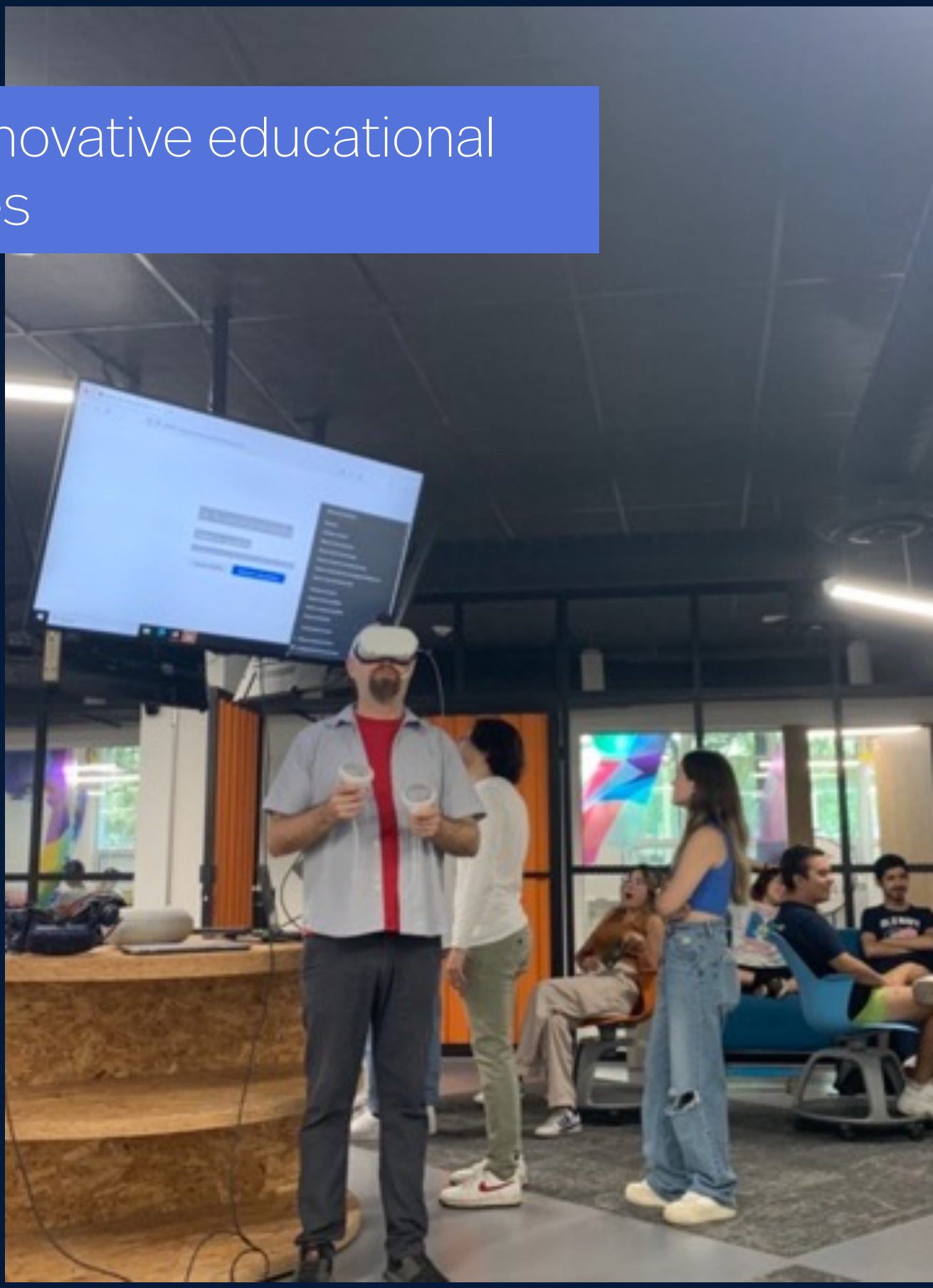
Curricular Credential Badges

To enable the strategy of the Evaluation and Alternative Credentials Center, regarding the granting of Curricular Credentials badges, a special experience was designed that involved the development of an "Institutional Achievement Manager" and the integration of technology to issue Curricular Credentials. Starting in July 2023, this manager will be in charge of storing the achievements, official recognitions, and information on credentials, diplomas and recognitions of all the students and graduates of the institution.



Screenshot of the "Institutional Achievement Manager"

8.6 Innovative educational spaces



Immersive Learning Classroom (AIRX)

The Immersive Learning Classroom with Extended Reality allows teachers and students to interact in a dynamic learning environment with active activities and classes, thus promoting the application of the knowledge acquired to develop projects and solve challenges. This innovative classroom offers each student the opportunity to "immerse" themselves in tangible knowledge, allowing them to work in an individual and collaborative way.

This year, 17 immersive resources were created, impacting:

763 Students-course

30 Teachers

11 Educational units

It should be noted that different special visitors were received, who were shown several of the most outstanding experiences, such as Virtual Reality and Mixed Reality through Hololens, or the Virtual Reality resource "Escape room Future Exploration":

- Dr. Jesús J. Rodríguez, National Director of the Medical Surgeon program, School of Medicine and Health Sciences, Tecnológico de Monterrey.
- Dr. Daniel Badenes, Academic Secretary, National University of Quilmes, Argentina.
- Delegation from the University of Alba, Chile.
- Directors and representatives of Future Design Lab, Yadira Ornelas and Stuart Candy, Australian futurist and designer, associate professor of design at Carnegie Mellon University and director of the CMU Situation Lab.

"Professor with hologram effect" initiative

In 2023, all campuses that have "Professor with hologram effect" rooms will be reactivated. Currently there are 11 receiving campuses: Monterrey, Saltillo, Laguna, State of Mexico, Mexico City, Santa Fe, Tampico, Chihuahua, Juárez City, Querétaro and Guadalajara; as well as 3 transmitting campuses: Monterrey, Santa Fe and Querétaro.

Strategy deployment

During this year, some of the innovations used to improve the delivery of classes were shared, through the use of hologram effect technology in various spaces and events.

Enabling spaces with the use of telepresence

- Creation of a permanent space for telepresence projection in the House Museum of Don Eugenio Garza Sada.

Events of national and international impact

- The first class was taught where the 11 campuses of the Tecnológico de Monterrey were simultaneously connected, with Postgraduate students from the School of Engineering and Sciences, with the class "Winning with AI" taught by Dr. Emilia Militza Basualdo Salinas.
- Tecnológico de Monterrey continued its alliance with the Delft University of Technology (TU Delft), in the Netherlands, through the School of Architecture, Art and Design, and the School of Engineering and Sciences on the Querétaro and Monterrey campuses.
- Participation in the Meeting of Advisors, of the Tecnológico de Monterrey, with a projection stand to show technology and the interaction between two people.
- Journalist Paola Rojas was received for the recording of the program "Without prejudices", where she interviewed two professors from the School of Engineering and Sciences: Dr. Carlos Astengo, leader of the Institute of Innovation for the Video Game Industry, and Dr. Lorena Martínez, Coordinator of the video game concentration at Tecnológico de Monterrey.
- Reception of a delegation from Latin American institutions at the "Times Higher Education" event.
- A special transmission was made through the "Professor with a hologram effect" as part of the opening ceremony of the 80th Anniversary of the Tecnológico de Monterrey.

- An agreement was signed with the DUOC University (Chile) for the construction of the transmitting and receiving rooms in said institution, for the provision of classes with a hologram effect. A training workshop was held for the use of the "Professor with hologram effect".
- Participation through the hologram effect in the conference "Emerging technological transformations", given by Mtra. Leticia Castaño Sánchez, leader of educational innovation, at the "1st International Education Congress: Innovating the futures of education", at the Private Technical University of Loja (Ecuador).
- A conference was given for the Peru headquarters by Master Jorge Blando, Director of Continuing Education.

