

# Postgraduate Certificate

## Mental Calculation and Problem Solving





## Postgraduate Certificate

### Mental Calculation and Problem Solving

- » Modality: online
- » Duration: 6 weeks
- » Certificate: TECH Global University
- » Credits: 6 ECTS
- » Schedule: at your own pace
- » Exams: online

Website: [www.techtitute.com/us/education/postgraduate-certificate/mental-calculation-problem-solving](http://www.techtitute.com/us/education/postgraduate-certificate/mental-calculation-problem-solving)

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# 01

# Introduction

There are numerous tools for teaching and applying mathematical knowledge. It is true that, for their effective development, the ability in Problem Solving and the acquisition of skills in Mental Calculation are fundamental. Therefore, establishing a participative teaching based on the innovation of strategies is fundamental for the professional who wants to keep up to date. Precisely for this reason, TECH has designed this exclusive university qualification to provide teachers with a key tool in the transformation of the concept of these subjects. To this end, this program has been designed in which, over 150 hours of the most up to date theoretical and practical content, the graduate will delve into the main areas where difficulties occur when performing mental calculations.





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*A fully online program that offers you to delve into models and metamodels for the generation of strategies in Problem Solving”*

The mastery of mathematics is key for human beings in their understanding and adaptation to current life and the environment that surrounds them. With the use of new technologies for teaching, management skills and numerical resources are of special interest, as new options have opened up in the labor market that support this. The demand for professionals with extensive knowledge and proficiency in specific areas such as Problem Solving has increased exponentially. Therefore, in-depth management allows thousands of professionals to access newly created jobs. Technological advances are also reflected in the are also reflected in the classroom, so it is essential for teachers to keep abreast of the latest developments in their sector.

In this way, and with the aim that professionals can be up to date on the keys to teaching Mental Calculus, TECH together with a team versed in this field have designed a program that gathers the most exhaustive information on the subject: the Postgraduate Certificate in Mental Calculus and Problem Solving. Through this exclusive 6-week educational experience, the student will delve into the materials and games to work on mathematics and learn how to face obstacles in Problem Solving.

All this through a 100% online program designed by experts in mathematics that includes, in addition to the most complete and up to date theoretical syllabus, hours of additional content presented in different audiovisual formats to motivate students in their learning. In addition, you will be able to access and download the material to consult it whenever you need it. Thanks to its totally online format, graduates will be able to choose their own study schedule and adapt it to their personal needs.

This **Postgraduate Certificate in Mental Calculation and Problem Solving** contains the most complete and up-to-date educational program on the market. The most important features include:

- ♦ The development of practical cases presented by experts in Arithmetic, Algebra, Geometry and Measurement
- ♦ The graphic, schematic, and practical contents with which they are created, provide practical information on the disciplines that are essential for professional practice
- ♦ Practical exercises where the self-assessment process can be carried out to improve learning
- ♦ Its special emphasis on innovative methodologies
- ♦ Theoretical lessons, questions to the expert, debate forums on controversial topics, and individual reflection assignments
- ♦ Content that is accessible from any fixed or portable device with an Internet connection



*Specialize in the study and scientific foundation of logical principles with this exclusive university qualification”*

“

*You will be able to download all the content to any electronic device from the Virtual Campus and consult it whenever you need it”*

The program's teaching staff includes professionals from the industry who contribute their work experience, to this program, as well as renowned specialists from leading societies and prestigious universities.

The multimedia content, developed with the latest educational technology, will provide the professional with situated and contextual learning, i.e., a simulated environment that will provide immersive education programmed to learn in real situations.

This program is designed around Problem-Based Learning, whereby the professional must try to solve the different professional practice situations that arise during the academic year. For this purpose, the students will be assisted by an innovative interactive video system created by renowned and experienced experts.

*Upgrade your skills in teaching strategies for teaching mathematics and propel your career into a more ambitious professional future.*

*Enroll now and gain access to a multimedia library full of valuable content presented in a variety of different audiovisual formats.*



# 02

# Objectives

The many advances that have been made in the field of education have allowed the development of increasingly effective and personalized pedagogical strategies according to the needs of the students. Therefore, the objective of this program is none other than to make available to the teaching professional the most up to date and comprehensive information related to problem-based learning through the mastery and development of Mental Calculus, allowing you to implement into your practice the most effective teaching tools for teaching in just 6 weeks of 100% online training.





