First edition

# TEC21 EDUCATIONAL MODEL

## CHALLENGES FOR A TRANSFORMATIVE EXPERIENCE

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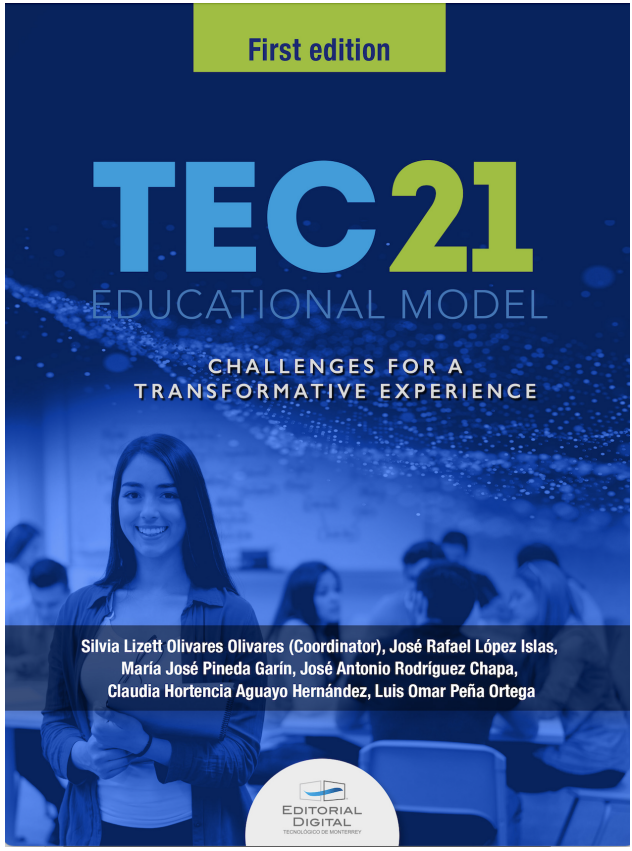


Tec21 Educational Model: challenges for a transformative experience
Primera edición
Silvia Lizett Olivares Olivares, José Rafael López Islas, María José Pineda Garín, José Antonio Rodríguez Chapa, Claudia Hortencia Aguayo Hernández y Luis Omar Peña Ortega
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# Glossary

## A

### Action-Learning

It is a learning approach that implies the presence of real people solving real problems and acting in real-time, therefore learning from inquiry and reflection during the process.

### Affinity networks

Integration of students as members of associations, academic groups, and social groups related to their professional identity.

### Authentic teaching

A set of instructional and evaluation activities, sequenced and connected in time, that address problems and conflicts to be solved by the students, featuring conditions that are very similar to professional practice.

## C

### Challenge

A life experience designed to expose the student to an engaging and challenging situation in their environment.

### Challenge-Based Learning

An instructional approach that actively involves the student in a real, relevant, and context-immersed situation entailing the definition of a challenge and the implementation of a solution.

### Competencies

Conscious integration of knowledge, skills, attitudes, and values allows students to successfully face both structured and uncertain situations.

### Competency-based education

A complex systemic educational approach that prioritizes the integral formation of students so that, with an ethical and civic commitment, they can sustainably undertake, contribute, and solve the problems of the global and local environment. It implements competitive, challenging, and committed training in evaluation processes for the constant improvement of the institution, programs, professors, and students, according to the demands of the social and labor environment.

### Courses

A training unit that contemplates issues which, due to their design, contain elements of situated learning. They have the purpose of detonating students' interest in researching content in a contextualized manner. Courses complement the student's development by providing learning and tools along with the educational blocks.

## D

### Didactic sequence

The result of establishing a series of learning activities, with a certain order, enables the recovery of previous knowledge for the purpose of linking it with real contexts.

### Disciplinary competencies

Knowledge, skills, attitudes, and values are considered necessary for professional practice; their development implies a gradual construction starting with the fundamental competencies and ending with the final competencies required for the area of knowledge.

### Disciplinary area competencies

Competencies that professionals from different areas belonging to the same field of knowledge and professional practice have in common.

### Disciplinary competencies by program

Specific performance indicators of an undergraduate program, based on the integration of knowledge, skills, attitudes, and values of a disciplinary nature.

## E

### Educational partner

Agent or entity from the manufacturing or service sector, the government, civil society, or community groups, with which the institution establishes a long-term collaboration agreement to meet different challenges.

### Experiential Learning

The process of learning through experience is also referred to as learning by doing. Knowledge is created based on the transformation of an experience.

### Exploration

The first phase of the Tec21 Educational Model. This phase is designed for students to experience the professional options as they enter a particular area of knowledge, as well as to confirm their vocation by being introduced to its field's contents.

### Exploration block

The training unit included in the third semester of Tecnológico de Monterrey's 2019 study programs, as part of the personalization opportunities. This five-week block is aimed at bringing students closer to content related to disciplinary areas different from those included in their academic program.

## F

### Focus

The second phase of the Tec21 Educational Model. It aims at delving into the contents of the selected undergraduate program as a graduate profile. During this phase, students begin the development of the program's competencies and continue the development of transversal and area competencies.

## G

### Generic competencies

Skills and abilities required in any job, also called Transversal competencies

## H

### Human flourishing

Conscious development of people that focuses on their physical, intellectual, emotional, spiritual, and social fulfillment and on having a positive impact on their environment and society.

## I

### I Education

A part of the specialization phase that seeks to deepen the students' knowledge in a particular area of the program in terms of its content.

### Inspiring teacher

A respected and admired teacher by his students and colleagues because of his or her positive impact, achieved through motivation and demand, in reaching the maximum potential of his or her students.

## M

### Mentor for student success

Counselor whose primary function is to accompany and ensure the success of students during their time at the institution. It represents a guide to enhance the students' university experience.

## P

### Program Director

A guide for students regarding decisions related to the personalization of their program, as well as curricular or co-curricular opportunities for their growth and development. Directors are part of the accompaniment model as they guide students in the personalization of their academic pathway and the empowerment of their disciplinary opportunities within their time at the university.

## R

### Research groups with a strategic focus

Grouping of professors, researchers, undergraduate, and graduate students, and international researchers, where scientific activity is focused on priority areas and their efforts are aimed at the resolution of problems relevant to society.

## S

### Self-knowledge

Possession of appropriate knowledge of oneself in a process of constant reflection.

### Specialization

The third phase of the Tec21 Educational Model. The specialization phase provides various possibilities for the deepening or broadening of learning, within the selected profession or outside of it.

### Specific competencies

Skills and abilities required for a particular occupation or profession.

### Sub-competencies

Phased actions that describe in detail how to build competency. They are deployed in a staggered manner at three levels of proficiency: A, B, and C, which increase in complexity of observable behaviors and performances, as students progress through the program.

## T

### T Education

A part of the specialization stage that is aimed at students broadening their skills towards specializations in other areas, to connect different perspectives.

### Tec21 Educational Model

The model focused on the relationship between the student, the environment, and the teacher, in which students develop personal and professional competencies through the resolution of challenges linked to real problems and show their proficiency through different learning evidence.

## Tec Week

Training unit aimed at strengthening the development of transversal competencies through activities that may involve students from different disciplines and semesters. These weeks correspond to weeks 6 and 12, and the activities are defined by theme to develop elements of the vision, deepen disciplinary competencies, carry out LiFE activities, and activities to strengthen the graduate profile, and prepare students for professional life.

## Training units

Curricular spaces that are delimited in content and time. The Tec21 Educational Model categorizes them as Blocks, Courses, Tec Weeks, and Tec Semesters.

## Training Programs

A competency-based model that integrates the knowledge and procedures of the discipline, as well as the attitudes and values that enable professionals to be participative and committed to society.

## Transversal competencies

Human capabilities are transferable to a variety of functions and tasks in the exercise of any profession, as well as to personal or social life. These competencies include communication, ethical judgment, problem-solving, leadership, creativity, teamwork, and the ability to learn, among others.

# W

## Week 18

The period during the stages of exploration, focus, and specialization at the end of each semester with the following objectives: 1) to guide the future training process of each student, encouraging reflection through feedback based on the analysis of the integrated learning resulting from the semester's experience and 2) to share achievements among students, teachers, and mentors to find the best university experience practices.

## Week 18: Wrap-up

Week in which an evaluation exercise is conducted on the learning outcomes achieved during the corresponding phase; a strategy aimed at monitoring the progression of students in the development of their competencies.

## Week i

A time during the semester when students from all undergraduate programs participate simultaneously in disciplinary, multidisciplinary, and challenging learning activities. During this week, regular academic activities are halted so that students can engage full-time in an experiential learning experience.

# Introduction

In 2012, the Board of Trustees of Tecnológico de Monterrey established, as an institutional mandate, the strengthening of academic quality for all educational programs. To this end, it was defined a set of strategic initiatives, among which was the development and implementation of a new educational model that would allow students, the institution, and society to face the challenges and opportunities that are envisioned for the 21st century. The design team conducted extensive literature research, consulted the various audiences served by the institution, and made benchmarking visits to learn about other innovative experiences.

The team developed specific proposals to develop leaders for the new social, economic, political, and technological environment. The design and implementation started in a gradual manner for the various components that would integrate innovation based on strategic and benchmarking findings. The full implementation started in August 2019 when the first class of students entered with curricula designed entirely under the guidelines of the **Tec21 Educational Model**. Throughout the years of development, all the successes, lessons learned, and proposals related to the project have been documented and enriched as the academic community participates.

This book is an initiative to recapitulate the foundations of the Tec21 Educational Model. It includes updates to its components since its implementation. The literature selected is highly relevant to describe and acknowledge the strategy considering:

- official books of the Tec21 Educational Model;
- landmark references that originally inspired the Tec21 Educational Model, either in its original version or updated versions in subsequent years;
- reports of peer-reviewed publications that present results related to any of the components of the model, in any of its editions;
- publications that use the same constructs, variables, or language of the Tec21 Educational Model and, therefore, are compared to find similarities and differences between each of the proposals;
- references that have been previously quoted in documents of the Tec21 Educational Model;
- publications that provide a holistic view and stratifies information within a component;
- key authors that provide arguments for the value-added of the Tec21 Educational Model or its foundations.

In this sense, the referenced sources aim to be useful for the development of reliable indicators that assess the effectiveness of the longitudinal implementation of the 2019 curricula. Furthermore, the structure presented here should guide educational research interests aligned with the strategic and educational purposes of the model. The effort and dedication invested by

teamwork and their members are somehow reflected through this document. Therefore, some remarkable references are included, which are related to the components of the Tec21 Educational Model to be used as an input for inquiry, research, or educational theory learning.

# Chapter 1. Background


Certain changes in the higher education environment were identified during the initial design of the Tec21 Educational Model, which prompted institutional leaders to radically transform the structure and curricular organization of their programs and teaching-learning strategies. The accelerated evolution of information technologies and globalization inspired Fisch and McLeold (2008) to encourage educators to reflect for the purpose of transforming educational models, for institutions to prepare professionals to work in companies or functions that do not yet exist, to use technologies that have not yet been invented, and to solve problems that have not yet been identified as such.

Furthermore, Barber et al. (2013) anticipate the imminent avalanche of broad educational proposals such as MOOCs (Massive Online Open Courses), online universities, or book publishers that integrate education along with bibliographic resources. From their perspective, these options forever change the interests and rules of higher education, and question the value-added of an academic degree in the long term, thus describing aspects that should be deemed by universities as part of their evolution:

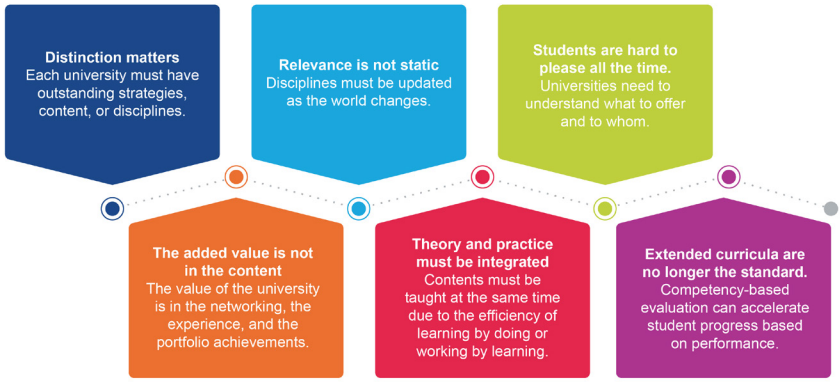



*Figure 1.1* Aspects to consider in the evolution of universities

Furthermore, the New Media Consortium (NMC) establishes trends that must be considered in new educational models (Johnson et al., 2012):

- The new emphasis must consider **Challenge-Based Learning** and active learning.
- People expect to learn and study wherever and whenever they want.
- The technologies implemented to increase their positioning on the cloud, and therefore are decentralized.
- Educational paradigms shift to include online learning, hybrid learning, and collaborative models.

Although some of these predictions have shifted approaches, in reality, they were the inspiration to establish some of the foundations of the Tec21 Educational Model.

Furthermore, benchmarking was conducted with other universities such as McGill, Universidad de los Andes, and Oxford, among others, to learn outstanding practices for attributes such

as performance, efficiency, prestige, etc. Benchmarking refers to contrasting quality and continuous improvement processes with other institutions, which have demonstrated improvement of academic excellence for higher education in several organizational systems (Tasopoulou and Tsiotras, 2017). Based on this premise, in 2014, visits were made to various universities and institutions around the world, which led to the conclusion that:

- Students can postpone the decision of choosing their major until they experiment with the discipline; furthermore, they require formative challenges throughout academic, intensive, and regular periods. Finally, they must demonstrate the development of disciplinary and transversal competencies.