Meeting of Directors 2023

"Times Higher education" event for Latin America

"Professor with hologram effect" in numbers

1,084 Students-course

33 Teachers

124 Educational units

11 Campus

Teaching indicators

59 Educational units

98 Teachers

7,230 Students

Hall Immersive Room

In 2023, the Hall Immersive Room integrated new delivery strategies to facilitate and improve the proximity of teachers to students in an immersive environment, impacting more than 7,000 students in the different Professional, Graduate and Continuing Education programs. In 2023, more than 300 sessions were scheduled, taught by 98 teachers from different campuses, who attended this room to share their knowledge and hold talks with invited experts and training partners. In addition, students and teachers from foreign universities, partners of Tecnológico de Monterrey, attended.

The following are some of the new experiences taught from the Hall Immersive Room.

Presentation of “Challenges”, Undergraduate careers

During the first week of the February-June 2023 semester, more than 1,000 students from different Undergraduate semesters had the opportunity to interact with their teachers, classmates and training partners, during the presentation of the challenges to be resolved in said semester.

The School of Engineering and Sciences, through the educational units “Materials and Manufacturing Analysis” and “Design of products subjected to static loads”, connected from India to: Janardhan Rao, Tool Fixture Design ETEC Manager; Alejandra González, Manufacturing Engineering Supervisor; Ana P. Treviño, Tooling Engineer; and Malhar Kulkarni, Tooling Engineer. They served as representatives of the training partner John Deere. The educational unit “Design of Machine Elements” was attended by Ángel Morales, representative of the training partner Sumitomo Drives Technologies.

The Business School taught the educational unit “Ideation and prototyping” from this room, where the following participated as representatives of the training partner: Jesús D. Morales, Deputy Director of New Technologies, Head Digital Hub Banca Afirme; and Nicolás Noriega, General Director of 24xoro. In a second session, the students were able to talk with Agustina Garavento, Brand Manager of the Hune corporate.

Boost for international collaboration

International doctoral workshop of the EGADE Business School

With the participation of 20 students from Thailand, Italy, Colombia and Mexico, the Workshop "The art and craft of scientific communication for collaborative quantitative research" was taught from the Hall Immersive Room. This belongs to the doctoral program in Engineering Sciences, of the EGADE Business School. The objective of this workshop was to develop collaborative skills in remote research, scientific writing (using the cloud-based LaTeX system) and oral communication through effective virtual presentations.

The workshop was given in the September-December 2023 quarter, by Dr. Federico Trigos, and included the participation of renowned guest experts on the subject, such as: Mario Doria (Mexico); Margherita Peruzzini and Pietro Bianca (Italy); and Chadwick Holmes (USA).

Global Week, from the School of Social Sciences and Government

In Week 6 and Week 12 of the Global Week program of the 2023 academic periods, in the educational unit "Diversity in a globalized world", 798 students and 9 teachers from this national school had the opportunity to interact and collaborate with teachers and students from the Universiti Kebangsaan of Malaysia, the Catholic University of Salta of Argentina, the University of Notre Dame, and the Technological University of Colombia, as well as with notable guests on different topics.

Hall Immersive Room at Guadalajara Campus

Finally, in September 2023, the Hall Immersive Room, located in the Habitat of the Future of Business building of the Business School, Guadalajara Campus, began operations as a space to hold synchronous sessions via videoconference. Thanks to the characteristics of this room, the teacher can interact with his or her in-person and remote students, living a unique experience by taking advantage of the panoramic view of 27 monitors that favor the creation of an immersive environment.

Tec Virtual Campus

The student experience evolves towards alternatives for development and coexistence, without being limited to a physical campus. With this in mind, it is necessary to generate virtual and hybrid experiences as a new normal, personalizing the university life of each student. In 2023, Tec Virtual Campus, the academic metaverse of Tecnológico de Monterrey, had a great impact: 12,839 students participated in 191 academic activities, inspiring 258 teachers to train in the design of activities.

To date, complete classes have been held in this metaverse, at both High School and Professional levels. In conjunction with the Global Shared Classroom program, activities have been carried out with 13 universities worldwide.

- Catholic University of Peru
- University of Lima, Peru
- University of the Andes, Colombia
- Catholic University of Colombia
- Javeriana University, Colombia
- University of Chile
- San Sebastian University, Chile
- Central University, Chile
- Duoc UC, Chile
- Xavier University, USA
- University of South Carolina, USA
- University of São Paulo, Brazil
- Cardenal Herrera University, Spain

Added to this academic experience is the offer of services to students, provided by Tec Services, Tec Media, Biblioteca Cervantina, and Talent Attraction, which serve students nationwide, expanding their possibilities of interaction in this digital space.

Without a doubt, today it can be said that Tec Virtual Campus is a philosophy, and not just a platform. The lessons learned, the experiences designed, the interactions generated, the openness of the Tec community to use the metaverse, is what really has value. That is preserved and transferred to the relevant educational technology.

To know the published articles referring to this topic, please consult Annex 1: Publications on educational innovation.

New educational spaces in the Library

The Library seeks to bring the best learning content closer, as well as facilitate access to information, capitalizing on the use of educational technology. It offers an educational space designed so that students and teachers can carry out various digital learning experiences in an immersive environment with Virtual Reality technology, through a technological environment equipped to explore, study and/or carry out activities and tasks designed by their teachers. (as), for the development of skills in the various educational units.

During the August-December 2022 semester, four new VR Zones were deployed on the Chihuahua, San Luis Potosí, Saltillo and Toluca campuses, thus adding a total of 11 VR Zones nationwide.

Impact on:	2022	2023	Unit and/or comments
Undergraduate students (reservations)	6,743	5,288	30,000
Teachers	337	265	602

By using Virtual Reality technology, students live educational experiences through one or different possibilities, this through exploration and discovery. The objective is for them to know and become familiar with the Virtual Reality information resources available. Through independent study, students will be able to prepare for their assessments, review content from their subject and acquire new knowledge. They will also collaborate in teams or small groups when joining a class to work on a topic guided by the teacher.

Finally, they will carry out academic activities around an exercise designed by their teacher, which can be part of the educational unit, with value in the evaluation of the subject.

Both students and teachers can freely use the VR Zone in the Library, when they observe available stations or through an electronic agenda that allows digital reservations to be made and ensure the availability of the stations (https://biblioteca.tec.mx/inicio/zonavr).

8.7 Internationalization

Global Shared Learning

The **Global Shared Learning** (GSL) initiative continues to grow and innovate, following the COIL (Collaborative Online International Learning) methodology. The **GSL Classroom** and **GSL Week** models continue to be appreciated by teachers and students at Tecnológico de Monterrey, as well as by their peers at international partner universities. Despite the reactivation of semester and intensive international programs, these two approaches were the key drivers of 'internationalization at home' for 16,392 students, of which 8,539 belong to Tecnológico de Monterrey and 7,853 are international students. Likewise, they played a fundamental role in the internationalization of teachers from both our institution and partner universities during this year, achieving a historic figure of 726 teachers, of which 351 are from the Tecnológico and 382 come from various academic institutions.

GSL Classroom

In 2023, two calls were made to invite Tecnológico de Monterrey teachers to send their proposals to carry out a **GSL Classroom** collaboration with a partner university, resulting in 318 collaborations with 92 universities from 18 countries.