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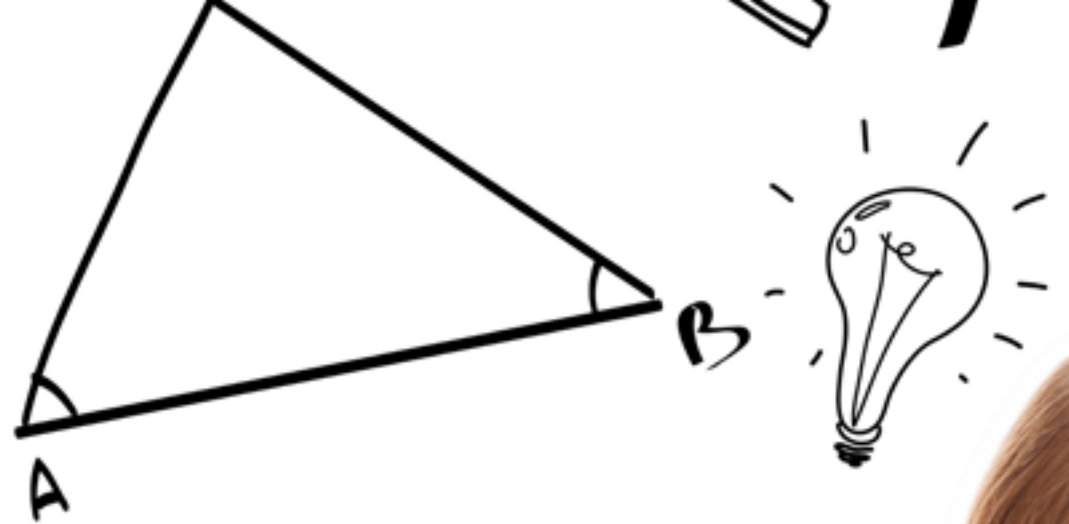
*Master the practical procedures to avoid difficulties and blockages in the resolution of mathematical problems and become an elite teacher”*



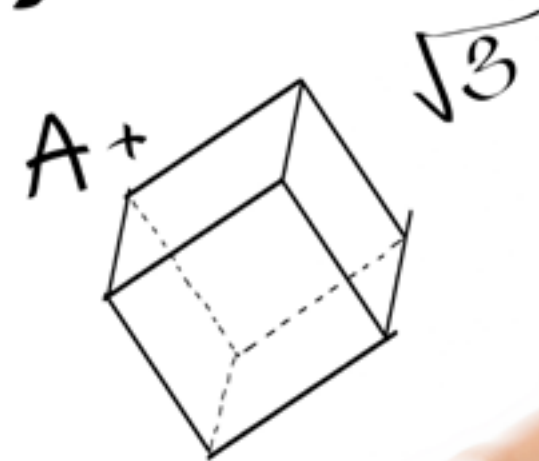
## General Objectives

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- Provide students with theoretical and practical knowledge that will allow them to acquire and develop essential competencies and skills for their role as teachers
- Design didactic games for learning mathematics
- Gamifying the classroom, a new resource for motivation and learning applied to mathematics



$$2+2=4$$





### Specific Objectives

- Know the concept of mental arithmetic and its importance in the teaching of mathematics
- Establish strategies to teach mental arithmetic
- Apply methodologies for problem solving through mental arithmetic

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*Achieve your goals through in-depth mastery of the factors involved in learning Problem Solving”*



# 03

# Course Management

For the structuring of the teaching team that makes up this Postgraduate certificate, TECH has taken into consideration the academic curriculum of the candidates, their professional experience in the field of education and a sample of their work quality through successful projects in which they have participated. Thanks to this, it has been possible to develop a staff of the highest level that will accompany the graduate during the 6 weeks of training and will also be available to answer any questions that may arise during the course of the training.





“

*Become proficient in teaching Mental Calculus and Problem Solving under the guidance of the most renowned experts in the field”*

## Management



### Ms. Delgado Pérez, María José

- ♦ TPR and Mathematics teacher at Peñalar College
- ♦ Secondary and High School Teacher
- ♦ Expert in management of educational centers
- ♦ Co-author of technology books with McGraw Hill Publishers
- ♦ Master's Degree in Educational Center Management and Administration
- ♦ Leadership and management in Elementary, Middle School and High School
- ♦ Graduate in teaching with a specialization in English
- ♦ Industrial Engineer

## Professors

### Ms. Hitos, María

- ♦ Pre-school and Elementary School Education Teacher Specialized in Mathematics
- ♦ Pre-school and Primary Education Teacher
- ♦ Coordinator of the English Department in Pre-school
- ♦ Linguistic Qualification in English for the Community of Madrid