- **The evaluation of knowledge** should be independent of teaching, considering centralized standardized tests.

- Professional **programs** may be shorter with fewer courses than those observed in Latin America.

- **Multidisciplinary work** is emphasized by teamwork (Tecnológico de Monterrey, 2018a).

There have been updates, continuous improvement, and action research since conceptualization, piloting strategies, transition, and deployment of Tec21 Educational Model in Tecnológico de Monterrey's 2019 programs started in 2015. Action research applies behavioral sciences and institutional problems for the purpose of providing feedback to enable adaptation and improvement upon the original plan (Storberg-Walker and Torraco, 2004). For the 2019 curricular design, there were modified different aspects of the programs, in order to create solutions aligned with the educational trends to address the new demands for society according to each professional field.

According to Díaz Barriga F. (1993), a curricular model can be understood as a theoretical construction or a form of representation that describes an educational process and its function according to the selection of components, forms of operation, and relationships. A curricular proposal refers to a specific plan, idea, or project that contains various recommendations oriented to a specific benefit. The structure of the 2019 curricular programs follows the principles of competency-based education, which are defined as the conscious integration of knowledge, skills, attitudes, and values in a way that provides an opportunity to successfully face both structured and uncertain situations (Tecnológico de Monterrey, 2018a). According to the Formative Programs Model, "competencies integrate both the knowledge and procedures inherent to the discipline, as well as the attitudes and values that make it possible to be participative professionals who are committed to society" (p. 9).

The Tec21 Educational Model aims to train "leaders with an entrepreneurial spirit, a human sensibility, and international competitiveness" in line with the 2020 Vision. This declaration evolved in 2018, when the new 2030 Vision was announced, which aimed towards "leadership, innovation, and entrepreneurship for human flourishing".

According to Crocker Sagastume et al. (2021) **human flourishing** should be experienced as biopsychosocial well-being evidenced by unrestricted growth and development, both in individuals and groups, in a sustainable, harmonious, responsible, and free spirit, with human quality.

The curricular structure of the new program's design is divided into three different stages: **exploration, focus, and specialization**. Each stage establishes a set of training units through which students must develop the graduate profile according to their **personalization** needs.

To learn more about the Tec21 Educational Model, watch the following video, remember that Youtube offers English subtitles from the settings menu.

TEC21

# Chapter 2. Competencies

The Tec21 Educational Model defines **competencies** as the "conscious integration of knowledge, skills, attitudes, and values which allows students to successfully face both structured and uncertain situations " (Tecnológico de Monterrey, 2018a, p.6.). Some authors such as Tobón (2006), Monzón (2006), Castillo and Cabrerizo (2010) establish the relevance of directing educational actions for the development of students with the knowledge, skills, attitudes, and roles to enabling them to commit and participate, fully and responsibly, in the various environments or contexts in which they participate. Competencies are classified as disciplinary and transversal, as shown in Figure 2.1.

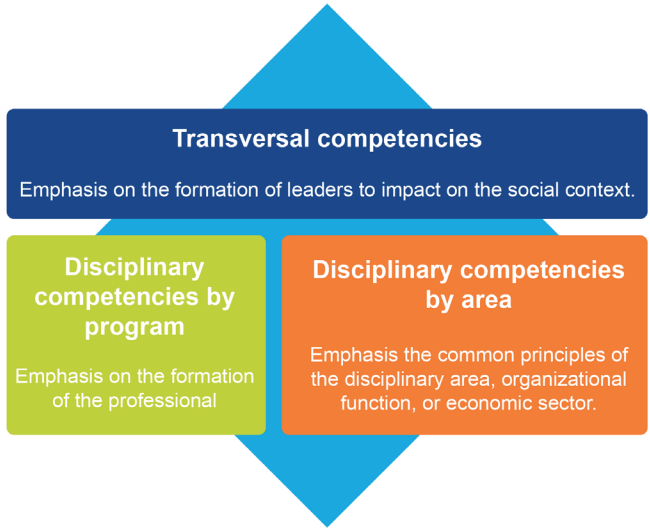



*Figure 2.1* Competencies classification at Tec21 Educational Model

Competencies are divided into **sub-competencies**, which are phased actions that describe in detail how to build competency. They are deployed in a staggered manner at three levels of proficiency: A, B, and C, which increase the outcome complexity of behaviors and performances, as students progress through the program.

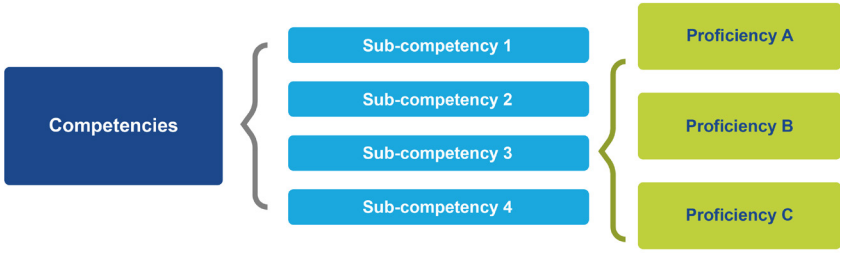



*Figure 2.2* Graphic representation of a competency's composition

Sub-competencies are included in each of the training units of the academic programs. The training units can be **courses, blocks, Tec Weeks, Week 18s, or Tec Semesters**, which have different length and purpose, as described below.

## 2.1 Disciplinary competencies by area

Labor and social contexts require collaboration to solve problems within a specific discipline, economic sector or organizational department from engineering, business, health, government, etc. **Disciplinary competencies by area** emphasize training in the fundamentals of the disciplinary area to address common contents from different professions. They also involve the development of knowledge, skills, and attitudes to contribute as a member of an interprofessional team. Interprofessional collaboration facilitates communication between members of teams from the same discipline to optimize results in terms of strategy, service, and a humanistic approach. For example, in healthcare, interprofessional collaboration is encouraged to increase patient-centered care, which has resulted in improved clinical practice outcomes in terms of the quality and safety offered to the patient (Koehn and Charles, 2019).

This (cross-disciplinary) integration enables the blending or combination of multiple professional profiles sharing technical terminology, tools, and even methods within an academic area (Gheorghe et al., 2014). Collaboration between peers from different disciplines within the same area of study enriches the students' perspective, allowing them to find interdisciplinary solutions to problems. Those areas are stratified in six (figure 2.3) which are the major entries of the Tec21 Educational Model.


*Figure 2.3.* Entries of the Tec21 Educational Model

## 2.2 Disciplinary competencies by program

**Disciplinary competencies by program** are aimed at developing the professional profile of the program selected starting from the focus stage, as well as building the core of the knowledge, skills, and attitudes that characterize the professional. Due to their specificity, they are defined considering the proposals of associations, collegiate bodies, and accrediting organizations, which establish consensus on what should be the capabilities of the graduates of each particular program, according to the conceptualization of the profession.

| Program | Collegiate groups and accrediting bodies |
|---|---|
| **Architecture** | • ANPADEH: Acreditadora Nacional de Programas de Arquitectura y Disciplinas del Espacio Habitable A.C.<br>• NAAB: National Architectural Accrediting Board<br>• RIBA: Royal Institute of British Architects<br>• UIA: Union Internationale des Architectes (UNESCO-UIA Charter for Architectural Education) |
| **Design and Digital Art** | • COMAPROD: Consejo Mexicano para la Acreditación de Programas de Diseño A.C.<br>• NASAD: National Association of Schools of Art and Design |
| **Social Sciences** | • CONAED: Consejo para la Acreditación de la Enseñanza del Derecho A.C.<br>• CONACE: Consejo Nacional de Acreditación de la Ciencia Económica, A.C.<br>• ACCECISO: Asociación para la Acreditación y Certificación en Ciencias Sociales A.C. |
| **Humanities and Education** | • ACCECISO: Asociación para la Acreditación y Certificación en Ciencias Sociales, A. C.<br>• CLAEP: Consejo Latinoamericano de Escuelas de Periodismo<br>• ACEJMC: Accrediting Council on Education in Journalism and Mass Communication<br>• CONAC: Consejo de Acreditación de la Comunicación y las Ciencias Sociales, A.C. |

| | |
|---|---|
| **Business** | • AACSB: Association to Advance Collegiate Schools of Business<br>• AMBA: Acreditation for MBA schools<br>• EQUIS: EFMD Quality Improvement System |
| **Engineering and Science** | • ABET: Accreditation Board for Engineering and Technology<br>• ANFEI: Asociación Nacional de Facultades y Escuelas de Ingeniería |
| **Medical Surgeon** | • AMFEM: Asociación Mexicana de Facultades y Escuelas de Medicina<br>• AAMC: American Association of Medical Colleges<br>• ACGME: Accreditation Council for Graduate Medical Education;<br>• Modelo CanMEDS de la *Royal* College of Physician and Surgeons of Canada |
| **Nutrition and Wellness** | • CONCAPREN: Consejo Nacional para la Calidad de Programas Educativos en Nutriología, A.C. |
| **Medical Surgeon Dentist** | • CONAEDO: Consejo Nacional de Educación Odontológica A.C. |
| **Clinical and Health Psychology** | • CNEIP: Consejo Nacional para la Enseñanza e Investigación en Psicología |

*Table 2.1* List of associations, collegiate bodies, and organizations which serve as the basis to define disciplinary competencies.

Transversal competencies

**Transversal competencies** at Tecnológico de Monterrey are applicable to all professions, as they constitute quality characteristics for professional work to address problems in a social context (Tecnológico de Monterrey, 2019b). Different institutions and universities around the world have promoted the **generic or transferable competencies**, to enable graduates to perform in their context and throughout life. The Tuning Project has promoted and coordinated European and Latin American universities for the purpose of identifying and exchanging information on transversal competencies, ensuring their quality, effectiveness, and transparency (Tuning, 2004). It is worth mentioning that the Tuning Project separates competencies into generic and specific competencies, in which the former comprise skills that are necessary for any job and the latter comprise skills required for a specific occupation or profession (Tobón, 2006). In Mexico, the Inter-institutional Committees for the Evaluation of Higher Education in Mexico (CIEES) coincide, to a large extent, with the generic competencies proposed in the Tuning Project (2004).

These transversal competencies are core elements of the formation process at Tecnológico de Monterrey. Although the concept has been used for job competencies at multiple educational levels, in higher education it has meant efforts to guide universities in the development of integral, participative, and resilient individuals prepared for the complexity of today's world. At Tecnológico de Monterrey, a multidisciplinary group of experts undertook the task of identifying the most relevant transversal competencies for integral education. The results produced seven competencies: self-knowledge and management, innovative entrepreneurship, social intelligence, ethical and civic commitment, reasoning for complexity, communication, and digital transformation. These are stated and supported in the Transversal Competencies report (Tecnológico de Monterrey, 2019b).


*Chart 2.4* Transversal competencies of the Tec21 Educational Model

# Chapter 3. Components of the Tec21 Educational Model

A transition towards the formation of competencies requires innovation and deep structural reforms that transform the disciplinary orientation towards an integrated vision that connects with the environment, based on real-life professional issues and situated learning (Colén and Medina, 2019; Díaz Barriga A., 2006). Therefore, the 2019 programs of Tecnológico de Monterrey redirect efforts beyond the education of professionals, as they seek the development of leaders capable of addressing the challenges of their context, which translates into four components: challenge-based learning, personalization, inspiring teachers, and memorable experience as described in Figure 3.1.

## 1. CHALLENGE-BASED LEARNING

An educational strategy that incorporates challenges in block-type training units as part of the competencies development. It includes four dimensions: challenge, student, context, and faculty, which interact for the purpose of learning.

## 2. PERSONALIZATION

Program orientation alternatives in terms of the sequencing, classification, integration, and complexity of the training units, that shape different graduate profiles. It consists of offering pathways for students to plan their professional identity.

## 3. INSPIRING FACULTY

Faculty attributes are aspirational examples for students and the people with whom they relate, including inspiring, informed, connected, innovative, and information technology users.

## 4. MEMORABLE LEARNING ENVIRONMENT

Construction of affinity networks that strengthen personal and professional identity through experience, which are built-in four components: personal, social, organizational, and within physical and virtual spaces.

*Figure 3.1* Components of the academic programs of the Tec21 Educational Model for 2019 Plans

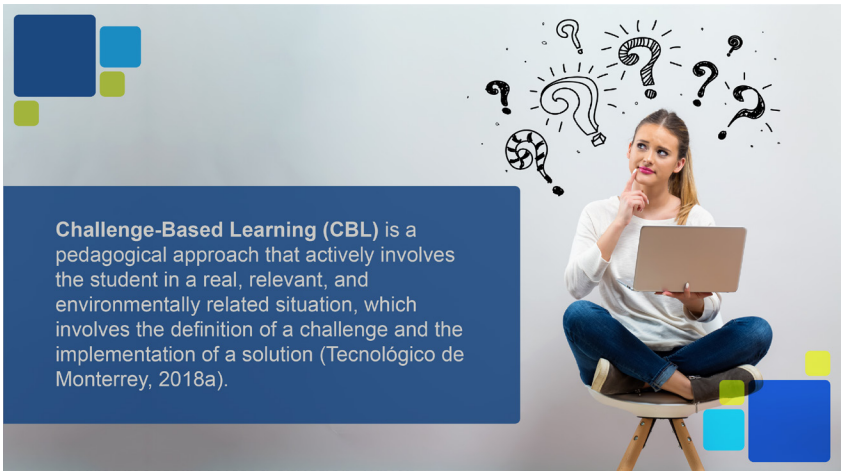
## 3.1 Challenge-Based Learning

Curriculum design is the central and distinctive centerpiece of the Tec21 Educational Model, as each program is bolstered by innovation for generating recognition of the university's work (Barber et al., 2013). Therefore, challenges are incorporated into Tec21 as part of a core educational approach to train students in functions that do not yet exist and to solve authentic situations that require dealing with curiosity, uncertainty, authenticity, and complexity (Fisch and McLeod, 2008).