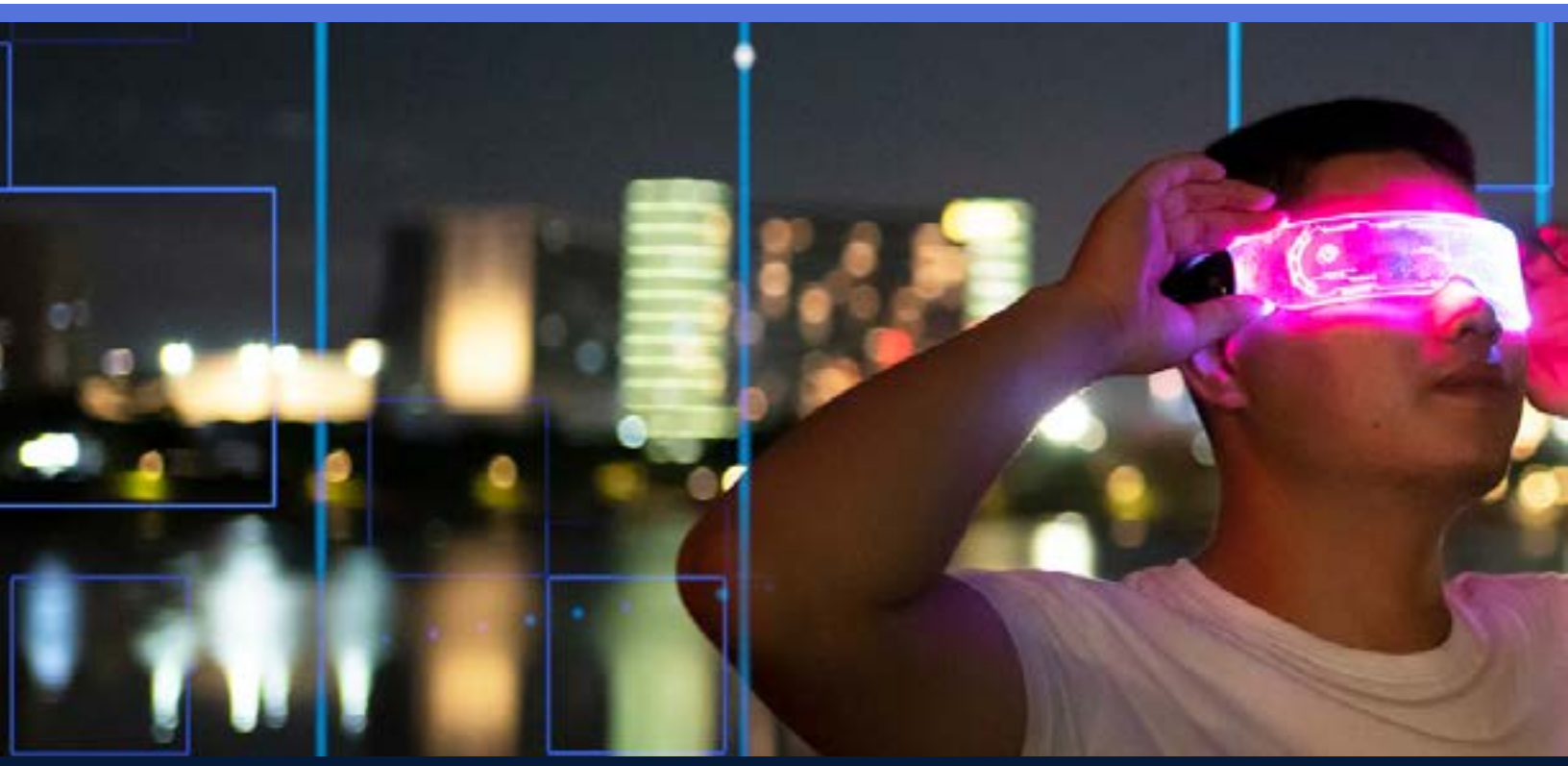
This translated into a virtual international academic experience for a total of 14,416 students, of which 7,395 were Professional students from Tecnológico de Monterrey, and 7,021 were Professional and Master's students from partner universities. To facilitate the international experience of these students, we have the collaboration of a total of 684 teachers, of which 324 belong to the Tecnológico de Monterrey and 360 are teachers from our collaborating universities.

Period	Collaborations	Tec students	International students	Total students	Tec teachers	International teachers	Total teachers
Feb-Jun	**157**	**2,927**	**3,204**	**6,131**	**161**	**167**	**328**
Aug-Dec	**161**	**4,468**	**3,817**	**8,285**	**163**	**193**	**356**
Totals	**318**	**7,395**	**7,021**	**14,416**	**324**	**360**	**684**

GSL Week

This model is part of the **Tec Week** offer for Undergraduate students, of the Tec21 Model. During 2023, **GSL Week** was offered four times (two per semester). The week-long collaborations were carried out with 12 partner universities in 8 countries. This benefited a total of 1,976 students, of which 1,144 are Professional students from Tecnológico de Monterrey, and 832 Professional and Master's students from partner universities; In addition, 42 teachers participated, of which 27 were from Tecnológico and 22 were from partner universities.

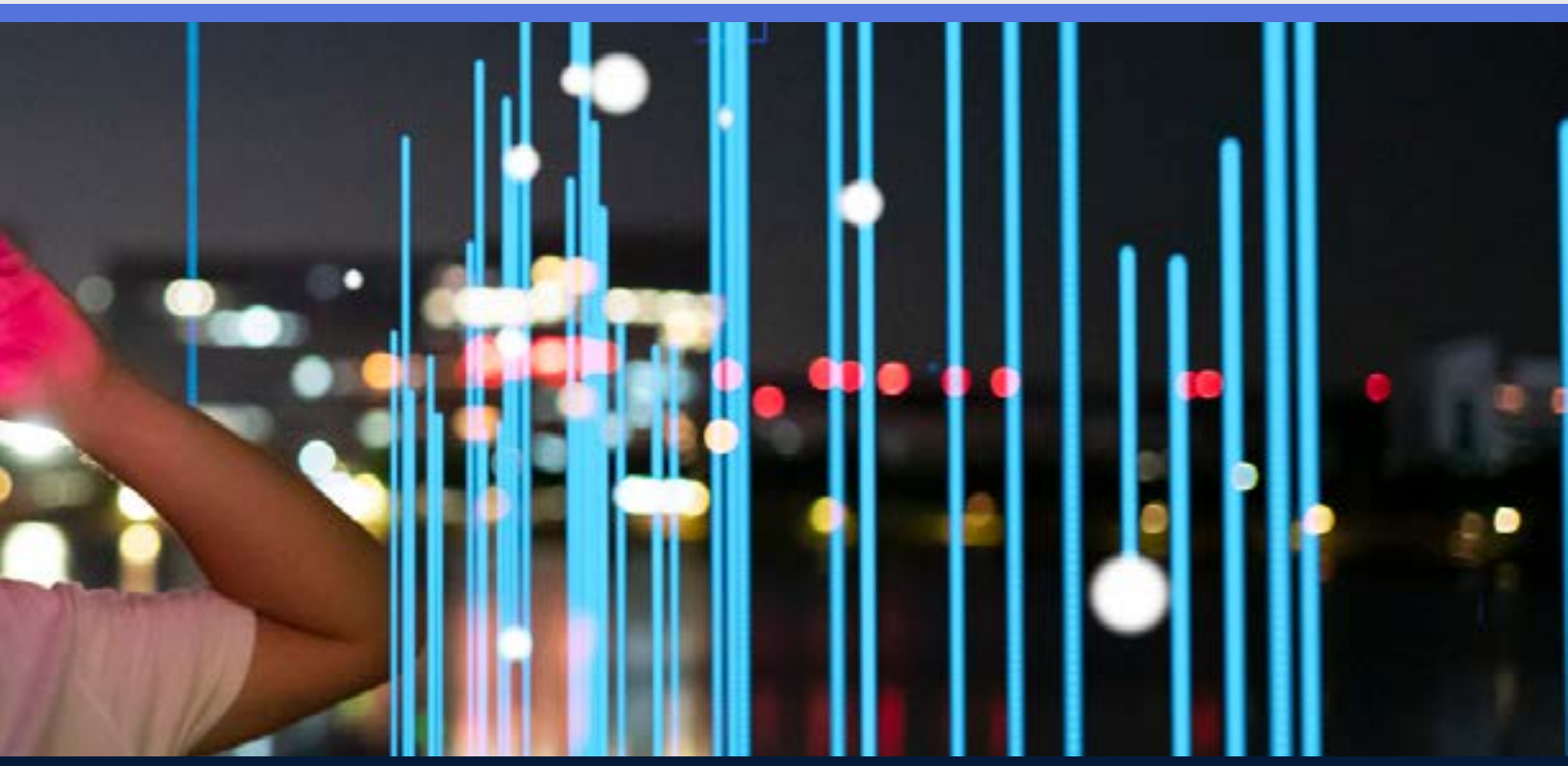
Period	Collaborations	Tec students	International students	Total students	Tec teachers	International teachers	Total teachers
Feb-Jun	**16**	**600**	**474**	**1,074**	**13**	**10**	**16**
Aug-Dec	**10**	**544**	**358**	**902**	**14**	**12**	**26**
Totals	**26**	**1,144**	**832**	**1,976**	**27**	**22**	**42**



Traveling programs

During the intensive summer period, 46 students were received for the **iSummerMX 2023** itinerant program: 27 of these for the Global Business program, and 19 for the Mexican Culture Heritage program. The students come from 17 different universities, located in 9 countries.

