# Postgraduate Diploma

## Problem Solving and Mental Arithmetic in the Early Childhood Classroom

tech global university

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## Problem Solving and Mental Arithmetic in the Early Childhood Classroom

- Modality: **online**
- Duration: **6 weeks**
- Certificate: **TECH Global University**
- Accreditation: **18 ECTS**
- Schedule: **at your own pace**
- Exams: **online**

Website: www.techtitute.com/us/education/postgraduate-diploma/postgraduate-diploma-problem-solving-mental-arithmetic-early-childhood-classroom

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# Introduction

Mathematics is one of the most important subjects in education, since it is the basis for many other subjects (physics, chemistry, technology, etc.) and even forms part of every person's daily life. For this reason, teaching it through problem solving has become a highly effective didactic strategy, since it allows children to develop their logical thinking in this science, but also in daily life. For this reason, TECH has developed a complete program that teachers can implement in their practice, promoting mental arithmetic and problem solving. So, in only 450 hours of 100% online professional development, they will be able to raise the level of their classes to the maximum, contributing to state-of-the-art teaching.

*TECH presents this Postgraduate Diploma as an opportunity to implement the most innovative concepts on Mathematics teaching for problem-solving in the early childhood classroom"*

Solving math problems is very complicated for many children, especially for the youngest ones when they are starting in this science. However, developing their logical thinking through this practice is fundamental because, as many specialists have determined, the use of this pedagogical strategy is highly beneficial to enhance their cognitive skills, because it allows them to face more effectively, not only in the subject but in everyday situations of life, in the family or social environment. For this reason, more and more education professionals wish to implement techniques related to problem solving in their curricula, so that students can understand the meaning of each of the operations, establish inferences and cause-effect relationships.

And so that the graduate can know in detail the best teaching strategies for this, especially applicable to the first levels of education (3 to 6 years), TECH presents this complete Postgraduate Diploma. This is a multidisciplinary academic experience through which the teacher will be able to delve into the teaching of Arithmetic, Algebra, Geometry and measurement, but in a dynamic and innovative way: through games. They will also be able to learn in detail the best techniques to promote Logical-Mathematical Thinking in Early Childhood Education, focusing their quarterly programming on effective problem solving.

To do so, you will have 540 hours of the best theoretical, practical and additional content, which has been compacted in a convenient and flexible 100% online format. Therefore, the graduate will be able to access the Postgraduate Certificate course from anywhere, anytime and from any device with an Internet connection: PC, Tablet or cell phone. Furthermore, they will be able to download all the material for consultation, even when they do not have coverage or when the academic experience has been completed. This way they will not have to worry about schedules or on-site classes when studying for this high-level Postgraduate Diploma that adapts not only to their needs, but also to the demands of the modern educational sector.

This **Postgraduate Diploma in Problem Solving and Mental Arithmetic in the Early Childhood Classroom** contains the most complete and up-to-date educational program on the market. The most important features include:

- The examination of practical cases presented by experts in Mathematics teaching
- The graphic, schematic and practical contents of the book provide technical and practical information on those 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 work
- Content that is accessible from any fixed or portable device with an Internet connection

*You will have 540 hours of the best theoretical, practical and additional content at your disposal to expand each of the sections of the syllabus according to your needs and goals"*

*A Postgraduate Diploma that will convert you into an expert, by building comprehensive knowledge of arithmetic, algebraic, geometric and measurement strategies for children"*