Challenge-Based Learning is oriented to the formation of leaders, which involves creativity and resilience to accept the inevitability of change as an advantage rather than a constraint (Yeung and Ulrich, 2019). Furthermore, Challenge-Based learning promotes the formation of individuals with the emotional intelligence and ability to self-manage their knowledge for the development of self-confidence, motivation, empathy, and social skills, among others (Artamonova et al., 2018). According to Artamonova et al. a student-centered education approach facilitates the development of these types of skills.

Various definitions of Challenge-Based Learning (CBL) are introduced in the literature. Apple's Challenge-Based Learning proposal is an engaging multidisciplinary approach to teaching that motivates students to leverage technology to solve real-world problems (Nichols and Cator, 2008). According to Cordray et al. (2009), Challenge-Based Learning focuses on obtaining knowledge that is discovered from a combination of theoretical arguments and competencies, which students need to master the construction of a solution. Olivares et al. (2018) argue that Challenge-Based Learning is an experience that takes place in a context that transcends the classroom, where participants must

face a series of activities which, together, represent an extraordinary challenge that requires an interdisciplinary and creative approach, with the collaboration of different actors: students, teachers, and external experts.




From a strategic point of view, Tecnológico de Monterrey's definition of CBL responds to the trend: "the new emphasis should be on Challenge-Based Learning and Active Learning", as projected in the Horizon Report (Johnson et al., 2012, p. 4).

All the proposals presented above coincide in certain concepts, such as challenge, student, environment, and teacher, as well as in the relationships between them for the development of competencies. Table 3.1 below refers to the details of several educational directions, and figure 3.2 summarizes the relationships between the elements.

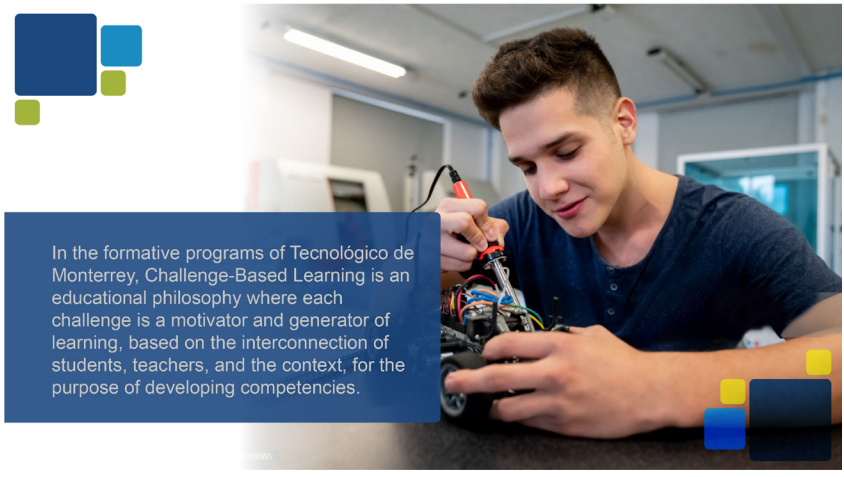
| Reference theory | Description | Predominant elements |
|---|---|---|
| **Experiential Learning** | Process in which knowledge is created from the transformation of an experience (Kolb D. A., 2015). | Student<br>Context |
| **Authentic Teaching** | A set of instructional and evaluation activities, sequenced and connected in time, that pose problems and conflicts to be solved and whose conditions are very similar to the professional context (Monereo et al., 2012). | Student<br>Context<br>Faculty |
| **Action Learning** | Learning from the presence of real people solving real problems in real-time, so students can learn from inquiry and reflection during the process (Marquardt and Waddil, 2004). | Context |

| | | |
|---|---|---|
| **Challenge-Based Learning** | A multidisciplinary approach that encourages students to leverage the technology they use in their daily lives to solve real-world problems (Nichols and Cator, 2008). | Challenge<br>Context |
| | Establishment of conditions that guide curiosity based on dialogue and challenges considering feedback, application, challenge, thinking, and self-esteem (Nottingham, 2020). | Challenge<br>Faculty |
| | Experience in which participants develop solutions that require an interdisciplinary and creative approach for the development of transversal competencies (Olivares Olivares et al., 2018).<br>2. Training model in which students actively collaborate to solve contemporary problems, based on inquiring and integrating theoretical-practical contents which are transformed into creative and innovative proposals that impact targeted audiences (Olivares Olivares, 2021). | Context<br>Faculty |

*Table 3.1* Comparative table of the elements that make up Challenge-Based Learning


*Figure 3.2* Components of the Challenge-Based Learning

### *3.1.1 Challenge*



A challenge is a life experience designed to expose the student to an attractive and challenging situation in a specific context (Tecnológico de Monterrey, 2018a). Several authors conceptualize challenge as a trigger that encourages students towards answering a starting question. For example, Apple states that a challenge starts from a question that drives actions to create meaningful solutions (Nichols and Cator, 2008). Cordray et al. (2009) define a challenge as a problem statement designed to awaken the interest of learners to inquiry deeper into certain content.

Nottingham (2020) argues that a challenge is more demanding or stimulating than a traditional method since it encourages students to learn more. The author suggests that a challenge incorporates two elements: on the one hand, a "cognitive imbalance" to generate deep inquiry and higher-order thinking, and on the other hand, "scaffolding", which implies guidance for uncertainty, bewilderment, and doubt. The objective is to channel learning toward potential ability, rather than the comfort zone.

In the Tec21 Educational Model programs, the challenge contributes to the development of disciplinary and transversal competencies, individually and collaboratively, including knowledge, skills, attitudes, and values (Tecnológico de Monterrey, 2018a). Williams (2019) suggests that a challenge should reflect a real problem as closely as possible to be meaningful; thus, it will promote collaboration among team members and inquiry of prior knowledge demanded by solutions.

In general, a challenge encourages students to address relevant and complex situations that involve both disciplinary and multidisciplinary strategies (Tecnológico de Monterrey, 2018a). Similarly, **Authentic Teaching** refers to relevant situations faced by students which should be meaningful to significantly

capture their interest (Monereo et al., 2012). This multidisciplinary characteristic is also recommended by the Apple model. The difficulty level must be carefully selected, not being so high that discourages students' motivation, nor so simple to be completed in less estimated time (Nottingham, 2020).

Challenges might develop multiple and integrated disciplinary and transversal competencies, regarding the phase of the program. For example, Cordray et al., (2009) argue that a challenge associated with disciplinary content in the field of engineering might extend learning in combination with an ethical dimension. Olivares et al., (2018) integrate public health challenges in which students participate with institutions in an industrial park integrating medical disciplines with product design or engineering areas. Eraña-Rojas et al., (2019) implemented a challenge that combines medicine with criminalistic and law to invite students to describe a crime scene. As students progress through the phases of the program, the challenges are associated with elements of further specialization according to the program of their choice.

In addition to the blocks where the challenges are installed, the courses include problem situations that contain elements of situated learning by design (Díaz Barriga A., 2006). The intention is to detonate the interest of students in delving into knowledge in a contextualized manner. The courses complement student development by providing learning and tools in parallel to the academic blocks.

### *3.1.2 Student*


Challenge-Based Learning actively involves students in the learning process through discussion, reflection, collaborative work, and the application of knowledge in multiple contexts (Tecnológico de Monterrey, 2018a). This active approach is oriented to build **experience-based and collaborative learning**, as students establish a solution to each challenge. Since students are legally adults when they start higher education, the principle of andragogy is applied. Learners become the center of the learning process making decisions about what, how, and when they learn (Caraballo Colmenares, 2007).

Cordray et al. (2009), argue that the challenge strategy is student-centered since each team defines the "best" solution according to the inquiry and assessment of multiple alternatives. Therefore, students have the opportunity to manage their capabilities to find the "best" alternative to their challenge to learn beyond individual knowledge and impact others through creativity and innovation.

According to the Observatory for Educational Innovation (2015), one of the theoretical perspectives underpinning Challenge-Based Learning is associated with Kolb D.A.'s experiential learning. (2015), which holds, as a fundamental principle, that students learn best when they actively participate in open learning experiences. Kolb D.A. mention, in the original version of Experiential Learning Theory (ELT), that he was inspired by Kurt Lewin to generate conclusions from phenomena inquiry. This action research influences the creation of a continuous learning cycle that starts from a concrete experience that leads to inquiry and reflection in multiple iterations, which enables a learning experience. Kolb D. A. cites John Dewey, who also studied the influence of empirical experience from a philosophical perspective of pragmatism, and Jean Piaget, who describes how experience impacts intelligence. Therefore, Experiential Learning considers that the learner has the opportunity to exercise an active role instead of engaging with passive lecturing; this theory establishes that learning is assimilated from different learning styles quadrants: concrete experience (CE), reflective observation (RO), abstract conceptualization (AC) and active experimentation (AE). The process of moving between each quadrant becomes a spiral where the emphasis is on the process and cyclical relearning, rather than a specific outcome (Kolb A. Y. and Kolb D. A., 2005).

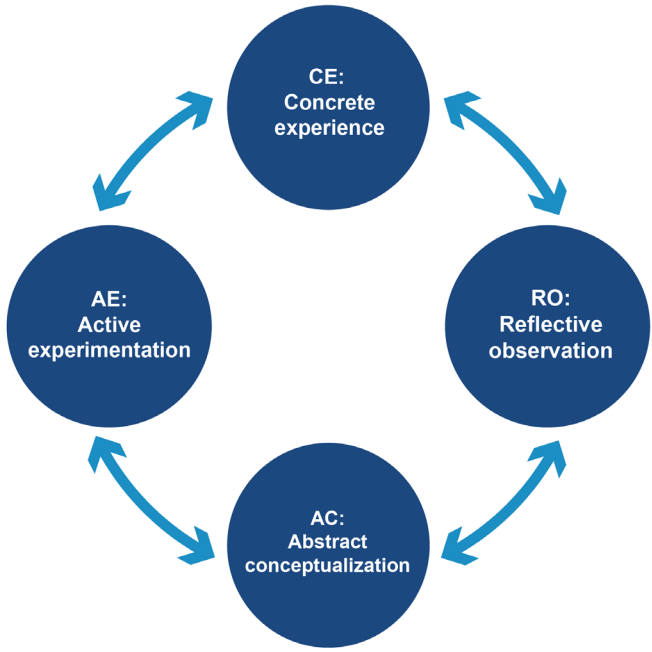



*Figure 3.3* Quadrants of Experiential Learning

Regarding the collaborative dimension, socialization is an indispensable process in learning, featuring the appropriation of the discourses, values, and identity of the professional community. Learners participate with greater commitment and responsibility in the tasks they perform by teamwork (Monereo et al., 2012). Challenge-Based Learning also demands that students work with peers, teachers, and local or global experts, to ask adequate questions, develop a deeper knowledge of the subject area, accept and solve challenges, and act and share their experience (Nichols and Cator, 2008). The learning process is democratized among participants through an inclusive and open dialogue in which each member might contribute with valuable contributions.

### *3.1.3 Context*


In Challenge-Based Learning, the aim is for students to be capable of facing learning experiences at the local, national, or international level, and discussing situations of global significance that allow them to undertake local actions (Tecnológico de Monterrey, 2018a); this approach challenges students to learn and be interested about what is happening in the environment. The foregoing relates to Authentic Teaching, which refers to a set of instructional activities that pose problems and conflicts to be solved in contextual conditions that are consistent with the professional environment (Monereo et al., 2012).

The environment dimension is also associated with **Action Learning**, which enables the integration of students in the real world of professional practice, to increase their social contribution from the early stages of the program (Kalinga et al., 2018). This type of Action Learning focuses on solving real challenges to improve the learning of groups aiming to solve a problem through

research and reflection, guided by a facilitator (Olivares et al., 2019). In this sense, Willams (2019) argues that the challenges should be relevant for organizations from different sectors to be engaged in educating future professionals, and therefore, students should alternate activities between organizations and higher education.

For this reason, Tecnológico de Monterrey created the figure of the **educational partner**, which is an organization from different economic or community sectors (manufacturing, services, government, associations, or community groups), with which there is a formal agreement to share experiences, challenges, and requirements to improve both education and transformation. The benefits of being an educational partner at the institution include:

- receiving a fresh, external perspective on your organization from students for innovation or improvement;
- accessing student talent with recruitment potential;
- identifying organizational trends by having a collaborative relationship with a highly prestigious university;
- connecting with the academic community of Tecnológico de Monterrey as an advisor, expert, guide, or evaluator during the challenge, and
- contributing to the transformation of the country through the training of entrepreneurial leaders.

### *3.1.4 Faculty member*


In the Tec21 Educational Model, active learning is delegated to teams, so the role of the teacher is a facilitator; that is, the teacher becomes an advisor so that students address the predefined challenge. According to Nottingham (2020), in Challenge-Based Learning, the teacher brings scaffolding to the educational process, through questions that retrieve knowledge and critical reflection.

In Authentic Teaching, the teacher must offer support and advice for analysis, conflict management, and outcome focus during the learning process (Monereo et al., 2012). According to Góngora (2008), in traditional learning, the teacher is completely in charge of the instruction and the only content expert to make decisions about the topics to be transmitted. In this model, the student is a passive agent who only receives instruction. In contrast, facilitation during a challenge is flexible since

both the student's expectations and the teacher's interests are considered to create more space for the student's self-responsibility and competency learning.