### Ms. Iglesias Serranilla, Elena

- ♦ Teacher of Pre-school and Elementary School Education with specialization in Music
- ♦ Elementary School Education First Cycle Coordinator
- ♦ Training in New Learning Methodologies

### D. López Pajarón, Juan

- ♦ Secondary and High School Science Teacher at the Montesclaros School of the Educare Group
- ♦ Coordinator and Head of Educational Projects in Secondary and High School.
- ♦ Technician at Tragsa
- ♦ Biologist with experience in the field of environmental conservation
- ♦ Master's Degree in Direction and Management of Educational Centers by the University International of La Rioja

**Ms. Soriano de Antonio, Nuria**

- ♦ Philologist Specialist in Spanish Language and Literature
- ♦ Master's Degree in High School Education and Vocational Training from the Alfonso X el Sabio University
- ♦ Master's Degree in Spanish for Foreigners
- ♦ Expert in Educational Center Management and Administration
- ♦ Expert in Didactics of Spanish
- ♦ Degree in Hispanic Philology from the Complutense University of Madrid

**Ms. Vega, Isabel**

- ♦ Specialized Teacher in mathematics didactics and learning disorders
- ♦ Elementary Education Teacher
- ♦ Elementary School Education Cycle Coordinator.
- ♦ Specialized in Special Education and Mathematics teaching
- ♦ Graduate in Teaching

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*Take the opportunity to learn about the latest advances in this field in order to apply it to your daily practice"*

04

# Structure and Content

The teaching team that TECH has selected for this program has worked intensively in the design of the 150 hours of theoretical, practical and additional content included in this Postgraduate Certificate, thanks to which it has been possible to create a rigorous, complete and innovative syllabus. In this way, graduates will have access to a highly training program, which will allow them not only to improve their teaching competences, but also to implement in their pedagogical strategies the keys for the teaching of Mental Calculus.







“

*The most effective and dynamic educational program on the market is at your disposal thanks to this postgraduate certificate”*

## Module 1. Mental Calculation and Problem Solving

- 1.1. Mental Calculation
  - 1.1.1. What is Mental Calculation?
    - 1.1.1.1. Definition
    - 1.1.1.2. Mechanical or Stimulus-Response Calculation
    - 1.1.1.3. Reflective or Thoughtful Calculation
    - 1.1.1.4. Skills
  - 1.1.2. Authors' Contribution
    - 1.1.2.1. María Ortiz
    - 1.1.2.2. Jiménez Ibáñez
    - 1.1.2.3. Hope
    - 1.1.2.4. Dickson
    - 1.1.2.5. Carrol y Porter
    - 1.1.2.6. Alistair McIntosh
  - 1.1.3. Justification
    - 1.1.3.1. MC Classroom Implementation
    - 1.1.3.2. 6 Reasons why Mental Calculation is Important
  - 1.1.4. Mental Calculation in the Basic Curriculum of Primary Education
    - 1.1.4.1. Royal Decree 126/2014
    - 1.1.4.2. Contents
    - 1.1.4.3. Assessment Criteria
    - 1.1.4.4. Assessable Learning Standards
  - 1.1.5. Advantages of Mental Calculation
    - 1.1.5.1. Bernardo Gómez
    - 1.1.5.2. María Ortiz
  - 1.1.6. Disadvantages of Mental Calculation
    - 1.1.6.1. Definition
    - 1.1.6.2. Four Areas of Difficulty
    - 1.1.6.3. Causes
  - 1.1.7. Approximate Calculation
    - 1.1.7.1. Definition
    - 1.1.7.2. Algorithmic Thinking
    - 1.1.7.3. Onset





- 1.1.8. Mental Arithmetic
  - 1.1.8.1. Definition
  - 1.1.8.2. Elementary Forms
  - 1.1.8.3. Levels of Use
- 1.1.9. Keys to Teaching Mental Calculation
  - 1.1.9.1. Uses
  - 1.1.9.2. Strategies
  - 1.1.9.3. Practice
  - 1.1.9.4. Decision
  - 1.1.9.5. Mentality
- 1.2. Teaching Mental Calculation
  - 1.2.1. Contents and Activities for the M.C
    - 1.2.1.1. Basic Concepts of Number and Properties Related to Operations
    - 1.2.1.2. The Tables
    - 1.2.1.3. Strategies
    - 1.2.1.4. Oral Problems
    - 1.2.1.5. Games and Didactic Material
  - 1.2.2. General Didactic Guidelines
    - 1.2.2.1. Strategies to be Proposed
    - 1.2.2.2. Sequencing
    - 1.2.2.3. Level of the Student Body
    - 1.2.2.4. Playful Activity
    - 1.2.2.5. Constancy
    - 1.2.2.6. M.C Programming
  - 1.2.3. Mental Calculation Strategies
    - 1.2.3.1. Definition
    - 1.2.3.2. Simpler Strategies
  - 1.2.4. Strategies for Addition
    - 1.2.4.1. Counting
    - 1.2.4.2. Double
    - 1.2.4.3. Commutative Property
    - 1.2.4.4. Associative Property
    - 1.2.4.5. Decomposition