The iSummerMX programs coincided with the five-week Tec 21 calendar, and their start and end were on the Mexico City campus. Additionally, the students studied, had LiFE activities and cultural visits in the cities that host the rest of the international campuses: Querétaro, Guadalajara and Monterrey, as well as Campus Puebla.



8.8 Laboratories, software and digital information resources

TecDigital Labs

With the learning acquired in the pandemic, and keeping in mind the future of the institutional educational model and initiatives where the diversity of delivery modalities is already a reality, a digital transformation of the delivery experience of the academic software portfolio was designed. This new experience allows teachers and students to access the software at any time, anywhere and from a standard computer. This is how TecDigital Labs was born.

Some of the benefits and features of the project are:

- **Accompaniment:** possibility of accompanying and advising the student in real time
- **Tracking:** allows you to carry out guided activities by sharing your screen with students
- **Control:** makes it easier to help students by taking control of their session in the cloud
- **Monitoring:** allows you to know the progress of the activities that are being carried out through real-time monitoring
- **Flexibility:** teachers and students have access to specialized software whenever they require it
- **Versatility:** supports in-person, hybrid and remote modalities at the same time
- **Analytics:** measures the use of specialized software in the cloud, for making academic and strategic decisions
- **Scalability:** it has the capacity to adapt to the demand for the use of specialized software, according to the course programming of the period
- **Efficiency:** allows savings in the renewal of computer equipment, adaptation of spaces and licensing

Groups enabled with TecDigital Labs in 2023

School	Groups
Engineering and Sciences	610
Business	430
Architecture, Art, and Design	488
Humanities and Education	35
Medicine and Health Sciences	40
High School	371
Total	**1,974**

Indicators TecDigital Labs

	(WINTER '23) TecDigital Labs	(FJ '23) TecDigital Labs	(SUMMER '23) TecDigital Labs	(AD '23) TecDigital Labs
Analytics	Accurate usage measurement	Accurate usage measurement	Accurate usage measurement	Accurate usage measurement
Use during class time	**37** enabled groups with **292** hours of use	**836** enabled groups with **5,340** hours of use	**20** enabled groups with **781** hours of use	**1,321** enabled groups with **2,467** hours of use
Use outside of class hours	**1,430 hours**	**30,820 hours**	**158 hours**	**13,983 hours**
Cloud software	8 softwares	9 softwares	9 softwares	9 softwares
Groups with access	37 groups	836 groups	20 groups	1,321 groups
Students with access	277	13,511	212	16,904

***Soldados and SPSS are the most used software in the institution**
***Information updated as of 16/08/2023**

Disciplinary academic software portfolio

The schools' academic software portfolio has established itself as the only source of disciplinary applications that support students' acquisition of knowledge and skills, while making it easier for teachers to design their teaching experiences. .

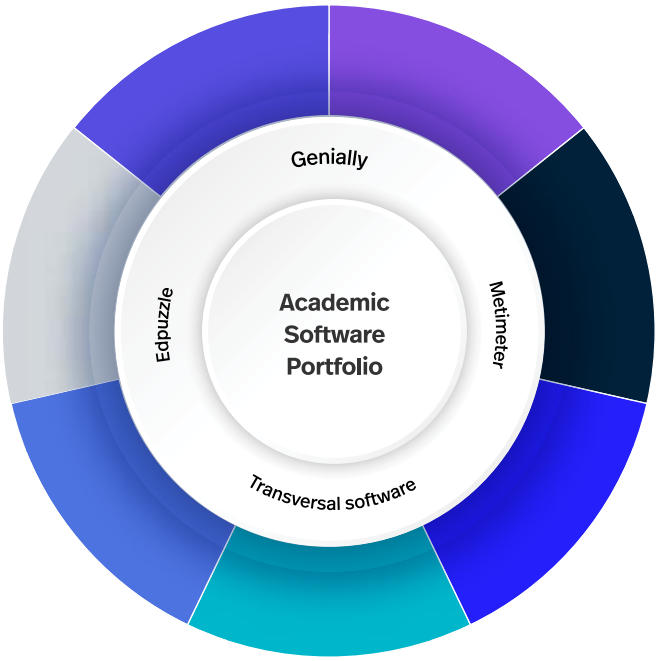
Through an institutional process, the availability of the required software is ensured before each academic period, guaranteeing that both teachers and students have the necessary resources for their educational units.

Currently the portfolio consists of:

- **308** specialized software available

Impact

- **+94,000** students
- **+10,000** teachers



138 SCHOOL OF ENGINEERING AND SCIENCES

72 HIGH SCHOOL

12 SCHOOL OF MEDICINE AND HEALTH SCIENCES

24 SCHOOL OF SOCIAL SCIENCES AND GOVERNMENT

27 BUSINESS SCHOOL

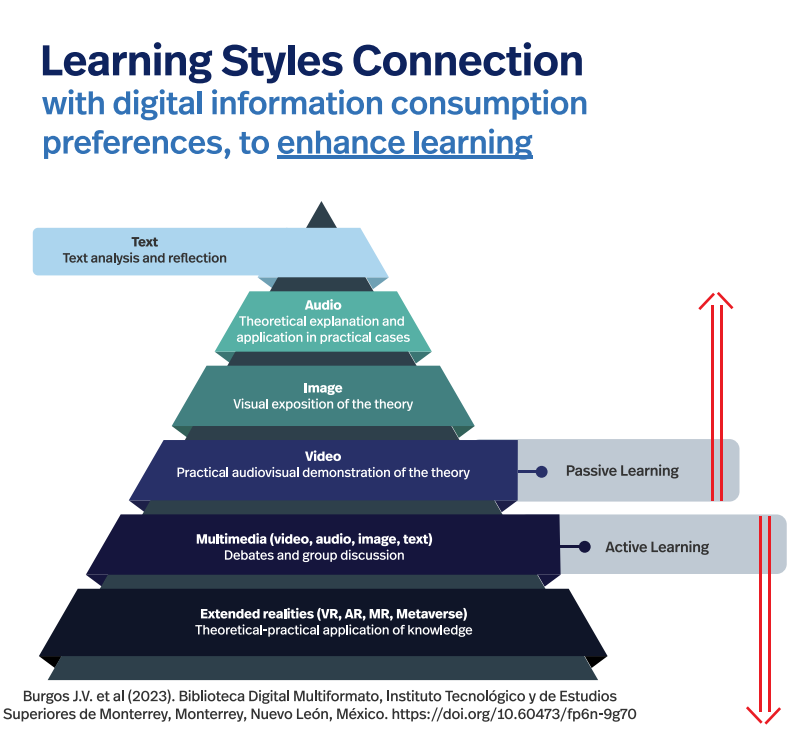
35 SCHOOL OF ARCHITECTURE, ART, AND DESIGN