For Olivares et al. (2018), during Challenge-Based Learning, the teacher exercises a non-intrusive leadership that guides the group on the scope and technical contents to empower students for the development of quality and creative outcomes. In this sense, the teacher does not provide solutions, but an opportunity for dialogue and reasoning to motivate changes in the mental models of the students.

According to Williams (2019), teachers in Challenge-Based Learning play an active role in the search for and communication with local industry in terms of creating relevant situations for student training. In the Tec21 Educational Model, challenges are linked to the contextual requirements represented by educational partners, which implies managing a long-term beneficial relationship.

One of the characteristics of Challenge-Based Learning is that instead of a training unit being taught by a single teacher, there is a teaching team that can contribute from multiple perspectives and different disciplines or areas of professional practice. In this sense, development and training is required for them to transition from an individual to a collaborative vision, which requires alignment towards a shared vision among them and with the educational partner, as well as a deep reflection towards continuous improvement in each teaching session (Meeuwissen et al., 2021).

The blocks include versatile functions that teachers develop for the implementation of challenges at different times:

**Designer.** Defines the methodology to train competencies within the block, including theoretical and practical modules, the recruitment of educational partners, and the didactic sequence throughout the block.

**Block Coordinator.** Organizes the collaboration between all faculty members partnering the instruction of one block. The coordinator's work starts before the academic semester, as he/she ensures the adaptation of the general block design, manages the relationship with the educational partner when applicable, and leads the communication between challenge-advisor teachers and module lecturers, from the beginning of the period until evaluation.

**Challenge advisor.** Supports advice and follows up with students in the process of solving the challenge within a block. Guides each student to develop competencies through participation a real and challenging problem.

**Lecturer.** Delivers the learning modules that provide theoretical or practical support for the resolution of a challenge.

**Evaluator.** Designs organize, and implements the multiple student learning evaluation processes, including competency assessment according to performance level. Provides feedback to students that support their progress.

### *3.1.5 Didactic sequence*


A **didactic sequence** is a result of establishing a series of learning activities, with a specific order, which enables the students' retrieval of previous, to connect it to real-life situations (Díaz-Barriga A., 2013). According to Ausbel (1983), learning is meaningful when the student relates relevant pre-existing theories, to new ideas, concepts, and assumptions. For Mezirow (2009) these frames of reference are habits of the mind, culture, and language through which meaning, and coherence of each experience are constructed.

The Observatory for Educational Innovation (2015) compares Challenge-Based Learning with Problem-Based Learning and Project-Based Learning. Some contrasting variables are presented in Table 3.2.

| Feature | Problem-Based Learning | Project Based Learning | Challenge-Based Learning (Tec21) |
|---|---|---|---|
| **Goal** | Dialogue among participants | Specific and unique outcomes for all teams | The variable deliverable for each team to promote innovation |
| **Authenticity** | Hypothetical problems | Academic projects linked to authentic circumstances. | Real-life challenges |
| **Time** | A week | Variable from weeks to months | 5, 10, or 15 weeks |
| **Sequence** | Acknowledge prior learning, discuss potential solutions, and reach conclusions through dialogue. | Structured according to plan from start to finish with a standardized and tangible outcome. | Open and creative according to educational partners' requirements. |

*Table 3.2* Comparison between different didactic strategies

The table above shows that Challenge-Based Learning promotes greater participants' creativity because they can propose their own path during the challenge and consider solutions from different areas of knowledge, connected to reality, during the learning process.

There are different proposals on the sequence that Challenge-Based Learning should follow; however, it is articulated and adapted according to faculty block designers' preferences. A block is a training unit that includes the challenge and theoretical or practical modules. These modules provide the contents that offer the conceptual or procedural fundamentals for teams to generate reliable and evidence-based ideas to address their solution.

| Apple (2011) | Cordray et al. (2009) | ETHAZI Model (Tknika, 2020) | Olivares Olivares (2021) |
|---|---|---|---|
| 1. From the big idea to the challenge | 1. Selecting a real-life challenge | 1. Planning the challenge<br>2. Identifying and engaging with the challenge | 1. Aligning expectations |
| 2. Establishing the fundamentals of the solution | 2. Generating ideas that provide possible innovative solutions to the challenge. | 3. Setting parameters | |
| | 4. Researching and studying content to develop the solution. | 4. Obtaining and organizing information | 2. Knowledge inquiry |
| 3. Identifying the solution (questions, activities, resources) | 3. Analyzing the challenge from different perspectives | 5. Generating alternatives<br>6. Submitting proposals<br>7. Selecting the proposal | 3. Progress on the intervention plan |
| 4. Implementing and evaluating | 5. Validating the solution | 8. Action planning<br>9. Executing actions<br>11. Evaluating | **4. Integrating the best solution** |
| 5. Publishing results and reflections | 6. Implementing and disseminating | 10. Showing results | 5. Disseminating the contribution |

*Table 3.3* Comparative of didactic sequences proposed for Challenge-Based Learning

The four proposals presented above are similar, only varying order or description of activities, so that each teacher/designer can establish his or her own sequence for the block. Olivares Olivares (2021) proposes a didactic sequence that emphasizes the integration of the "best solution" as a key differentiator between a challenge and other educational strategies.

## 3.2 Personalization

From a strategic point of view, personalization originally responds to a need to align with the trend: "people expect to learn and study wherever and whenever they want" presented in the Horizon Report (Johnson et al., 2012, p. 4). The 2020 edition of this report shows the need for change in higher education to produce more personalized versions that consider collaboration with other formative dimensions (Brown et al., 2020). Therefore, the Tec21 Educational Model is conceptualized by considering the need of potential students to pursue a pathway aligned with their aspirations.

Furthermore, an accelerated technological transition changes the way of interacting and the learning preferences of a generation that Prensky (2014) calls "digital natives", whose out-of-school experiences are beginning to leave them dissatisfied with a rigid education. This group wants to be heard and trusted to follow their passions and interests (Piscitelli, 2008). The concept of digital natives is eventually replaced by Generation Z or Gen Z (Rickes, 2016). Although there is no consensus on the beginning and end of this cohort, a compilation by Schiwieger and Ladwig (2018) states that they were born between 1996 and 2012. According to the authors, these students prefer customizable micro-experiences rather than fixed predefined activities (Schwieger and Ladwig, 2018; Southgate, 2017). Other

characteristics of this generational group include creativity, entrepreneurship, the pursuit of fairness, goal orientation, practical experience, and ability to multitask, among others.

In 2020, the SARS-CoV-2 pandemic accelerated changes and forced the field of education into new scenarios, including remote education and work, adoption of hybrid learning models, technology applications such as artificial intelligence, data analytics, micro-credentials, open resources, and t distance learning models quality driven; colliding with mental health risks (Pelletier et al., 2021).

These new demands drove a new educational design consistent with higher education trends and student requirements. Curricular designs can be represented graphically as linear sequences, spiral sequences, or sequences in phases or pathways (Olivares Olivares, 2021). The Tec21 Educational Model follows the latter and is contrasted with the linear and spiral as presented in Figure 3.4, considering sequencing, organization, integration, and complexity.

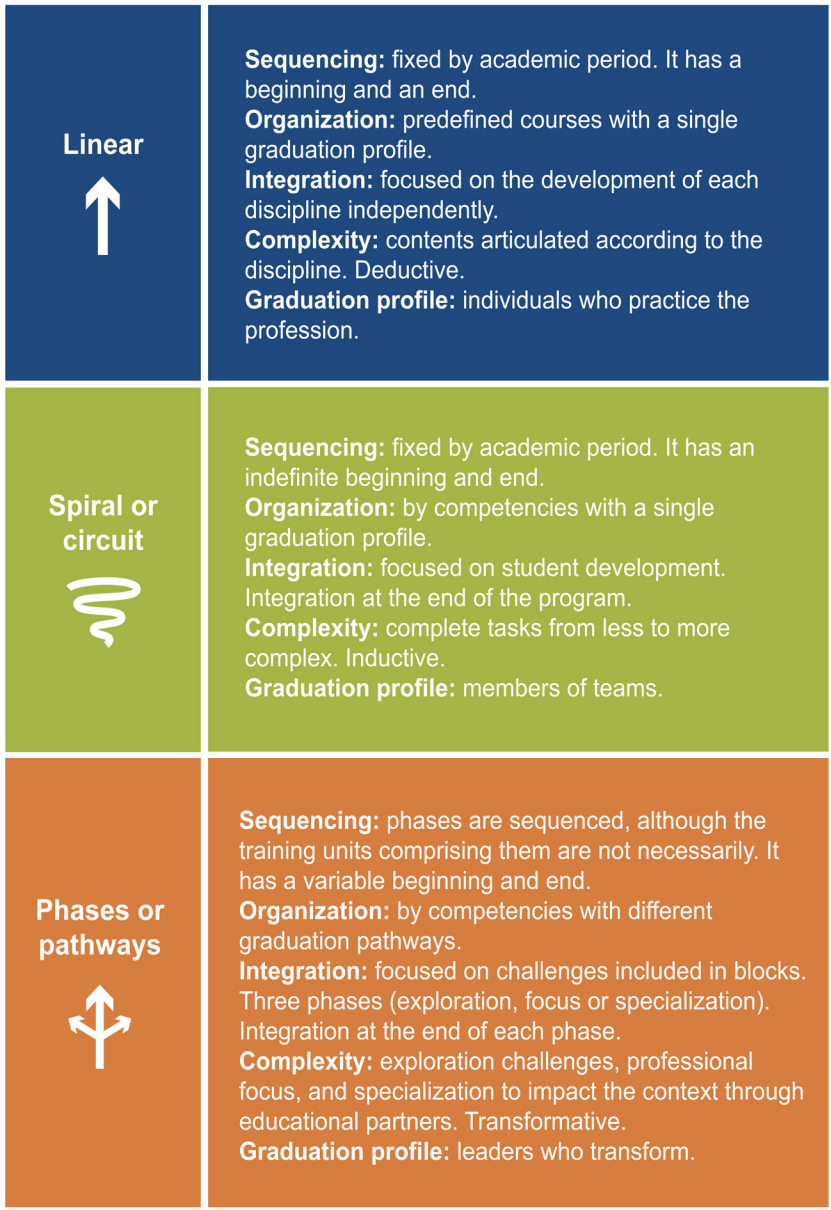
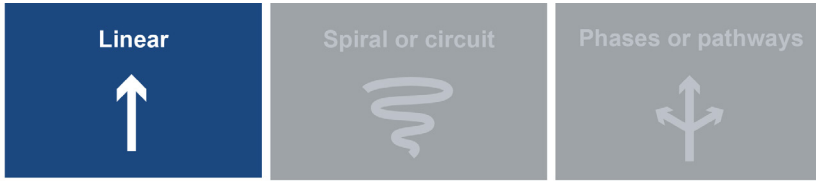



*Figure 3.4* Study plans representation

### *3.2.1 Linear programs*




In 2014, Stanford conducted a program to devise the institution's future educational model. In one of the scenarios, they described the imminent obsolescence of traditional programs with a standardized linear curricular model (Stanford 2025, 2019). Traditional curricula have a linear representation with a sequence featuring a start, progress, and an end, which produce a fixed education (Lunenburg, 2011). The Stanford 2025 project (2019) describes these programs as consistent with an industrial and mechanistic Era in which processes and products were standardized to massify production and reduce the probability of error. This offers advantages in operation and institutional structures because they can be oriented to the functions or disciplines of departments, which share the same professional biography.

Linear curriculum progress implies making vocational decisions months before starting a program, due to the single graduation profile. Even though there are some students with strong vocations, the new generation requires more flexibility for career selection. According to Olivares et al. (2020, p.15), "professional identity is the dynamic evolution through which the student recognizes him or herself as a person who is part of social and academic groups for the purpose of performing his or her role within professional contexts and thus generating conscious change". This implies that being a dynamic evolution, students may change their minds about their future as they discover the meanings associated with their professional conceptualization, including reflection on the impact they wish to make in their communities.

When the program has predefined subjects, a career change decision change implies for the student to start again in another curricular plan. These standard programs are poorly aligned with the freedom demanded by Generation Z (Jenlink, 2019) who are willing to combine activities and reshape their interests. While this notion of studying and then working was separate in the past, individuals entering college today are beginning to overlap the two activities (Schwieger and Ladwig, 2018). For example, in the cohort admitted to Tecnológico de Monterrey in 2019, out of a total of 11,650 students, 26% reported previous work experience.

In a linear program, the contents are linked to each other in a way that the student cannot advance to an academic unit if he/she has not concluded the previous one. According to Davies and Devlin (2007), disciplinarity describes autonomous and discrete areas of study that generally do not cooperate or coordinate efforts with each other. According to the authors, although these disciplinary boxes may have porous boundaries, students tend to replicate a unidimensional view in which certain aspects associated with the discipline are valued. While this enables students to greatly deepen their knowledge in a particular line of study, it also generates a limited capacity for systemic thinking, long-term vision, as well as low tolerance of others' perspectives (Medina et al., 2010).

According to Díaz Barriga A. (1993), the isolated disciplinary courses have been widely criticized because they ignore psychological structures and the complexity of human learning processes. This deductive approach to the curricula implies that courses are provided in independent pieces to be eventually articulated by the graduate (Lunenburg, 2011). In other words, the student makes connections only after the parts have been internalized. In the best of cases, the courses of a disciplinary area integrate contents at the end of their sequential chain.

Linear, fixed, and standard programs clearly define the expectations for specific graduation profiles, which ensure minimum standards for a program with high disciplinary content, but at the same time anticipate and limit the student's decision-making capability for the definition of his or her professional identity.