- 1.2.5. Subtraction Strategies
  - 1.2.5.1. Counting
  - 1.2.5.2. Decomposition
  - 1.2.5.3. Completing Numbers
- 1.2.6. Strategies for Multiplication
  - 1.2.6.1. Sum Reduction
  - 1.2.6.2. Distributive Property
  - 1.2.6.3. Commutative Property
  - 1.2.6.4. Factorization and Association
  - 1.2.6.5. Basic Multiplications
- 1.2.7. Division Strategies
  - 1.2.7.1. Division Test
  - 1.2.7.2. Divide by 2 and 3
  - 1.2.7.3. Basic Divisions
- 1.2.8. Approximation
  - 1.2.8.1. Definition
  - 1.2.8.2. María Ortiz
  - 1.2.8.3. Utility and Advantages
- 1.2.9. Approximate Calculation Strategies
  - 1.2.9.1. Reformulation
  - 1.2.9.2. Translation Processes
  - 1.2.9.3. Compensation Processes
- 1.3. Sequencing and Activities to Work on Mental Calculation
  - 1.3.1. Manipulative Resources
    - 1.3.1.1. What are they?
  - 1.3.2. Design of Activities
    - 1.3.2.1. Infant
  - 1.3.3. Learning Calculation in Relation to Other Areas of Knowledge
    - 1.3.3.1. Tongue
  - 1.3.4. Number Tables
    - 1.3.4.1. What are they?
  - 1.3.5. Numerical Pyramids
    - 1.3.5.1. What are they?
  - 1.3.6. Numerical Triangles
    - 1.3.6.1. What are they?
  - 1.3.7. Magic Squares
    - 1.3.7.1. What are they?
  - 1.3.8. Mathematical Games
    - 1.3.8.1. What are they?
  - 1.3.9. Other Games
    - 1.3.9.1. What are they?
- 1.4. Other Resources for the Development of Mental Calculation
  - 1.4.1. Japanese Abacus
  - 1.4.2. Flash Method
  - 1.4.3. Smartick
  - 1.4.4. Supertic
  - 1.4.5. Geogebra
  - 1.4.6. Mothmatic
  - 1.4.7. Arcademics
  - 1.4.8. Kahn Academy
  - 1.4.9. Gauss Project
- 1.5. Problem-Based Learning
  - 1.5.1. General aspects of the PBL
  - 1.5.2. Features of a PBL
  - 1.5.3. Planning of a PBL
  - 1.5.4. Role of the Teacher
  - 1.5.5. Role of the Students
  - 1.5.6. Design of the PBL
  - 1.5.7. Implementation of the PBL
  - 1.5.8. Evaluation of PBL
  - 1.5.9. Benefits of PBL