42 SCHOOL OF HUMANITIES AND EDUCATION

308 Unique software

Digital information resources and evolution of the Digital Library

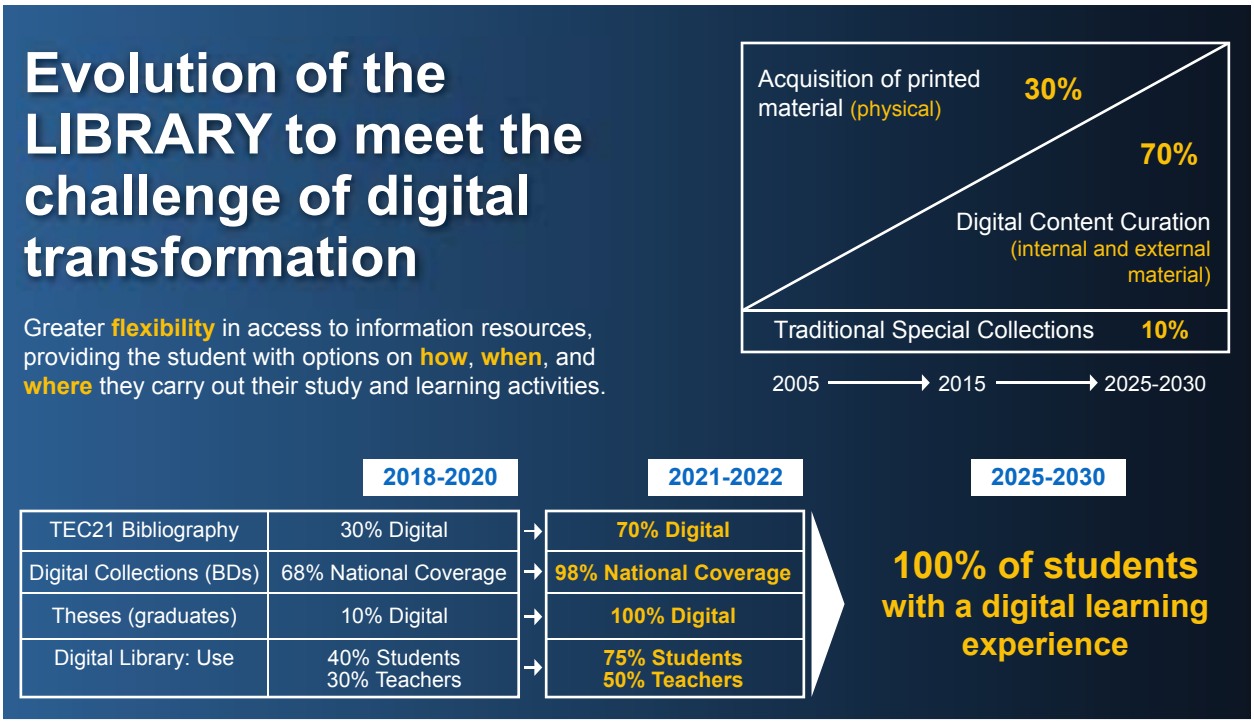
In 2022, the "Multiformat Digital Library" project was launched, which offers learning content beyond the text that enriches the students' experience, and is aligned with the digital education strategy and the consolidation of the Tec21 Model. Taking into account that there are different learning styles, and that there has been an evolution in the way students learn and perceive the world around them, the Library seeks to satisfy these different needs or styles for learning through multi-format resources, such as such as: audio, video, immersive and virtual reality resources, and images.



Burgos J.V. et al (2023). Biblioteca Digital Multiformato, Instituto Tecnológico y de Estudios Superiores de Monterrey, Monterrey, Nuevo León, México. https://doi.org/10.60473/fp6n-9g70

Additionally, with the commitment to improve the educational experience of students, the Library released a new Library Portal, with an innovative design and a new intuitive interface characterized by more efficient and easy-access navigation, with the objective of facilitate the process of discovery and search of information.

It is important to mention that in recent years the role of the Library in the teaching-learning processes has been consolidated, ensuring access to the bibliography required in the study plans with 70% in digital format, as well as access to unique materials that favor educational innovation.



Impact

Students: **94,424**

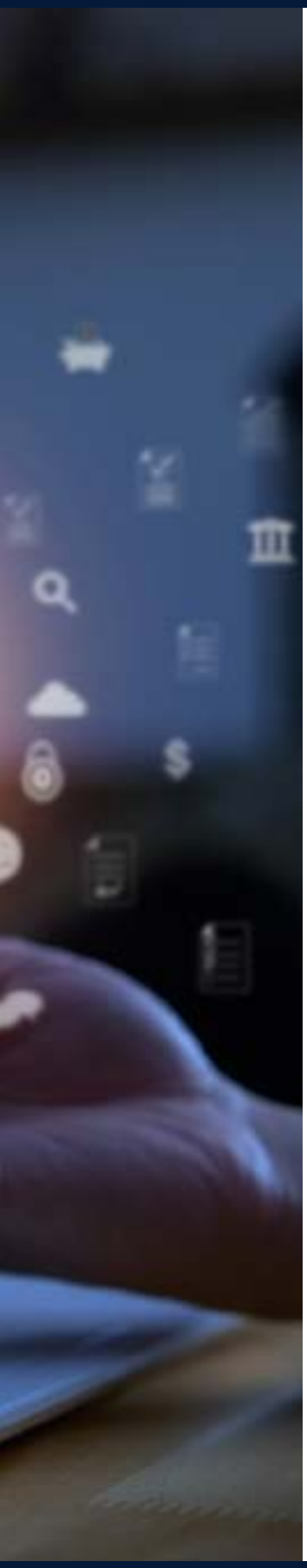
- High School: **26,794**
- Undergraduate: **60,169**
- Graduate: **7,461**

Teachers: **10,896**

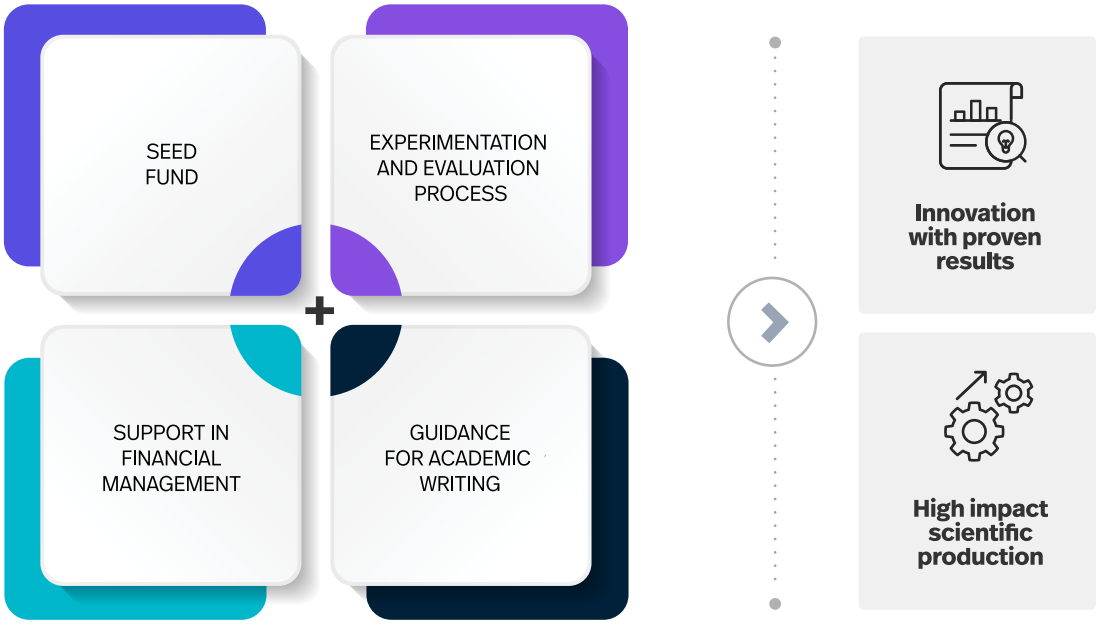
Researchers: **986**

8.9 NOVUS projects

This initiative from the Institute for the Future of Education, encourages and promotes a culture of innovation among the faculty of Tecnológico de Monterrey.



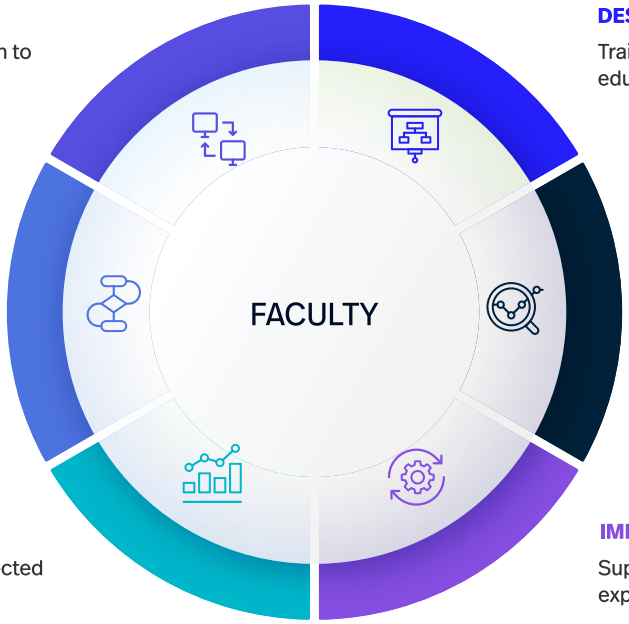
Novus aims to transform education from the classroom, and to do so it empowers the teaching community so that they can develop and implement educational innovations in response to specific educational needs.