### *3.2.2 Spiral or circuit curriculum*

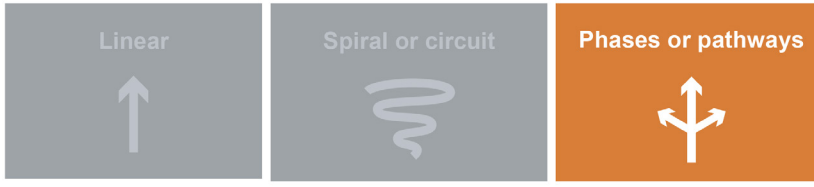

Unlike deductive teaching, an inductive vision starts from the problems and looks for answers dispersed in multiple disciplines, which is more related to the employment context and society demands. The spiral programs start from problems and select contents according to them. The Stanford 2025 project (2019) distinguishes linear from open-loop representation by considering learning beginning and end. The future vision of this university sheds light to establish continuous, lifelong learning, rather than a specific formative cycle in higher education. According to Taranto and Buchanan (2020), lifelong learning requires inducing self-direction during training so that the student learns to learn.

Spiral programs are organized sequentially in academic periods but are integrated into training units improving complexity from several disciplines. According to Harden and Stamper (1999), the spiral curriculum aims to intermittently revisit the problems with a greater depth, with the intention of developing

competencies at different times until eventually achieve desired outcomes. Then, the spiral process requires programmatic assessments based not only on theoretical aspects but also on skills and attitudes.

The spiral curriculum is aimed to integrate the development of competencies rather than isolated disciplinary content and, therefore, the student performance development. They generally use active learning strategies and assessment of observable behaviors to identify the continuous development of the student until the desired exit profile is achieved. The spiral conceptualization favors increasing the complexity of performance in the assigned tasks. Complexity may be associated with the uncertainty of the courses of action, variables involved, authenticity, required perspectives, or the need for supervision, among others.

### *3.2.3 Curriculum in phases or pathways for better personalization*



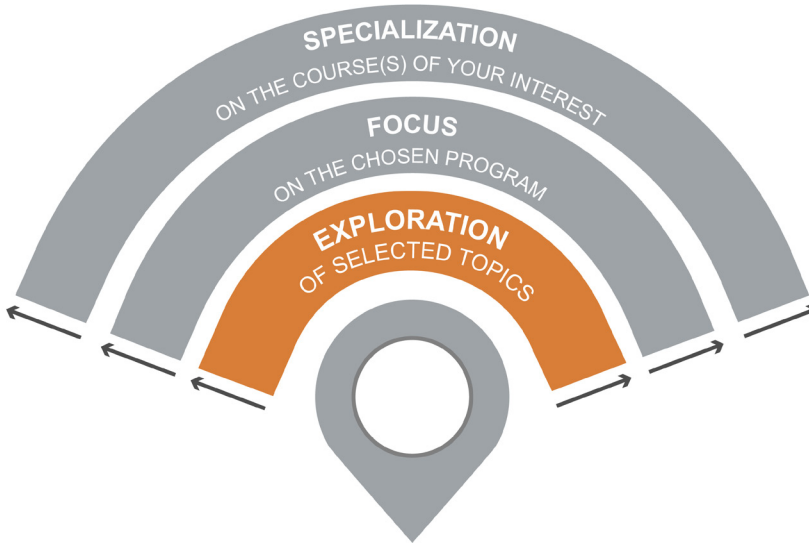

The Stanford 2025 project (2019) includes a proposal to reform the graphical representation of the curriculum by phases, replacing the linear model with a personalized approach. Díaz Barriga F. (2005) describes it as non-serialized trajectories, which are independent of each other. To alternate between professions with different graduate profiles, it is important that they have few or no previous knowledge requirements for registration. As the

student has more choice and freedom of selection, the program is considered more flexible. Ryan and Tilbury (2013) weigh flexibility in academic programs according to the curricular design when students can advance at different paces, enroll in partial academic workloads, and obtain academic credits at other institutions.

Tecnológico de Monterrey's study plans include some elements of the linear or spiral graphical representation; however, they are based primarily on a graphical representation by phases, which favors the personalization of the student's program according to his or her interests (Figure 3.5).


*Figure 3.5* Phases of the Tec21 Educational Model

*Exploration*




The first phase of the Tec21 Educational Model is the exploration phase, which relates to the "calibration" stage of the curriculum according to the scenarios of the Stanford 2025 project (2019). Furthermore, it follows the benchmark results, which establishes that students can postpone choosing their major until they experiment more about the discipline (Tecnológico de Monterrey, 2018a).

Having certain characteristics that include a group of common programs contributes to the construction of **self-knowledge** of the professional's identity, established by Olivares et al. (2020), which implies that the individual has clarity about his or her values and preferences for reasoned decision-making. According to the authors, this phase includes the selection of a career path based on a deep understanding of their capabilities and opportunities for development and growth, as well as the

planning of a short-, medium- and long-term agenda that gives them a sense of independence. This relates closely to the Stanford 2025 (2019) proposal of defining a life mission that integrates personal and professional development.

The exploration phase is an opportunity to experience the professional options of a particular area and gives the student the opportunity to confirm his or her vocation by being introduced to its contents. During this phase, students begin the development of transversal competencies, as well as disciplinary competencies which allow them to value the activities of other professional roles within the area.

The institution offers co-curricular and extracurricular education through LiFE (Leadership and Student Formation), which enables the selection of activities to customize the exploration of interests in the fields of arts and culture, athletics and sports, wellness, and counseling, or leadership.

Such student-centered approach considerations aim to offer an integral experience for fulfillment and enhancement of leadership. The LiFE Model evolves the concept of extracurricular activities into the concept of training for life, where transversal competencies are developed for the purpose of helping students find their self-realization (Domínguez Blanco et al., 2020).

*Focus*

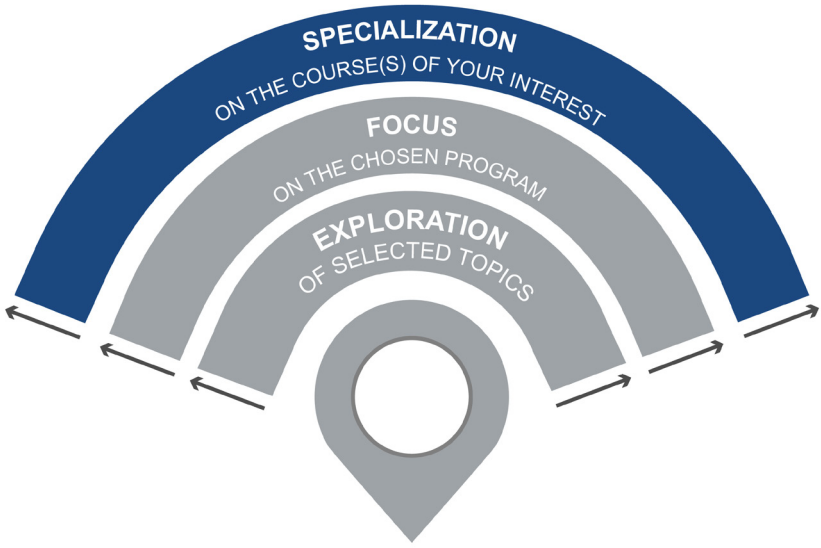

The second phase of the Tec21 Educational Model is the focus, which is similar to the so-called "elevate" stage proposed by Stanford 2025 (2019) project scenarios. This model fosters the development of a broad professional field (major). According to a study conducted by Khairunnisa et al. (2017) for both recruiters and graduates, majors provide students with employment opportunities.

This phase has the purpose of delving into the contents of the program selected based on a graduate profile. During this phase, students begin the development of disciplinary competencies by program and continue the development of transversal and disciplinary competencies by area.

This phase contributes to the **affinity networks** identified by Olivares et al. (2020), which are characterized by the integration of students as members of associations, academic groups, and

social groups related to their professional identity. These interpersonal connections within a program contribute to establishing formal or informal learning communities for lifelong personal and professional relationships. In this sense, students can select LiFE options, or leadership positions in student groups, which strengthens program competencies.

*Specialization*




The **specialization** phase of the Tec21 Educational Model provides alternatives for deepening or broadening learning within the selected profession, or outside of it. It considers, for example, options for Tec Semester as concentrations, internationalization experiences, internships, or elective courses; therefore, students could reach the highest level of competency in any of the categories, according to their program, or complement them. This resembles the "activate" stage of the Stanford 2025 project (2019) as the last phase of its innovative curriculum proposal. The possi-

bility of selecting a final specialization, according to the student's preferences, implies establishing optional spaces to deepen certain knowledge or broaden the transversal perspective of multifactorial topics. This broadening of elective spaces in academic programs generates in students greater depth of knowledge and employability skills (Hall and Young, 2007). Although electives imply greater logistics for enrollment processes to manage an accurate alignment between supply and demand, they also offer positive results for students.

In terms of deepening students' knowledge of the contents, this relates to the **I-shaped education** emphasis, which aims at students deepening their knowledge in a particular area of their program (Tecnológico de Monterrey, 2018a). This model enhances the professional conceptualization of the individual's professional identity (Olivares et al., 2020). According to the authors, this stage of maturity refers to the possibility of actively participating in a work context and being accepted within the community of practice to conduct activities that are only delegated to those knowledgeable in the area. This requires models in which alliances are established between educational entities and organizations (double-helix) or governmental entities (triple-helix) (Gheorghee et al., 2014). Both the contents of each program, as well as certain types of concentrations or exchanges abroad, favor I-shaped education.

A second emphasis considers broadening the development of skills towards specializations in other areas in order to connect different perspectives, also known as the **T-shaped education** approach (Tecnológico de Monterrey, 2018). This enables the reinforcement of conscious change within the professional identity (Olivares et al., 2020), which refers to the formation to contribute value, leading change for society, and considering multiple perspectives in a creative and sustainable way. Certain concentrations or exchanges abroad are available to students pursuant to

this T-shaped education approach, such as Finance for non-financiers, or Legal aspects of professional practice. Furthermore, concentrations are designed for the development of transversal competencies, which are appropriate in any of the institution's programs, such as research, entrepreneurship, or leadership, among others.

In a staged program, the transitions between stages become crucial moments for integrating content. Unlike linear programs, which tend to integrate toward the end of the curriculum, phases distinguish specific milestones to be achieved at key moments throughout the program. This conceptualization of milestones is reflected in proposals such as the one developed by the ACGME (Accreditation Council for Graduate Medical Education), which helps identify progress in student performance in different domains as they advance through the study plan (Lomis et al., 2017).

### *3.2.4 Training units to personalize the curricular route*

The Tec21 Educational Model includes, in its design, training units that personalize the development of students, which include Tec Weeks (6 and 12), general education courses, the exploration block, and the Tec Semester.

*Tec Weeks (6 y 12)*

From the exploration phase, students select Tec Week options to be immersed in a formative moment for the development of their professional identity, as they learn important competencies for life (IFC, 2019). This is relevant in the 2019 curricula given the need to address the widespread growth of deteriorating mental health among students and the demand for inclusive formative

spaces that explicitly address diversity issues (Brown et al., 2020). Tec Week occurs twice a semester during weeks 6 and 12 of the corresponding period and demands the full time of both professors and students.

Before 2019, **i Week** featured the development of employability soft skills such as the passion for self-learning, intellectual curiosity, problem-solving, critical thinking, collaboration, and innovation, as shown in Figure 5 (Olivares et al., 2019). Furthermore, when comparing different generations during i Week, the evidence showed the development of professional identity in the phases of self-knowledge, professional conceptualization, and conscious change (Olivares et al., 2020).

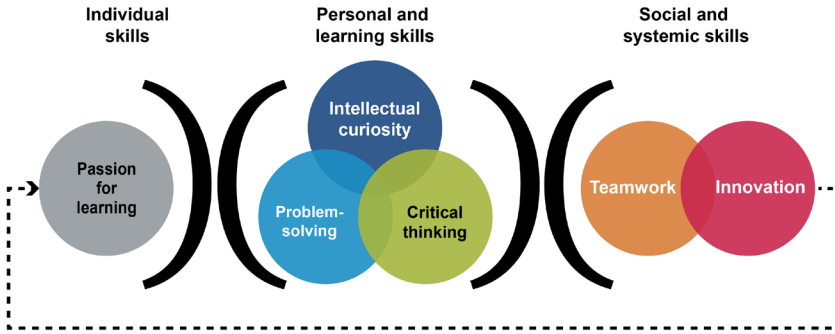



*Figure 3.6* Perceived value model for i Week

While i Week was a pilot and experiment for the development of transversal competencies in a five-day immersion experience, the Tec Week version, aims to promote the integral formation of students through one-week training units with experiences for the development of competencies for their personal and professional development including:

- introspection and reflection, to discover talents and interests as a result of individual self-knowledge;

- physical activation or cultural appreciation, for the development of wellbeing habits.

- recognition of the other, to establish empathetic and inclusive relationships for the construction of agreements;

- social impact, to establish commitments aimed at undertaking actions for transformation, and

- disciplinary workshops to reinforce the construction of professional conceptualization.

In general, sports, cultural or community service activities have traditionally been categorized as extra-curricular activities in higher education. According to Clegg et al. (2009; 2010), there is evidence that student participation in these types of activities benefits their employability, as well as their wellbeing and personal development; hence, there is no clear division between curricular and extracurricular activities from a formative perspective.

In traditional programs, credit-granting courses block the student's schedule, avoiding time for self-care (physical, mental, emotional), friendship, and community belonging. In extracurricular programs, participation in learning communities allows students to build their identity through engagement, experimentation, collaboration, and contribution with other group members (Clegg et al., 2009). Furthermore, students learn from their actions, especially when they form bonds or impact a community in need (Buckley and Lee, 2018).