- 1.6. Logic
  - 1.6.1. Study and Scientific Basis of Logic Principles
  - 1.6.2. Statements
  - 1.6.3. Conditional Expressions
  - 1.6.4. Explanation, Argumentation and Demonstration
  - 1.6.5. Reasoning: Deduction, Induction and Abduction
  - 1.6.6. Reduction to Absurdity
  - 1.6.7. Logic for Learning, Logic for Teaching
  - 1.6.8. Educational Intervention-Didactic Procedures
  - 1.6.9. Resources for Mathematical Logic
- 1.7. Mathematical Problems
  - 1.7.1. Concept of Problem
  - 1.7.2. Didactic Methodology for Educational Intervention
  - 1.7.3. Variables
  - 1.7.4. Constants
  - 1.7.5. Elaboration of Problems
  - 1.7.6. Interpretation of Problems
  - 1.7.7. Oral Problems
  - 1.7.8. Practical Procedures to Avoid Difficulties and Blockages in Mathematical Problem Solving
  - 1.7.9. Adaptation of the Statements
- 1.8. Metamodels and Models for the Generation of Problem-Solving Strategies
  - 1.8.1. Introduction to Metamodels and Models
  - 1.8.2. What are Metamodels for?
  - 1.8.3. Generative Metamodels
  - 1.8.4. Structuring Metamodels
  - 1.8.5. Link Metamodels
  - 1.8.6. Transformation Metamodels
  - 1.8.7. Composition Metamodels
  - 1.8.8. Interconnection Metamodels
  - 1.8.9. ICT Metamodels
- 1.9. The Mathematical Task in Problem Solving
  - 1.9.1. Mathematical Work
  - 1.9.2. Factors Involved in Problem-Solving Learning
  - 1.9.3. Problem Solving, the First Approach
  - 1.9.4. Resolution Strategies
  - 1.9.5. Problem Solving Phases
  - 1.9.6. Problem Solving Guidelines
  - 1.9.7. Obstacles and Problem-Solving Difficulties
  - 1.9.8. Overcoming Obstacles
  - 1.9.9. Resolution Check
- 1.10. Materials and Games to Work on the Problems
  - 1.10.1. Manipulative Resources
  - 1.10.2. Non-Manipulative Resources
  - 1.10.3. Playful Resources
  - 1.10.4. Design of Activities
  - 1.10.5. Learning Problems in Relation to other Areas of Knowledge
  - 1.10.6. Everyday Problems
  - 1.10.7. Board Games to Work on Problems
  - 1.10.8. Geoplane
  - 1.10.9. Pentominoes



05

# Methodology

This training program offers a different way of learning. Our methodology uses a cyclical learning approach: **Relearning**.

This teaching system is used, for example, in the most prestigious medical schools in the world, and major publications such as the **New England Journal of Medicine** have considered it to be one of the most effective.





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*Discover Relearning, a system that abandons conventional linear learning, to take you through cyclical teaching systems: a way of learning that has proven to be extremely effective, especially in subjects that require memorization"*

## At TECH Education School we use the Case Method

In a given situation, what should a professional do? Throughout the program students will be presented with multiple simulated cases based on real situations, where they will have to investigate, establish hypotheses and, finally, resolve the situation. There is an abundance of scientific evidence on the effectiveness of the method.

*With TECH, educators can experience a learning methodology that is shaking the foundations of traditional universities around the world.*



*It is a technique that develops critical skills and prepares educators to make decisions, defend their arguments, and contrast opinions.*



“

*Did you know that this method was developed in 1912, at Harvard, for law students? The case method consisted of presenting students with real-life, complex situations for them to make decisions and justify their decisions on how to solve them. In 1924, Harvard adopted it as a standard teaching method”*

The effectiveness of the method is justified by four fundamental achievements:

1. Educators who follow this method not only grasp concepts, but also develop their mental capacity, by evaluating real situations and applying their knowledge.
2. The learning process is solidly focused on practical skills that allow educators to better integrate the knowledge into daily practice.
3. Ideas and concepts are understood more efficiently, given that the example situations are based on real-life teaching.
4. Students like to feel that the effort they put into their studies is worthwhile. This then translates into a greater interest in learning and more time dedicated to working on the course.



## Relearning Methodology

At TECH we enhance the case method with the best 100% online teaching methodology available: Relearning.

Our University is the first in the world to combine case studies with a 100% online learning system based on repetition, combining a minimum of 8 different elements in each lesson, which represent a real revolution with respect to simply studying and analyzing cases.



*Educators will learn through real cases and by solving complex situations in simulated learning environments. These simulations are developed using state-of-the-art software to facilitate immersive learning.*