Every year, Novus launches an open call to fund educational innovation. An evaluation committee evaluates applications through a blind peer review process with a validated instrument. The selected project leaders live the Novus experience for over 18 months, during which they receive guidance and support on impact evaluation and project administration issues.

Novus Experience

Development of skills that allow scaling the impact of educational innovations.



The Novus experience is a process that develops skills in the institution's teachers, while ensuring successful implementations of educational innovation and the evaluation of its impact through experimentation. Thanks to collaboration with other institutional teams, an agile experience is enabled for teachers who participate in Novus.

Novus projects that presented results in this cycle

During 2023, the selected projects were implemented and 50 educational innovation projects of the Novus 2021 generation were formally closed. The results are detailed as follows:

Novus Experience Results

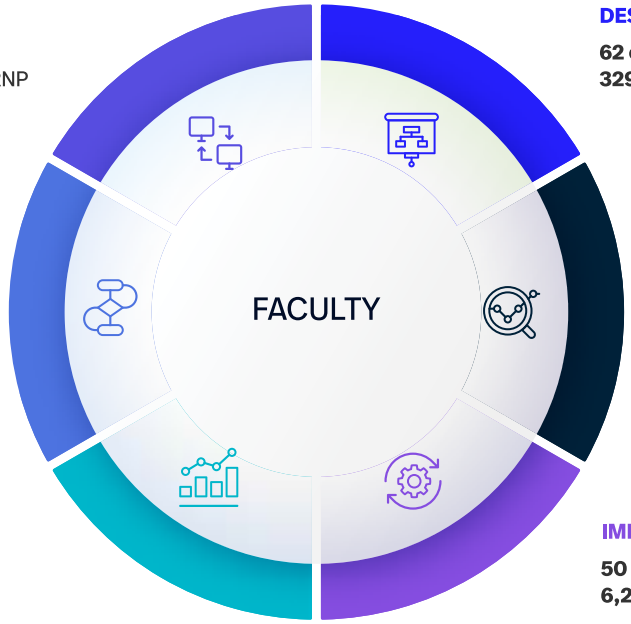
Class of 2021

SCALABILITY AND TRANSFER

1 project in the process of scaling
6 projects recognized during the RNP

DESIGN OF EXPERIMENTS

62 experimental protocols
329 project participants



ACADEMIC STRUCTURE

31 manuscripts published
35 publications in Q1/Q2 magazines

INSTRUMENT VALIDATION

38 revisions of scales or questionnaires

DATA ANALYSIS

49 projects impacted

IMPLEMENTATION FOLLOW-UP

50 projects with complete closure
6,277 students impacted in 315 courses

Call for applications 2023

In 2023, **879** teachers from the institution participated (an increase of **14.5%**, compared to 2022), who nominated **261** educational innovation proposals (an increase of **32%**, compared to 2022).

After a process of evaluation, selection and budget review, the **55 projects** that make up the **Novus 2023 generation** were selected with the participation of **204 teachers**.

The initiative had a collaboration with Ruta Azul*, specifically regarding the topic “Education for Sustainable Development”, in which 6 projects participate.

The selected projects* correspond mostly to:

- Region: **53%** Central-South
- School: **64%** Engineering and Sciences
- Education level: **80%** Undergraduate

*Ruta Azul is a sustainability initiative of the Tecnológico de Monterrey.

Recognition of outstanding projects

Within the framework of the National Teachers' Meeting, the teachers responsible for Novus projects with the best performance and greatest impact on educational innovation were recognized.

Of the generation of 2021 projects that successfully closed during the February-June 2023 semester, 6 obtained the best evaluation and 10 more were recognized for their good performance and impact.

The best evaluated projects, as well as those responsible, were the following:

- **Smart Feedback**
  - Use of Artificial Intelligence for educational dialogue, aimed at transformation through a more effective use of emotional tones in the academic or business feedback process.
  - Lilia C. Rodríguez
  - Business School
  - Querétaro Campus

- **App for the stimulation, development and evaluation of competencies in sustainable development**
  - App to promote learning and reflection, where students can learn about relevant and updated topics about sustainable development. It also has a board game for participants to complement their learning.
  - Martha E. Nunez
  - School of Architecture, Art and Design
  - Monterrey Campus

- **Tec 21 car assembler with Augmented and Virtual Reality**
  - Platform that includes Virtual and Augmented Reality lessons, with two lessons of each, focused on two Mecano car models within the Mx_REP simulator.
  - Carlos A. González
  - School of Engineering and Sciences
  - Querétaro Campus

- **Growing Together Bank, personalized evaluation for the "Statistical Thinking (UFPE)" educational unit through Virtual Reality**
  - Software in Escape Room format, which simulates a work day in a bank. The experience includes a series of activities to be carried out with descriptive statistics; Upon completion (and immediately), the resource gives them a detailed report with feedback and level of skill development.
  - Gabriela Monforte
  - Business School
  - Monterrey Campus

- **Mixed Reality Platform to improve the development of disciplinary competencies in the teaching of Control Engineering**
  - Virtual environment in which a plant to be controlled is represented, with implementation practices of control techniques using Mixed Reality.
  - Alejandro Guajardo
  - School of Engineering and Sciences
  - Guadalajara Campus

- **KUDI: financial game**
  - A learning environment where the student experience the progress of their learning, as well as their financial competencies, through play.
  - Adriana Valle and Brenda Cruz
  - Business School
  - San Luis Potosí Campus

8.10 Educational trends and innovative techno-pedagogical experiences

Impact (2014 to 2023)

- Page views: **24.6 M**
- Users: **14.1 M**
- Subscribers: **225,000**
- Followers on social networks: **500,000**
- In 2017 and 2021, Tecnológico de Monterrey obtained international recognition for its content. For more information, click here.

The Observatory is a unit of the Institute for the Future of Education (IFE) dedicated to the analysis and dissemination of the latest trends at the intersection of education, innovation and technology. Guides educators around the world in key areas of educational innovation through the production and distribution of open educational resources in English and Spanish. Through the different sections of its website, newsletter and social networks, a user can consult publications such as:

- Edu News: most relevant notes and articles in the world of education
- Edu Bits: pedagogical experiences and good practices in teaching (from teachers to teachers)
- Edu Tube: the latest in educational innovation in video, webinars, interviews, conferences, among others
- Edu Reads: reports, eBooks and readings on educational innovation and teaching strategies

Spanish Version

English Version

Highlighted achievements during 2023

- In the Spanish version of the site, the weekly newsletter in Spanish was named: "The main Latin American newsletter in education" by the Spanish educational magazine Espacios de Educación Superior.
- Launch of the Edutrends Report - Lifelong Learning, which has been downloaded more than 7,000 times.
- Collaboration with universities such as Universidad Oberta de Catalunya, and Pontificia Universidad Católica del Perú, among others.
- Publication of webinars and panels with experts, a total of 8 per year.
- Production of 8 podcasts with prominent women and men in the educational field worldwide, on topics of educational innovation, microcredentials, Artificial Intelligence, access to education, state of post-pandemic education in LATAM and the world, and equity in the workplace.

Edition and launch of the IFE Insights Reports, a series of reports aimed at decision makers: rectors, administrative staff of higher education institutions, directors of NGOs, directors of organizations such as UNESCO, educational policy experts, government officials, politicians/ministers /secretaries, researchers, think tank staff, among others.