The label "extra" has formed a barrier between academic courses and wellness activities and has segregated the student's formation with activities of different priority. From the exploration phase to the specialization phase, Tec Weeks favor membership

in affinity networks, physical activation, as well as the building of students' cultural capital with them at the center as a person. In other words, the qualifier "extra" is transformed into co-curricular to highlight the elements of the institutional vision. In this sense, the Tec21 Educational Model strengthens the transversal competencies for life, instead of the profession, in a systematic and directed way. According to Olivares et al. (2021) Tec Weeks, in their first implementation, featured the development of competencies such as self-knowledge, collaboration, negotiation effectiveness, recognition, and empathy (Olivares et al., 2021).

*General education courses*

The general education curricular component includes five areas that students must cover, with options to select from the range of courses available for each component. These areas are fundamental for their development as individuals and customize the learning experience, as they include multiple course selection alternatives according to the interests of students in each area of knowledge.

General education courses train students in competencies related to the reasoning for complexity, which are made up of sub-competencies such as scientific thinking, critical thinking, and systemic thinking, which are interwoven with other communicational sub-competencies such as speaking, writing, understanding of other codes, and dialogic communication (Table 3.4). For this reason, they are favored in the early stages of exploration and focus in academic programs, to offer cognitive and methodological structures that contribute to the students' formation.

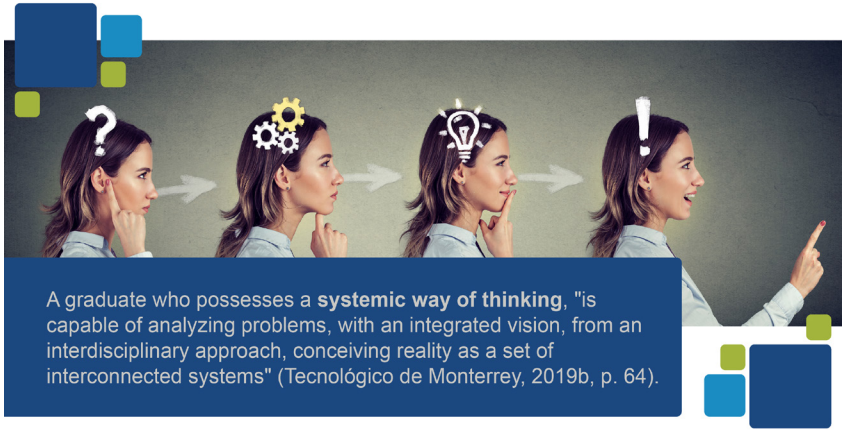
| Classification of general education courses | Transversal sub-competencies to be developed |
|---|---|
| Math and science elective | Scientific thinking<br>Digital culture |
| Digital culture | Critical thinking<br>Understanding of other codes |
| Humanities and fine arts electives | Systemic thinking<br>Written language |
| Understanding of other codes | Systemic thinking<br>Speaking |
| Social and behavioral sciences elective | Critical thinking<br>Dialogic communication |

*Table 3.4* Sub-competencies developed in general education

Regarding scientific thinking, students who enroll in general education elective courses in mathematics and science "solve problems and questions of reality, based on objective, valid and reliable methodologies" (Tecnológico de Monterrey, 2019b, p. 65). Scientific thinking is conducive to a society that values science to make decisions associated with regulations, policies, and standardized provisions (Zimmerman and Klahr, 2018; Arteaga Valdés et al., 2016). The formalization of impact practices towards this type of thinking establishes the need to teach science in educational institutions. This sub-competency, in combination with digital culture, addresses the need for adequate solutions to the requirements of society.

Critical thinking refers to the capacity to evaluate the soundness of one's own and others' reasoning, based on the identification of fallacies and contradictions that shape their own judgment in a situation or problem (Tecnológico de Monterrey, 2019b, p. 64). This definition is consistent with the proposal of Facione

(2011), who shares the specialized definition of the American Philosophical Association: "it is a self-regulated and purposeful judgment that results in interpretation, analysis, evaluation, and inference, as well as the explanation of the evidentiary, conceptual, methodological, criteriological, or contextual considerations on which that judgment is based". General education courses, in this sense, train students to generate judgments and evaluations to construct their reality. This sub-competency, in combination with that of dialogic communication and understanding of other codes, enables the transfer of the positions, findings, and conclusions obtained from the established judgment.



A graduate who possesses a **systemic way of thinking**, "is capable of analyzing problems, with an integrated vision, from an interdisciplinary approach, conceiving reality as a set of interconnected systems" (Tecnológico de Monterrey, 2019b, p. 64).

According to Liévano Martínez et al. (2012), a system is conceptualized as an element that includes multiple interactions and properties, with a common purpose based on which each of the parts makes a fraction of the contribution to fulfill it. In this sense, general education courses contribute to the formation of educated professionals, knowledgeable about a wide array of contents, not only those related to their profession.

*Exploration block*

An exploration block is a training unit incorporated into the third semester of the 2019 programs at Tecnológico de Monterrey, as part of the personalization opportunities. This five-week block has the purpose of bringing students closer to the contents of different disciplinary areas. The deepening of knowledge in I-shaped education is distinguished with the concept of diversification in T-shaped education (Tecnológico de Monterrey, 2018a). While I-shaped design specializes in specific topics of the program under study, the T-shaped design broadens the vision towards personal growth in other perspectives, aimed at challenging the conceptualization of the world, from new areas of knowledge.

In a competency-based curricular design, the integration of knowledge should be favored to move towards interdisciplinary knowledge (Torres Rivera et al., 2014). This allows for synergies between various disciplines to refine the solution of challenges that respond to the demands of today's world. Furthermore, the introduction of concepts from other fields of knowledge opens the doors to potential collaboration and the building of bridges between domains with little interaction. The exploration block is included as part of the personalization component because students have the possibility of selecting which area of knowledge they wish to expand or diversify the development of their competencies, according to their individual development plan. The blocks are aimed at allowing students to begin the construction of their specialization by connecting disciplines, which helps them define the purpose of the program they are studying. The block allows them to project their professional future, exploring disciplinary interactions that students may be interested in or passionate about.

The curricular structure of 2019 programs is conceptualized based on the guide shown in Figure 3.7 (IFC, 2019).

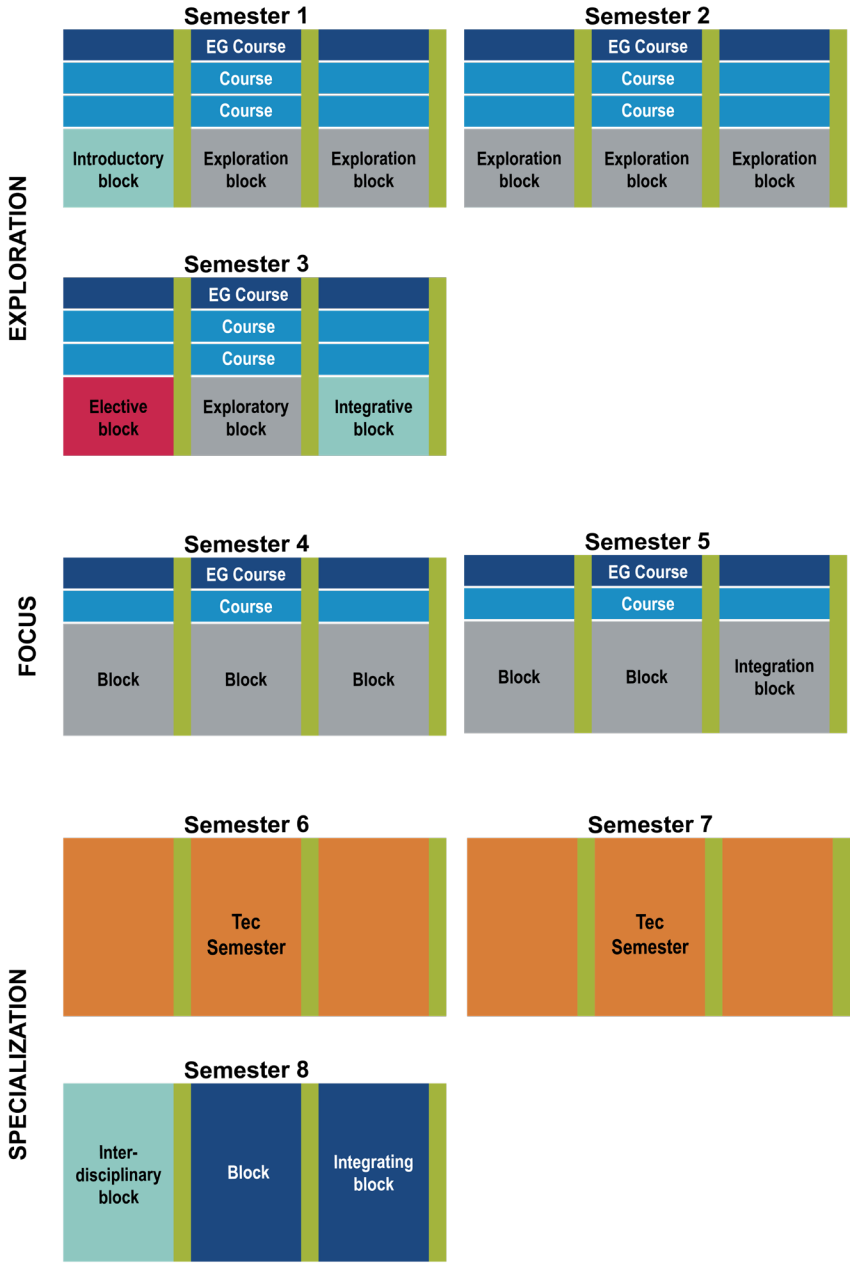



*Figure 3.7.* Structure of a Tec21 Educational Model program

## 3.3 Inspiring faculty

Inspiring faculty is a component of the Tec21 Educational Model since they participate in all training units, whether it is course, block, Tec Week, or Week 18. The Tec21 Educational Model highlights five teacher attributes, which are compared in Table 7 with other proposals. Van Dijk et al. (2020) conducted a systematic review of 46 frameworks on how to determine teaching functions or tasks and proposed the UNITE (University Teacher Expert) model. Moreover, Solpuk Turhan et al. (2019) conducted a study to create a model with the qualities of an inspiring teacher. From an analysis of professional identity, Cavazos Montemayor et al. (2020) provide a model on the characteristics that contribute to a teacher's self-concept and evolution. Table 3.5 presents these theories, which are integrated to describe each attribute for faculty according to the Tec21 Educational Model, as provided in the last column

| **UNITE Model (Van Dijk et al., 2020)** | **Inspiring teacher (Solpuk Turhan et al., 2019)** | **Professional identity (Cavazos Montemayor et al., 2020)** | **Tec21 Educational Model (Tecnológico de Monterrey, 2018a)** |
|---|---|---|---|
| Teaching and the support of learning | Personal characteristics<br>Supporting student growth | Self-concept<br>Job satisfaction<br>Expectations about the future of their profession | **Inspiring** |
| Professional development | Professional development | Professional competencies | **Professionally developed** |

| | | | |
|---|---|---|---|
| Educational leadership and management<br>Academic and researcher | Communication | Social recognition<br>Attitude towards change | **Connected** |
| Educational design<br>Evaluation and feedback | | Social relations in the academic department | **Innovative** |
| | | | **Information technology user** |

*Table 3.5* Competencies developed in general education

### *3.3.1 Inspiring*

Inspiring educators are respected and admired by their students and colleagues because they influence them through motivation and demand to achieve their maximum potential.

Furthermore, they are committed to providing quality of their teaching to benefit student learning and personal growth; they also represent a positive influence in how they act, which transcends the space and time of a single course (Tecnológico de Monterrey, 2018a). Several authors describe inspiring teachers as people who, by their actions and values, become role models who are difficult to forget, because they leave an important mark in students' memories (Rodríguez Alcócer, 2019; Van Dijk et al., 2020; Solpuk Turhan et al., 2019).

The teaching function includes guiding the learning process by creating an inclusive, safe, and stimulating environment (Van Dijk et al., 2020). According to the authors, the inspiring teacher organizes learning situations, provides clear instructions, explanations, demonstrations, and examples that trigger active and customized learning aligned with student capacities. Solpuk Turhan et al. (2019) add that inspiring teachers apply creative and diverse methods.

According to Solpuk Turhan et al. (2019), the inspiring teacher has certain personal characteristics such as fairness, sincerity, trustworthiness, positive attitude, and an inclusive, tolerant, reliable, and friendly mindset, as they support students in their academic, personal, and professional growth. Van Dijk et al. (2020) include interpersonal skills, professionalism, and ethical behavior.

### *3.3.2 Professionally developed*

Teachers should constantly renew their knowledge on their area of specialization, as well as in the educational field, through continuous participation in academic and professional activities, in order to include new content, methods, and pedagogical techniques in their teaching practice (Tecnológico de Monterrey, 2018). According to Van Dijk et al. (2020), professional development is relevant for every rol or practice. Solpuk Turhan et al. (2019) explain that professional development allows the individual to master teaching, research, or educational innovation.

According to Van Dijk et al. (2020), professional development can be generated by self-study, practical experiences, or evaluations. Teachers who pursue a professional identity as a teacher, engage themselves in formal programs or academic degrees as a commitment into a permanent path. Cavazos Montemayor et al. (2020) suggest acquiring competencies for teaching skills and performance in new roles such as counseling or advisory support.

### *3.3.3 Connected*

Inspiring professors actively and formally participate in multiple contexts as leaders, academics, philanthropy, or clinical (in the case of health professionals). Regarding their professional identity, they collaborate through networks to enrich their teaching activity and expose students to practical knowledge in authentic contexts (Tecnológico de Monterrey, 2018a). According to Van Dijk et al. (2020), formal and informal networks influence different environments and contribute to teamwork and leadership. Partnering requires communication skills, passion, empathy, unconditional interest, and an elevated sense of humanity (Solpuk Turhan et al., 2019).