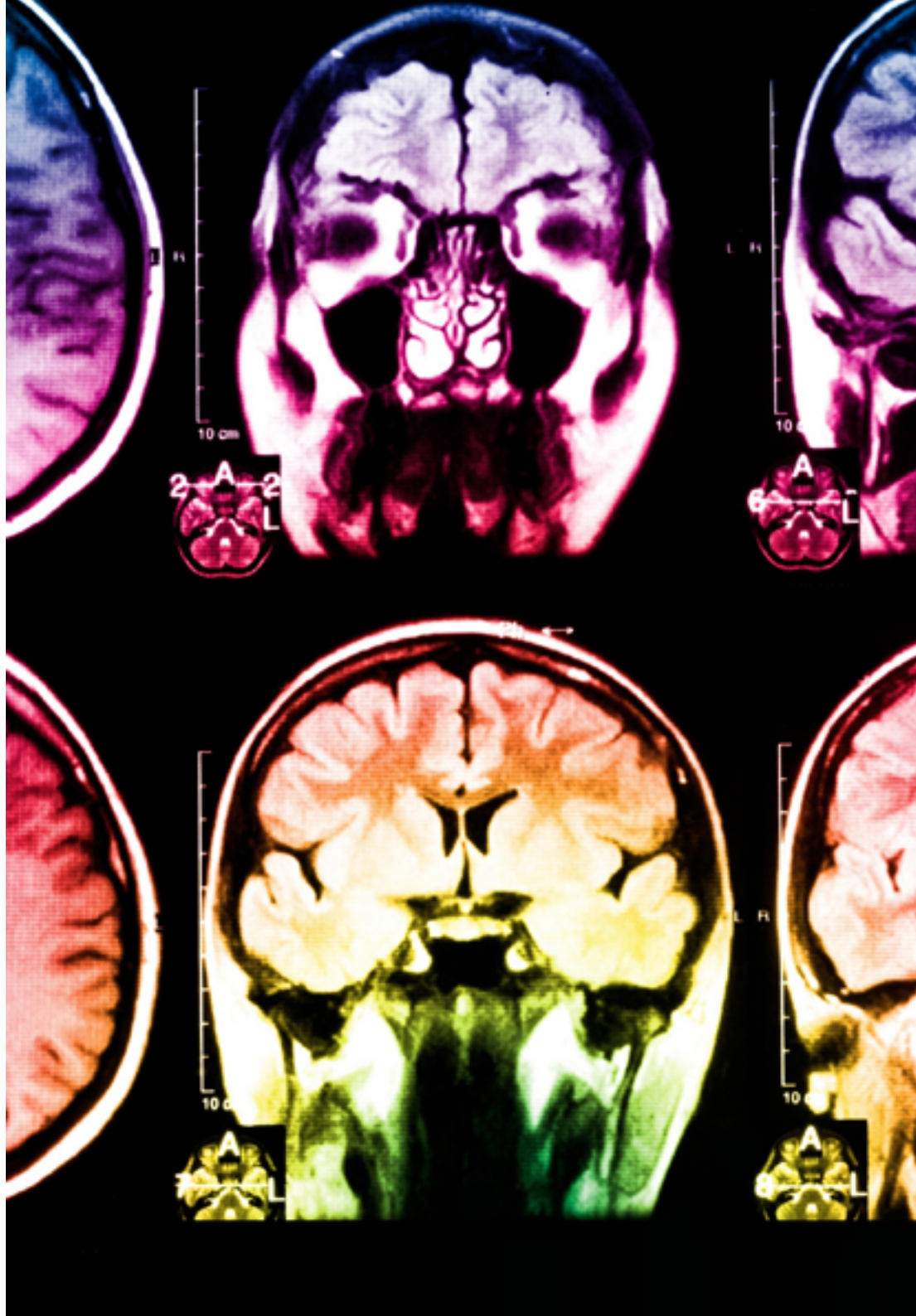
At the forefront of world teaching, the Relearning method has managed to improve the overall satisfaction levels of professionals who complete their studies, with respect to the quality indicators of the best online university (Columbia University).

With this methodology we have trained more than 85,000 educators with unprecedented success in all specialties. All this in a highly demanding environment, where the students have a strong socio-economic profile and an average age of 43.5 years.

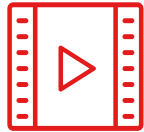
*Relearning will allow you to learn with less effort and better performance, involving you more in your specialization, developing a critical mindset, defending arguments, and contrasting opinions: a direct equation to success.*

In our program, learning is not a linear process, but rather a spiral (learn, unlearn, forget, and re-learn). Therefore, we combine each of these elements concentrically.

The overall score obtained by our learning system is 8.01, according to the highest international standards.



This program offers the best educational material, prepared with professionals in mind:



#### Study Material

All teaching material is produced by the specialist educators who teach the course, specifically for the course, so that the teaching content is really specific and precise.

These contents are then applied to the audiovisual format, to create the TECH online working method. All this, with the latest techniques that offer high quality pieces in each and every one of the materials that are made available to the student.



#### Educational Techniques and Procedures on Video

TECH introduces students to the latest techniques, with the latest educational advances, and to the forefront of Education. All this, first-hand, with the maximum rigor, explained and detailed for your assimilation and understanding. And best of all, you can watch them as many times as you want.