The first published report was titled: *Short-Cycle Programs*: *Effective responses to enterprises' needs through educational innovation.*

The report was developed by the IFE Observatory, for the Institute for the Future of Education (IFE), in alliance with *Generation* México, with the aim of making visible organizations that prepare young people in order to connect them with better jobs and opportunities.

Our educational innovation and digital education, in the world

In 2023, we presented to the international academic community a diversity of publications that highlight our commitment to educational innovation and digital education. These works reflect our application of advanced technologies to transform education, offering current perspectives on pedagogical approaches and digital platforms. Through research and practical experiences, we seek to guide educators and professionals interested in taking advantage of the opportunities of the digital age in education.

09

9.1 Publications

The following articles and papers were published and presented through peer-reviewed journals, digital media and national and international conferences.

Below is a list of publications and presentations.

- Articles in peer-reviewed journals: **7**
- Articles in other media and for presentations: **17**
- Conferences: **18**
- Articles published in THE Campus: **27**

To see all publications, go to Appendix 1.

9.2 Acknowledgments

In recognition of their educational innovation, Tecnológico de Monterrey teachers were honored in various national and international forums for the development of innovative educational projects.

The recognitions obtained are presented as follows.

QS Reimagine Education 2023 (shortlisted)

Participants	Campus	Project	Category
Lilia C. Rodríguez	Querétaro	Smart Feedback	AI in Education Award
Romain Pouzou	Querétaro	Financial Iteration Method for Entrepreneurs	Nurturing Employability Award
Elvira G. Rincón	Monterrey	Gamit! Platform to manage gamification based on a rewards mechanic	Breakthrough Technology Innovation in Education
Jan Rehak	Querétaro	Entrepreneurship Program Innovation Project: Leveraging Technology to Foster Entrepreneurship	Innovation in Business Education
Martha L. Velázquez	Chiapas	Center for Social Innovation	Sustainability Education Award

RIE 360 Award for Educational Innovation

Participants	School/Campus	Project	Award
Josefina Castillo	School of Engineering and Sciences, State of Mexico Campus	Interactive video on bacterial infection, with 3D and 360° modeling technique	Second place

Educational Innovation Fair 2023

Participants	School/Campus	Project	Categories
Brenda N. Santos	LiFE, Monterrey Campus	Gamit! Reward system platform	Impact Transcendence Prospection Multiplier
Diego A. Oliva	School of Medicine and Health Sciences, Mexico City Campus	First Student Research Day	Impact Transcendence Prospection
Carlos Agredano	Business School, Querétaro Campus	Explor AR (Watch-Learn-Live)	Impact Prospection
Iyali M. Curiel	School of Engineering and Sciences, Cuernavaca Campus	Promoting experience and learning in the concentration blocks on 4.0 systems and technologies through Master Classes and international experience	Impact Prospection
Mario A. Caudillo	School of Architecture, Art and Design, State of Mexico Campus	Week 18. The journey of students from creative studies entry to becoming a true hero, enhancing their human flourishing	Impact
Laura L. Salazar	School of Medicine and Health Sciences, Guadalajara Campus	Publication of article as a product of the course: Online education and dry eye disease during the COVID-19 pandemic	Impact Transcendence

Saul Montes De Oca	School of Engineering and Sciences, Toluca Campus	Implementation of the ABI strategy in the educational unit “Application of thermodynamics in process engineering” in the February-June 2021 semester	Impact Prospection
Fernando J. Ruiz	School of Engineering and Sciences, Toluca Campus	Complementary mini-workshops for engineering students, for the acquisition of new skills outside the box	Impact Prospection Multiplier
José M. Pardo	School of Engineering and Sciences, Laguna Campus	Challenge: Rocket Contest	Transcendence
Sandra E. García	School of Engineering and Sciences, Morelia Campus	STEAM Challenge: “Engineering and sound art” for the educational unit “Modeling of Movement in Engineering”	Transcendence
María G. Ortiz	School of Engineering and Sciences, Monterrey Campus	Xignux Challenge 2023. Educational innovation initiative aimed at promoting climate action (SDG13)	Prospection
Amaranta V. Jiménez	School of Engineering and Sciences, Saltillo Campus	Revolutionary solids through 3D printers in the training of future engineers	Prospection

Gabriela M. Salazar	Business School, Monterrey Campus	Internationalization from home: Global Shared Learning Classroom. Mexico and Spain: linking education and business	Prospection
Maritza Peña	School of Engineering and Sciences, Toluca Campus	Debating Tournament: Social Discussions from Mathematics	Prospection
Fabiola del C. Lima	School of Engineering and Sciences, Laguna Campus	TEC 360 with multidisciplinary TEC21 approach	Prospection
Delia A. Galván	School of Engineering and Sciences, Monterrey Campus	A didactic proposal for solving problems from socio-education	Prospection
Elvia I. Rosas	School of Engineering and Sciences, Monterrey Campus	PSR App is MERA, a mobile application for iOS and Android devices. With this application, students will develop skills, with elements of Augmented Reality and Gamification. The app has a deck of preloaded questions for software engineering and design of an intelligent organizational system subcompetences	Prospection
Miriam I. Navarrete	High School, Tampico Campus	Learning French thanks to Artificial Intelligence	Multiplier

Credits and acknowledgments

10

This publication is in charge of the Directorate of Educational Innovation and Digital Learning, of the Vice-Rectory of Educational Innovation and Academic Regulations of Tecnológico de Monterrey.

- Vice President of Educational Innovation and Academic Regulations:
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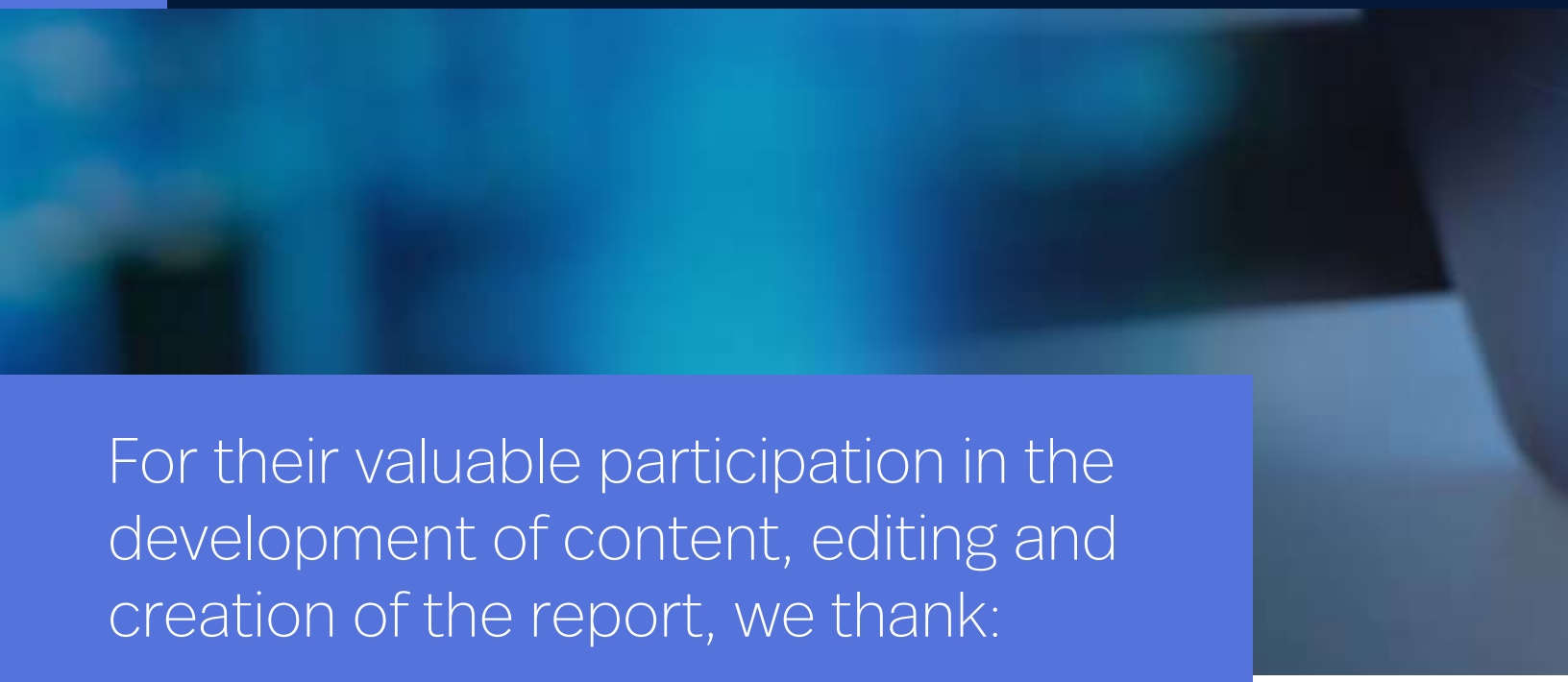