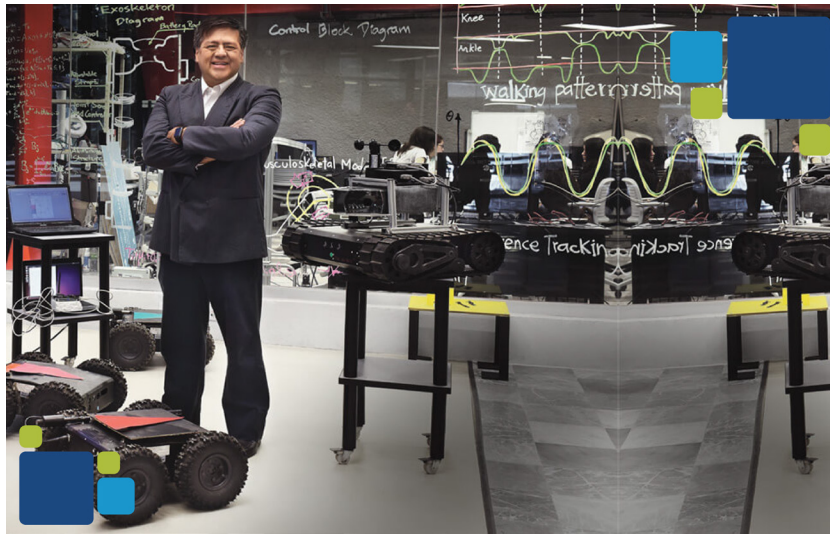
Moreover, teacher participation in research or extension activities allows them to transfer their knowledge, experience, and best teaching practices to audiences associated with disciplinary or educational research. Conferences and meetings generate ideas and inquiry processes to grow the basis of scientific knowledge in specific areas (Van Dijk et al., 2020). As teachers achieve greater social recognition as experts, they benefit positively from this role as part of their professional identity (Cavazos Montemayor et al., 2020).

### *3.3.4 Innovative*

Innovative teachers generate and implement original and wide-ranging pedagogical strategies and resources, which they adapt according to the profile of their students. Innovative educators promote learning, motivation, involvement, creativity, and change agency attitudes (Tecnológico de Monterrey, 2018a).

Innovative teachers design contents, materials, resources, and learning objects, which can range from a single course or a complete educational program (Van Dijk et al., 2020). In this sense, evaluation instruments need to be developed with quality standards that ensure the validity and reliability of the results. According to Cavazos Montemayor et al. (2020), the development of innovation projects generates positive interpersonal relationships and reinforced the teacher's identity.

### *3.3.5 Information technology user*




The teacher effectively incorporates the use of technology as a tool for the implementation, evaluation, and improvement of the teaching-learning process, according to the context and resources available in their environment (Tecnológico de Monterrey, 2018). As of 2020, with the multiplication of remote learning due to the COVID-19 pandemic, teachers require greater mastery of tools and strategies for distance learning, among which is the management of hybrid models, videoconferencing, collaborative platforms, and virtual classrooms (Pelletier et al., 2021).

The dimensions presented above can be enhanced as the teacher advances in his or her development. For Cavazos Monte-Mayor et al. (2020), the construction of professional identity is influenced by the processes of personal history, professional career, training, and identity crisis. The growth of teachers according to the UNITE model is obtained by the level of performance in each of the functions they exercise, by the number of roles in

which they can participate, and by the scope of their sphere of influence (Van Dijk et al., 2020). Another way to measure teacher growth is in their ability to work in cultures ranging from the individual, in his or her essential role as a teacher, balkanized in small, related groups, with a collegiate dimension in design or development projects, and in an extended community that breaks university boundaries (López Cabrera et al., 2020).

### *3.4 Memorable learning experience*

According to Gruppen et al. (2018), the learning environment refers to personal experiences and perceptions (psychology and education), social interactions (sociology and education), organizational culture and practice (anthropology and sociology), physical and online facilities, as well as spaces (sociology and education) in which learning occurs. According to the authors, it can be associated with formal and informal characteristics that relate to the experience occurring in the different dynamic contexts that facilitate learning. These four dimensions are described below.

### *3.4.1 Personal dimension*

Students interact with the learning environment through activities that enable personal growth, clarity of goals, and integral wellbeing for the development of professional identity and growing autonomy (Gruppen et al., 2018). Within this personal dimension, the Tec21 Educational Model promotes objectives through Week 18, the Advisory Support model, and the Promotion of well-being.

*Week 18*

Week 18 during the exploration, focus, and specialization phases occurs at the end of each semester and has the following objectives:

- guiding the future training process of each student, encouraging reflection through feedback based on the analysis of the integrated results of the semester's experience;

- sharing achievements among students, teachers, and mentors to find the best practices for the learning experience.

During the 18 Week students are expected to integrate their progress according to competencies development for self-knowledge and appraisal. The closing remarks enhance the university experience in alignment with their progress, interests, and talents (Ayala Aguirre et al., 2020).

*Advisory support model*

The advisory support model is incorporated into the 2019 curricula to help students enhance their capabilities, with the support of expert staff, to guide them to make informed decisions about their future (IFC, 2019). It seeks to be close to students so that they discover their self-realization with the development of emotional and spiritual balance (Domínguez Blanco et al., 2020).

The role of **mentor for student success** represents a guide to enhance students' experience. Student success considers variables such as retention, graduate rates, academic achievement, employability, graduate admissions, and holistic development (Domínguez Blanco et al., 2020). Previous studies showed that mentoring should go beyond academic support and contribute to other domains such as mental health and personal development (Raposa et al., 2019). The advisory support model also includes the figure of **program chief** (entry director/career director/academic society leader), who guides students with decisions related to their academic program, curricular or co-curricular opportunities for their growth and development. Program chiefs, in their different modalities, are part of the advisory support model by guiding students in selecting pathways and the empowerment of their disciplinary opportunities within their university experience.

*Wellness promotion*

Since wellness is fundamental for students, there are prevention and counseling programs through LiFE. Experts are assigned to design, develop, and implement strategies for self-care, addiction prevention, as well as physical, mental, and sexual health. The holistic health dimension is promoted so that students learn to take care of themselves and define a healthy lifestyle. Healthy habits increase the sense of personal and professional achievement (Domínguez Blanco et al., 2020).

### *3.4.2 Social dimension*

Learners engage with others and foster social capital to shape their perceptions and life experiences. Higher education relationships involve learners with learners, to experience competition, cooperation, shared values, and student culture. Learners-faculty members or learners-general staff relationships build trust, feedback, communication, instructional strategies, mentoring. Learner-community members promote accountability, acceptance, and trust (Gruppen et al., 2018). Learning communities are groups intentionally designed for their members to learn

from each other (Shochet et al., 2019). The LiFE model considers such communities for students to coexist with other students for social and wellness purposes.

*Student talent*

The LiFE Student Leadership and Formation model fosters physical, emotional, and spiritual balance in students to achieve self-realization. Therefore, showcasing talented students belong to a community based on diverse common interests (Domínguez Blanco et al., 2020). Buckley and Lee (2018) suggest that extracurricular experiences facilitate discovering passion and capacities through which students might stand out. LiFE activities bring about opportunities to strengthen affinity networks with other students who share common goals. For example, physical activation and cultural activities enable the development of lifelong competencies. Art and sports foster a sense of human spirit and physical fitness, respectively. Moreover, student groups foster leadership and social commitment to generate positive impact in diverse contexts.

*Sense of Humanity*

At Tecnológico de Monterrey, graduates are expected to be able to face the great ethical and social challenges of today's society. As Martínez Navarro (2006) points out, ethically responsible professionals have a civic responsibility in their community and must be committed to the achievement of targeted purposes. This sense of human formation is included in the curricular (specific blocks and social service), institutional, and social activities.

The social service experience develops in students the ability to identify which dimension of their professional field is related to the Sustainable Development Goals of the UN (United Nations).

Specific projects are aimed to create and implement transformative actions for the community or the environment. During their social service, students develop the ability to share their personal talent and professional excellence at the service of others. The design of social service educational experiences, incorporated into the academic curriculum, fosters the development of moral awareness, moral sensitivity, ethical reasoning, and motivation (Rest and Narvaez, 1994).

Furthermore, the Academic Integrity Program seeks to promote honesty and transparency in the performance of academic, research, and cultural activities. Integrity enables the construction of responsible individuals and groups, committed to high-quality standards and accountable for their actions (Boch and Cavallotti, 2016).

At the institutional level, an inclusive culture is promoted through the Center for Human Dignity, which fosters respect, care, and solidarity through the Volunteer Program. The Center for Human Dignity (Tecnológico de Monterrey, 2021) acts as an ombudsperson to address situations where human dignity has been trampled on, such as in cases of gender violence, in strict adherence to the values, principles, codes, and protocols of the institution. This entity addresses the Sustainable Development Goals, particularly Goal 5, gender equality, and Goal 10, reduction of inequalities. The initiatives represent the frame of reference that guides and aligns institutional thinking and management to achieve these development goals in the country, in collaboration with local, national, and international civil society organizations, both in the public and private sectors.

Furthermore, the LiFE program aims to generate an inclusive community that integrates students who are isolated into university life and promotes living in harmony with people of different ideologies and interests (Domínguez Blanco et al., 2020).

At the social level, there are programs such as Prepanet or Hambre Cero Nuevo León, which constitute efforts inspired by the 2030 Agenda aimed at strengthening the civic commitment of each graduate as part of their civic professionalism (Boyte and Fretz, 2010). Through volunteering students address the human dimension and create social capital, through credible commitments, support from each other, and recognition of others' potential.

### *3.4.3 Organizational dimension*

Institutions provide structure, guidance, and support for learning by including curricular resources and devices, geographic locations, accreditation rules and organizational practices, culture, and policies; these policies may include: an orderly environment, clarity of rules, working hours, regulatory environment, control,

curriculum, placements, technological infrastructure, among others (Gruppen et al., 2018). Strategically speaking, there are programs structured by the institution for the purpose of distinguishing itself from other universities. Some of the initiatives that make up the strength of the vision of Tecnológico de Monterrey include internationalization, entrepreneurship, leadership, and research.

*Internationalization*

Internationalization opportunities foster students learning from diverse countries, in terms of culture, socialization, and lifestyle. Tecnológico de Monterrey forges alliances and consortiums with highly prestigious organizations around the world, which enables the development of academic, research, and international cooperation programs. International agreements provide additional academic or dual degrees from foreign higher education institutions. The International Diploma is included as part of the Tec21 Educational Model as an additional distinction of students' professional degrees. This program is an opportunity to enhance both their global vision and their leadership and negotiation skills in international environments through the development of a wide array of experiences abroad, including language skills and accreditation of intercultural training units.

*Entrepreneurship*

Entrepreneurship experience at Tecnológico de Monterrey is recognized by The Princeton Review, a publication that places Tecnológico de Monterrey in 5th place among universities with an emphasis on entrepreneurship (The Princeton Review, 2021). As a transversal competency, innovative entrepreneurship is promoted in the curriculum and, as a discipline, students

can take training units which include general education courses, exploration blocks, or Tec Weeks. The Eugenio Garza Lagüera Entrepreneurship Institute seeks to develop and strengthen the entrepreneurial spirit in all students and faculty, as well as to promote and support the creation and development of companies by accelerating the innovative entrepreneurship ecosystem (IEEGL, 2021).

The entrepreneurship ecosystem is an environment accessible to students and the entire Tec community, which fosters the initiation of changes and transformations for a better world, aligned with Tecnológico de Monterrey's values. Entrepreneurship is innovative, conscious, inclusive, and collaborative value-added. The ecosystem includes four lines of action: the development of skills and competencies, support for entrepreneurs (incubators, accelerators, E-zone, among others), research, and networking.

*Leadership*

Tecnológico de Monterrey's vision for 2030 includes leadership as one of its central elements. The world requires leaders who dare to take risks and are capable of mobilizing resources to accomplish their vision. Ethical and conscious leadership is needed for social impact and inspiring people to pursue transcendent common goals. Leadership for service is also promoted, with empathetic leaders capable of taking their organizations to the next level (Tecnológico de Monterrey, 2019a).

The formation of leaders is an integral and complex process. Many of the elements of the Tec21 Educational Model contribute to leader formation by creating opportunities for reflection and growth. Academic programs, student experiences, international experiences, and LiFE programs promote leadership skills (Domínguez Blanco et al., 2020).

Moreover, Tecnológico de Monterrey defined a Quality Enhancement Plan (QEP) for leadership as a key objective for the reaffirmation of its accreditation before the Southern Association of Colleges and Schools Commission on Colleges (SACSCOC). The leadership initiative aims to strengthen the education of Tecnológico de Monterrey students to develop self-awareness, creation of innovative solutions to the challenges of their environment, building collaboration to transform reality, and contributing to the common good. There are four transversal competencies related to leadership: self-knowledge and management, Innovative entrepreneurship, social intelligence, and ethical and civic commitment (Tecnológico de Monterrey, 2018b).


*Figure 3.8* Transversal competencies present in the Quality Enhancement Plan

For example, the ULEAD program is an opportunity to develop leaders with competencies in self-awareness, critical thinking, conscious entrepreneurship, and civic engagement for social transformation, based on organizational, entrepreneurial, or re-

search projects managed by faculty experts. Students invited to this program demonstrate outstanding capabilities and motivation to contribute through high performance.