#### Interactive Summaries

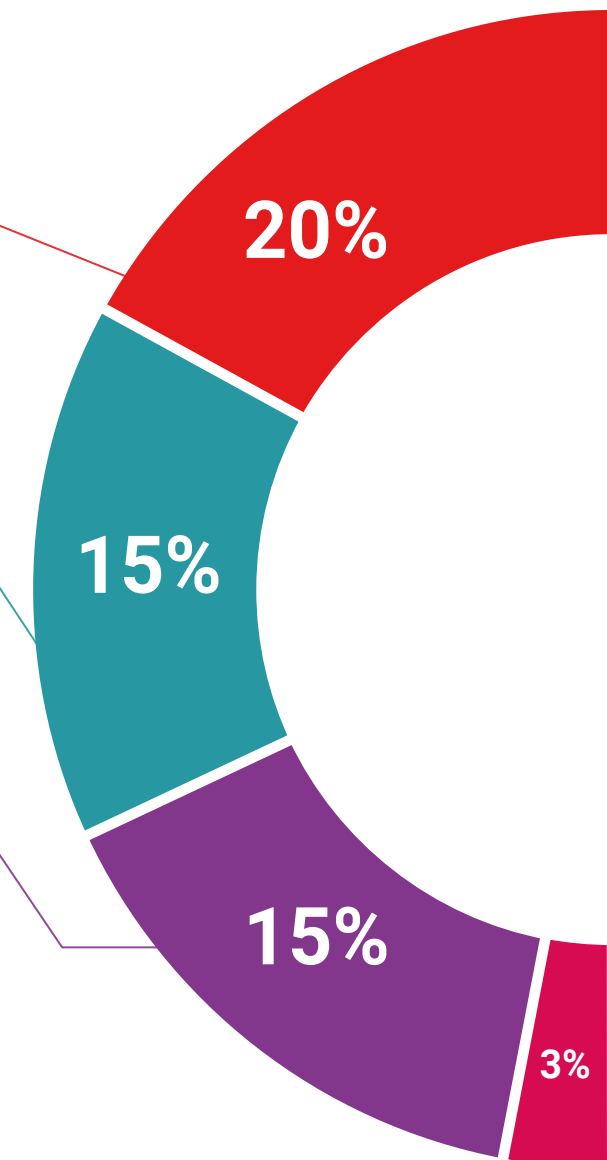
The TECH team presents the contents attractively and dynamically in multimedia lessons that include audio, videos, images, diagrams, and concept maps in order to reinforce knowledge.

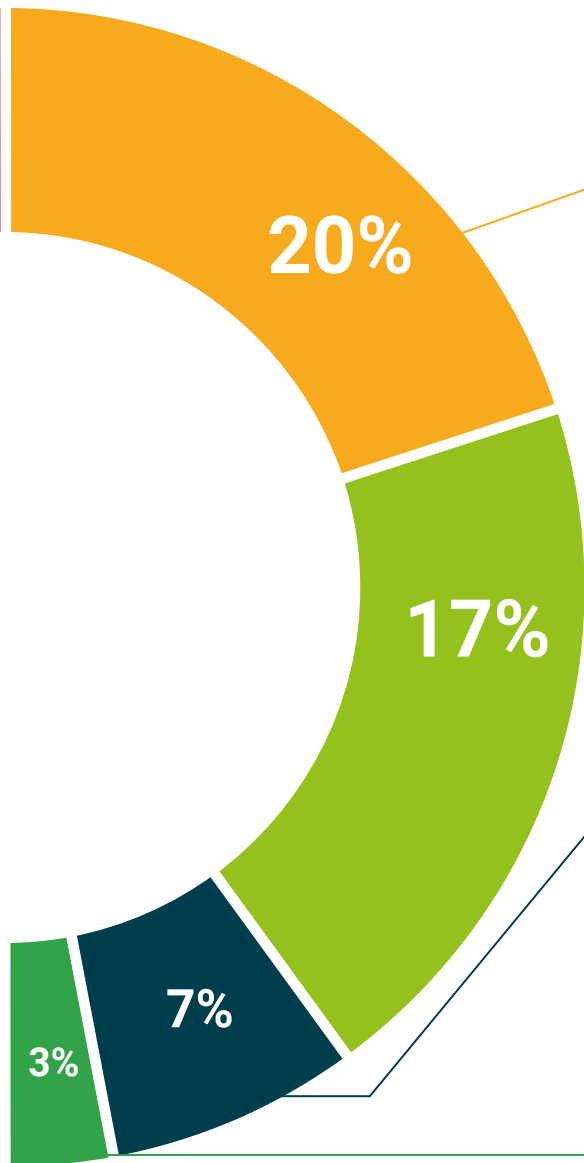
This exclusive multimedia content presentation training Exclusive system was awarded by Microsoft as a "European Success Story".