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Appendices

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Appendix 1. Publications on educational innovation

Peer-reviewed publications

- Aguirre Acosta, A. C., & Espínola Carballo, G. (2023). *The Use of Immersive Tools in Higher Education: Escape Rooms. In Proceedings of the 2022 6th International Conference on Education and E-Learning*. ICEEL 2022: 2022 6th International Conference on Education and E-Learning. ACM. https://doi.org/10.1145/3578837.3578848

- Alanís, P. I. M., Márquez, R. E. C., González, D. C., Mendoza, A. G. R., & Muñoz, D. (2023). *Analysis of the Impact of Virtual Reality on High School Students' Learning in Nutrition Courses. In Proceedings of the 2023 Future of Educational Innovation-Workshop Series Data in Action: Digital Ecosystem and Emerging Tools for Education*. IEEE. https://doi.org/10.1109/ieeeconf56852.2023.10104668

- Navarro-Durán, D., Félix-Herrán, L. C., Membrillo-Hernández, J., Craig, K. C., Ramírez-Cadena, M. J., & Ramírez-Mendoza, R. A. (2023). Active learning to develop disciplinary competencies related to automatic control in engineering curricula using low cost do-it-yourself didactic stations. *Frontiers in Education (Vol. 7)*. Frontiers Media SA. https://doi.org/10.3389/feduc.2022.1022888

- Reyes-Millán, M., Villareal-Rodríguez, M., Murrieta-Flores, M. E., Bedolla-Cornejo, L., Vázquez-Villegas, P., & Membrillo-Hernández, J. (2023). Evaluation of online learning readiness in the new distance learning normality. *Heliyon* (Vol. 9, Issue 11, p. e22070). Elsevier BV. https://doi.org/10.1016/j.heliyon.2023.e22070

- Reyna García, G. M., Ramírez Vásquez, N., & Puente Grimaldo, C. A. (2023). Improving Learning Experiences of Business Students in the Classroom Through Emotions in Higher Education. In *Proceedings of the 2023 Future of Educational Innovation-Workshop Series Data in Action: Digital Ecosystem and Emerging Tools for Education*. IEEE. https://doi.org/10.1109/ieeeconf56852.2023.10104795

- Tamayo Enríquez, F. A., Mosqueda Benavides, J. A., Aguirre Acosta, A. C., & Benavides García, I. G. (2023). The Impact and Outcomes of a VR Digital Plant for Enhanced Experiential Education across Academic Levels: Fostering High-Value Industry Competencies. In *Proceedings of 2023 World Engineering Education Forum - Global Engineering Deans Council (WEEF-GEDC)*. IEEE. https://doi.org/10.1109/weef-gedc59520.2023.10343940

- Zepeda, L., Benavides, I., Lopez, C., Roman, O., & Dominguez, Y. (2023). Guided Design Methodology for Activities that Integrate Generative Artificial Intelligence Tools in Education: A Pilot Study Promoting Ethical Use and Fostering Critical Thinking in Undergraduate Students. In *ICERI2023 Proceedings*. 16th annual International Conference of Education, Research and Innovation. IATED. https://doi.org/10.21125/iceri.2023.1811

Publications in THE Campus

Tecnológico de Monterrey is a founding partner of the *THE Campus* initiative, of Times Higher Education (THE), which aims to exchange knowledge and experiences around technology-enhanced learning.

THE is a digital platform that has more than 3 million monthly visitors, which makes it ideal for integrating the expertise of universities and communicating it among the international community.

In 2023, Tecnológico de Monterrey participated by publishing 27 articles about experiences and best practices on the implementation of digital modalities and educational innovation in higher education. Access the publications here:

1. *A good plan is essential to make online international courses a success*
2. *Seven ways to tailor your teaching for different class sizes*
3. *Using VR to break the ice in the classroom*
4. *Driving change: creating student-NGO partnerships for climate solutions*
5. *Seven steps to being a great teacher*
6. *Goodbye memorisation, hello open-book test*
7. *How to design and build microcredentials in four steps*
8. *Move student communication from passive to active using 'I like, I wish, I wonder'*
9. *Practical tips to remember when designing activities utilising ChatGPT*
10. *Introducing the 'virtual rally' – a strategy for collaborative learning*
11. *Recommendations for using design thinking in the classroom*
12. *Four steps to design a course that motivates students and consolidates learning*
13. *A beginner's guide to implementing new technologies in your classes*
14. *Effective feedback techniques for struggling students*
15. *Synchronous or asynchronous? When to use which when teaching online*
16. *A methodology to trigger social entrepreneurship ideas in your class*
17. *Develop the skills of the future through challenge-based learning*
18. *Five steps for creating the ideal home office*
19. *Five key competencies for successful digital teaching*
20. *How to set up immersive VR lessons on your campus*
21. *Seven steps for successfully introducing adaptive learning*
22. *Cameras on: how to overcome a key challenge in digital courses*
23. *The library and the metaverse: a match made in heaven*
24. *Five ways to use neuroeducation to improve student learning*
25. *Strengthening academic integrity requires action from students and teachers alike*
26. *Diagnostic, formative or summative? A guide to assessing your class*
27. *Five tips for creating cheat-proof classes*

For more information, visit:
https://www.timeshighereducation.com/campus/institutions/tecnologico-de-monterrey-tec

Other publications and presentations

- 15th International Conference on Education and New Learning Technologies, Edulearn 23, July 5, 2023. Palma, Spain.
- Analysis of the Impact of Virtual Reality on High School Students' Learning in Nutrition Courses, Generales, 10 de abril 2023.
- Annual Meeting of the Millennium Project Planning Committee, Dubai, 25- 28 de noviembre de 2023.
- Escape room "Future Exploration": collaborative virtual reality for teaching Strategic Foresight, Ciencias Sociales, 10 de abril 2023.
- Evaluation of a Virtual Campus Adapted to Web-Based Virtual Reality Spaces: Assessments of Teacher and students.
- Exploring the potential adoption of Metaverse for Higher Education: Structural Equation Modelling Approach in a Business School context.
- Future Exploration Webinars. Collaborative Virtual Reality for training in strategic foresight. World Future Society- Mexico, October 5, 2023. Mexico City, Mexico.
- How to set up immersive VR lessons on your campus, Transversal, 20 de marzo.
- Imbricación del Metaverso en la complejidad de la educación 4.0: Aproximación desde un análisis de la literatura.
- Motivation for Learning in Virtual Environments Journal of Social Science Studies, Ciencias Sociales, 10 de abril 2023.
- IX JSVE 2023 and III ICEVS "Facing the Challenges of the 21st Century in Higher Education", University of Valencia, June 6, 2023. Valencia, Spain.
- Tec Virtual Campus, a metaverse for engineering learning.
- The effect of a Virtual Reality resource on the engagement and learning experience of first-year engineering students, Escuela Ingeniería, 18 de abril 2023.
- Transforming Higher Education Using WebVR: A Case Study.
- Who is Who UNESCO Chair in Strategic Anticipation, Universidad Externado Colombia, September 12, 2023. Bogotá, Colombia.
- Wow experience with immersive reality: Gamification in the Tec Virtual Campus.
- XXV World Conference. Exploring Liminalities. Creating Spaces for Unlimited Futures. World Future Studies Federation. October 25-27, 2023, Paris, France.

Tecnológico de Monterrey

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