*Research*

One of the 2030 strategies of Tecnológico de Monterrey, is to promote research for innovative solutions to global challenges. This project has produced four elements that characterize research at Tecnológico de Monterrey in recent years (2017 - 2020) which include: the strengthening of institutional research, changes in the national research strategy, the future of research through the 2030 vision, and data-driven scientific decision-making (Hernández Gress et al., 2020). Research at the institution is carried out through the **Strategic Focus Research Groups** (GIEE by its acronym in Spanish), where scientific activity focuses on priority areas, directing their efforts towards the resolution of relevant problems to a society, with the participation of professors, researchers, undergraduate and graduate students, and international researchers.

### *3.4.4 Physical and virtual spaces*

Learning and practice take place within the physical spaces of education and infrastructure in general. Similarly, information technology and other resources also provide a virtual "space" in which learning is fostered (Gruppen et al., 2018). Along these lines, Tecnológico de Monterrey offers teaching in both face-to-face and digital formats.

*Learning spaces*

Face-to-face training units use classrooms and laboratories with the infrastructure required to trigger active learning and collaboration between students and teachers; both for the face-to-face and online modalities. Reconfigurable furniture has been included in the classrooms to promote learning moments compatible with Challenge-Based Learning; learning spaces include those shared by education partners and allies in their own environments, which enhance the experience in a context of high authenticity.

Digital spaces are divided into distance learning and hybrid spaces. According to Fidalgo et al. (2020), distance education is characterized by the physical separation between teacher and students in which technological means are used for communication purposes between participants. The following characteristics should be considered:

- The teacher and students interact through technology from different geographical locations. The course type defines the degree of real-time interaction, i.e., synchronous interaction.

- The contents, resources, or didactic activities must be designed specifically for a digital environment, in which the learner has a certain degree of control over his or her time, space, route, or pace of learning, in an asynchronous manner (Fidalgo et al., 2020).

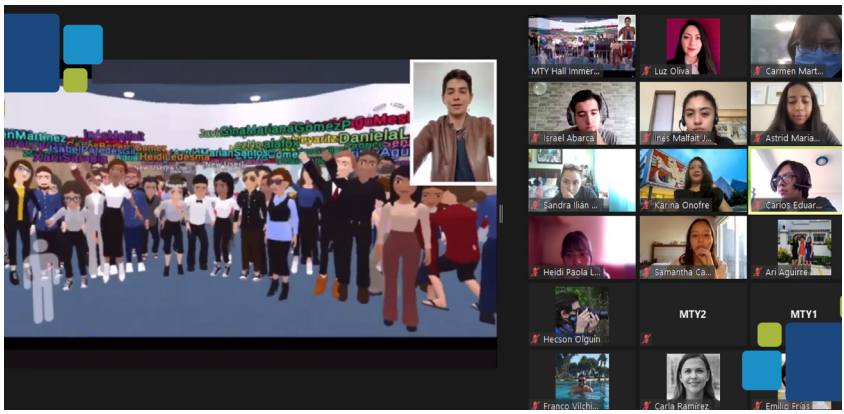
The hybrid modality combines, from the planning stage and throughout the course, the following components:

- The interaction between teacher and students happens in real-time within the same physical space (classrooms, workshops, laboratories, and workplace spaces). In some cases, it is possible to interact at a distance, in real-time, through technology.

- Distance learning content, resources, or activities must be designed specifically for a digital environment, in which the learner has some degree of control over time, space, route, or pace of learning.

The presence of COVID-19 required an emergency and drastic change from face-to-face education to an online modality, based on the need to ensure academic continuity (Valdez-García

et al., 2020). The model that emerged at Tecnológico de Monterrey is called HyFlex+, which was evaluated by students on various dimensions of quality in terms of functionality, time management, pedagogy, learning resources, and collaboration, in which, in general terms, students found the use of platforms such as Zoom and Canvas adequate for academic continuity (Zubieta-Ramírez et al., 2021).




Distance learning facilitates learning at the students' own pace according to their needs. For example, the leveling courses for the 2019 study plans consider this modality in which students advance according to their personal agenda planning, selecting the contents that require greater reinforcement.

As a complement to learning, the library also combines physical and virtual spaces. For example, the library of the Tecnológico de Monterrey, Monterrey Campus, has evolved into BiblioTEC, a building with 17,000 square meters of construction area, with a configuration featuring flexible spaces that adapt to the needs of individuals, teams, and large groups to promote learning, creativity, and collaboration (Maya Ortega, 2019). The role of the librarian is transformed from owner of space to cura-

tor and facilitator. The library participates in the development of information literacy skills to access, select and manage information, a task that becomes relevant in view of the exponential growth of information.

*Spaces for personal development and well-being*

Each of the campuses offers sports and cultural spaces that promote comprehensive training, with the support of expert trainers in each of the areas of interest, for the development and well-being of the students. These areas have a collaborative environment for the construction of active networks.

Punto Blanco is a physical space built for students, parents, teachers, and collaborators to reflect and relax. It has the purpose of providing a space for reflection and relaxation; to promote habits for a healthy and harmonious life, and to develop a state of mindfulness that allows an individual to make decisions in an assertive and efficient manner.

# Chapter 4. Assessment of learning


The assessment of learning is an essential process of the educational model, which is based on solid pedagogical methodologies, practices, and principles of academic integrity. Evaluation is carried out throughout the curriculum and focuses on the development and achievement of student competencies, evaluated through evidence of product or performance; these are reviewed with standardized instruments, called criteria tables, which are agreed upon and calibrated among teachers.

Evaluation serves three main purposes: providing feedback to students on their learning, to teachers on their pedagogical methods, and to the institution on the program's design. Evidence from evaluation supports credits granting to issue academic degrees and programs accreditation with official validity (Brookhart and McMillan, 2020). As an essential component of the learning process, assessment fosters the culture of continuous improvement, the capacity for self-analysis, and student responsibility. It is also a key element of the academic quality that has characterized Tecnológico de Monterrey as an educational institution throughout its history (Tecnológico de Monterrey, 2020b).

From a curricular perspective, evaluation takes place at different moments and includes initial assessment, training unit assessment, and Week 18: Wrap-up.

### *4.1 Initial evaluation*

The initial evaluation has the purpose of identifying the student's previous knowledge and competencies, particularly those that are indispensable for a successful start to the program. This evaluation also recognizes personal attributes that help the student to have a development plan to achieve the goals related to his or her graduation profile. With the results of this initial evaluation of prior learning, important decisions are made for performance reinforcement.

### *4.2 Training unit assessment*

Evaluation is part of the learning process and provides feedback for the development of sub-competencies. It has a diagnostic, formative, and summative function. Outcome-based assessment of training units provides information for continuous, formative, and feedback-oriented practices, promoting self-regulated learning (Panadero et al., 2018).

Learning evidence constitutes students' achievements and feedback, promoting performance improvement. The assessment is expressed in two terms, the degree of sub-competencies achieved in the course or block, and a score from assignments and other activities. Design teachers plan the frequency and type of assessments as a systematic and continuous process, according to general guidelines and instrumental conditions established by the Tec21 Educational Model and the institutional academic regulations.

Self-evaluation and co-evaluation are part of the learning process in the training units, to engage students on their own development. Assessment practices promote self-assessment, reflection, and critical thinking (Panadero et al., 2016).

### *4.3 Week 18: Wrap-up*

In the 2019 curricula, **the Week 18: Wrap-up** refers to a programmatic assessment that is applied longitudinally three times at the end of each curricular phase. The week is a strategy to review the student's progression in the development of his/her competencies. During the assessment process, both the student and the teacher identify achievements and opportunities to plan future actions towards the following goals and pathways. The teacher's role as evaluator assesses the integration of the sub-competencies achieved by the student considering his/her portfolio and performance during a situational scenario. The scenario considers the simulation of professional activities, which reproduces key competencies indicators (Pozo Flórez, 2013).

In the Tec21 Educational Model, evaluation includes learning experiences that integrate the sub-competencies or competencies achieved. Dimensions selected for this purpose are related to interdisciplinary capacities and knowledge. The frequency and type of evaluation applied during the training units or the Week 18:Wrap-up, promotes the balance between the effective, ethical, and social dimensions (Ramos Acevedo et al., 2020).

# Chapter 5. Evaluation of the impact of the Tec21 Educational Model


Tecnológico de Monterrey's vision towards 2030 is stated as: "Leadership, innovation and entrepreneurship for human flourishing" (Tecnológico de Monterrey, 2019a). The institution has developed a strategic plan for this vision. The document Towards 2030 identifies ten indicators to measure progress, primarily those related to the development of students' leadership and entrepreneurship potential; the enrichment of student life and citizen participation; the strengthening of institutional prestige and satisfaction; the development of the well-being, health, and happiness of the academic community; and the preparation of students for lifelong learning.

The implementation of the Tec21 Educational Model has an impact on multiple indicators associated with the institutional vision, which are measured and analyzed to enhance innovation and continuous improvement. In this sense, the structured system of progress indicators becomes the fundamental inputs to address design improvements in the short, medium, and long term.

Therefore, the indicators not only reflect the effectiveness of the model (based on the impact of the students' graduation profile and their contribution to society and institutional prestige); but also, about the specific short-term progress of each of the model's elements. According to Nejati et al. (2011), universities, as organizations, are committed to providing knowledge and welfare to society; Abreu-Hernández et al. (2008) add that they must also bear social responsibility for the training of professionals, the collaboration between institutions, and focus on to the needs of society.

Esperón (2014) points out that it is the institution's commitment to implement educational programs that guarantee safety, physical integrity, health, freedom, professional development, prestige, dignity, care for emotions, autonomy, and relationships (as cited in Abreu-Hernández et al., 2020). Some indicators that demonstrate the achievement of this commitment require monitoring employability, entrepreneurship, graduate studies, contributions to development and knowledge, self-perception of fulfillment, well-being, and life flourishing.

Learning milestones measurement is still an option to be explored as a tool for evaluation. While impact studies associated with external accrediting agencies are more widespread in the academic environment, the evaluation of the impact of different institutional initiatives on student learning is still a challenge. The trend of sustaining evidence-based decisions is motivating HEIs (Higher Education Institutions) to incorporate evaluation strategies using self-reporting instruments, such as learning proxies (e.g. NSSE, National Survey of Student Engagement), and experimentation with pedagogies and ICTs (Beerkens, 2018). In the latter case, the challenge of bridging the gaps between research data and its application in day-to-day operations, both in administrative and teaching terms, prevails.

Other models include implementation criteria that are transversal to several disciplines and, therefore, consider multiple dimensions involved in learning milestones. Even when these are self-reports, with the limitations inherent to these strategies, the information provided is valuable (Vermunt et al., 2018). In this sense, quantitative or mixed, experimental, or quasi-experimental approaches have limitations for their implementation in higher education institutions. However, there are instruments that can collect relevant information across disciplines and over time (longitudinal studies). These instruments represent an additional workload, so institutional support and alignment are required to balance academic rigor and operational feasibility, as well as the strengths and weaknesses of each instrument (Leiber et al., 2018).

Different academic program evaluation indicators are based on the Context (C), Input (I), Process (P), and Product (P) CIPP evaluation model developed by Stufflebeam and Zhang (2017). The CIPP is a particular, continuous, and cyclical process for identifying, obtaining, and providing useful information for evaluation. The CIPP is a modular approach that enables separate forms of assessment or four stages in a comprehensive assessment. Bezanilla et al. (2019) propose a model that identifies factors that require further development and disaggregates them into dimensions, criteria, and indicators.

Throughout the design and phases of implementation Tec21 Educational Model, is intended to evaluate its effectiveness, first by applying key performance indicators, and then by building new strategies aligned with the characteristics of the model. In 2016, the TecLabs department was created to provide scientific studies, supported by evidence, of the effect of the initiatives, deploying results to responsible operational teams for learning and continuous improvement. Now, at the Institute for the Future of Education, we seek to provide a platform for the deployment of

these studies and to strengthen the impact evaluation strategies integrated into the educational model.

Finally, the attention to society's needs affects the way in which the Tec21 Educational Model, in each of its components, contributes towards achieving the common good, both for the institution's community and other stakeholders. Research, extension, as well as social activities promote justice, equity, diversity, and civic responsibility for regional, national or global socioeconomic development (Larrán Jorge and Andrades Peña, 2017).

This book is an invitation to enrich the frame of reference for the construction of an evaluation system. The purpose is to guide future efforts as broad as the initiatives' possibilities. New indicators promote quality educational research (representative and reliable) and effective feedback to the operational units responsible for the deployment of the educational model. Likewise, it establishes baselines that drive longitudinal studies across different disciplines (in a transversal manner). This frame of reference is not limiting but shares fundamental aspects to consider when researching the model's effectiveness. Generally speaking, a system of evaluation indicators makes it possible:

- to measure the progress and impact of the educational model;
- to describe aspects of the educational model that cannot be directly measured; and
- to make comparisons between different areas of knowledge and at different times.

The system of indicators should therefore include process or enabling indicators that make it possible to identify progress and areas of opportunity in the implementation of each of the model's

components. It should also include indicators that measure the results of the implementation of each component, as well as indicators that measure the impact of the model as a whole. Thus, the system of indicators should provide tools for measuring the effectiveness of the educational model both in terms of the profile of its graduates and their contribution to society, as well as the short-term progress in the implementation of each of the aspects that make up the model.

Everyone involved in the implementation, improvement, and deployment of the Tec21 Educational Model contributes with elements that directly or indirectly transform education, as is the case of Tecnológico de Monterrey. The frame of reference for evaluation is being implemented by experts of the institution to become a valuable tool for academic administration (Spence, 2019).

The educational research, at different scales, could measure the impact of the Tec21 Educational Model. Several topics could be considered as the incorporation of new pedagogical elements, new technologies, and the participation of inspiring teachers from different schools. The invitation remains open for researchers and observers to continue adding evidence of the effect of the Tec21 Educational Model to keep transforming individuals, groups, and organizations.

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