#### Additional Reading

Recent articles, consensus documents and international guidelines, among others. In TECH's virtual library, students will have access to everything they need to complete their course.





**Expert-Led Case Studies and Case Analysis**

Effective learning ought to be contextual. Therefore, TECH presents real cases in which the expert will guide students, focusing on and solving the different situations: a clear and direct way to achieve the highest degree of understanding.



**Testing & Retesting**

We periodically evaluate and re-evaluate students' knowledge throughout the program, through assessment and self-assessment activities and exercises: so that they can see how they are achieving your goals.



**Classes**

There is scientific evidence suggesting that observing third-party experts can be useful.

Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.



**Quick Action Guides**

TECH offers the most relevant contents of the course in the form of worksheets or quick action guides. A synthetic, practical, and effective way to help students progress in their learning.



06

# Certificate

The Postgraduate Certificate in Mental Calculations and Problem Solving guarantees students, in addition to the most rigorous and up-to-date education, access to a Postgraduate Certificate issued by TECH Global University.



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*Successfully complete this program and receive your university qualification without having to travel or fill out laborious paperwork”*

This program will allow you to obtain your **Postgraduate Certificate in Mental Calculation and Problem Solving** endorsed by **TECH Global University**, the world's largest online university.

**TECH Global University** is an official European University publicly recognized by the Government of Andorra ([official bulletin](#)). Andorra is part of the European Higher Education Area (EHEA) since 2003. The EHEA is an initiative promoted by the European Union that aims to organize the international training framework and harmonize the higher education systems of the member countries of this space. The project promotes common values, the implementation of collaborative tools and strengthening its quality assurance mechanisms to enhance collaboration and mobility among students, researchers and academics.

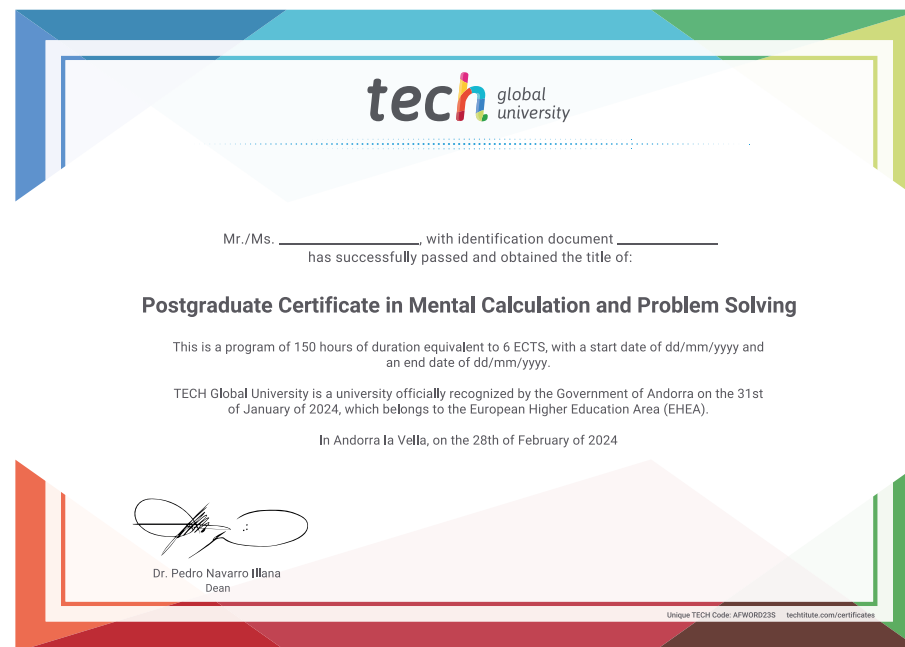
This **TECH Global University** title is a European program of continuing education and professional updating that guarantees the acquisition of competencies in its area of knowledge, providing a high curricular value to the student who completes the program

Title: **Postgraduate Certificate in Mental Calculation and Problem Solving**

Modality: **online**

Duration: **6 weeks**

Accreditation: **6 ECTS**







**Postgraduate Certificate**  
**Mental Calculation and**  
**Problem Solving**

- » Modality: online
- » Duration: 6 weeks
- » Certificate: TECH Global University
- » Credits: 6 ECTS
- » Schedule: at your own pace
- » Exams: online

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