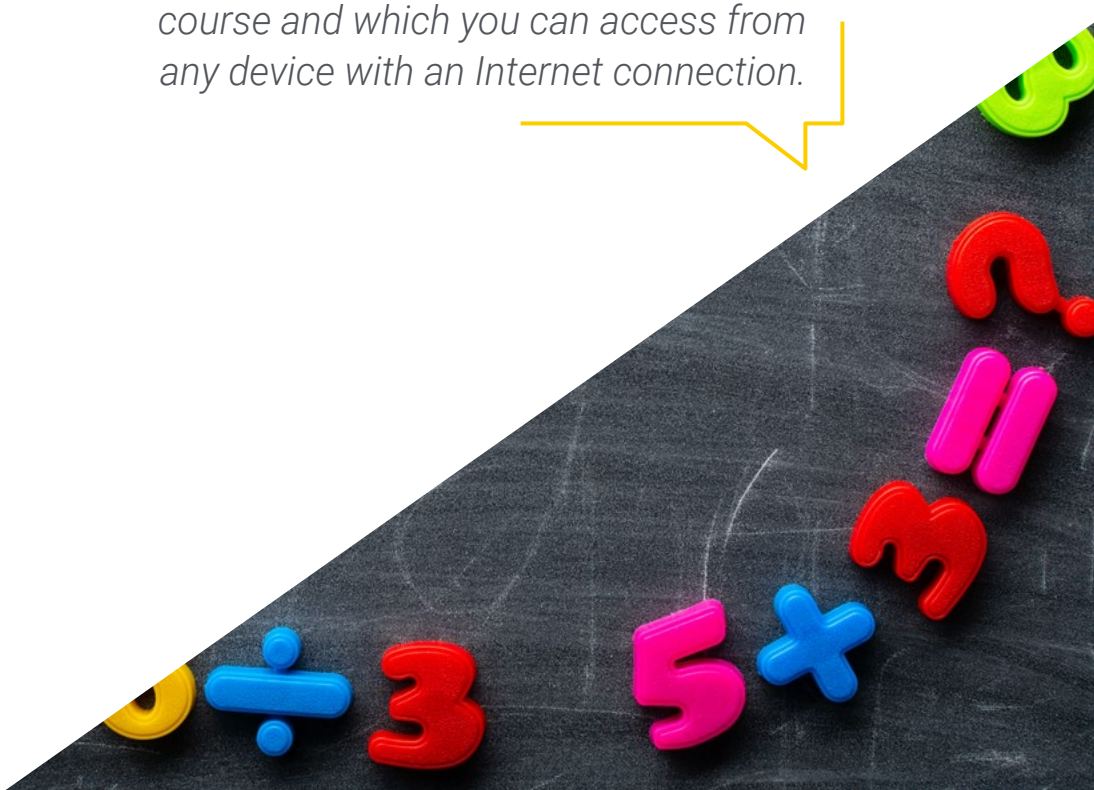
*If you are looking for a program that enhances your skills for the practice of Logical-Mathematical Thinking in Early Childhood, this is the perfect opportunity for you.*

*You will have access to a state-of-the-art Virtual Campus where you will find all the material from the beginning of the course and which you can access from any device with an Internet connection.*

The program's teaching staff includes professionals from the field who contribute their work experience to this educational 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 course. For this purpose, students will be assisted by an innovative interactive video system created by renowned experts in the field of educational coaching with extensive experience.



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# Objectives

Based on the great results obtained by the application of Problem Solving in the field of Early Childhood Education, TECH has considered necessary the development of a program through which teachers can learn in detail and implement to their teaching strategies the most effective pedagogical concepts to enhance this practice. Therefore, the objective of this program is none other than to make available to the graduate the most comprehensive and innovative information related to this area, allowing them to expand their teaching techniques based on the most innovative and dynamic learning plans.

*If you want to get up to date with the psycho-pedagogical foundations that govern the construction of mathematical thinking in the current educational environment, you are in front of the perfect option to achieve it"*

## General Objectives

- Learn mathematical concepts and vocabulary appropriate for a teaching unit
- Work with and learn the cardinal numbers in series, through the manipulation of the appropriate material, to know their composition and decomposition into lower ones
- Appreciate the usefulness of performing mediations to solve small everyday problems and become familiar with units of measurement of space and time

*TECH will provide you with the academic resources you will need to achieve even your most ambitious goals with the course of this comprehensive Postgraduate Diploma"*



## Specific Objectives

### Module 1. Logical-Mathematical Thinking in Pre-School

- Understand the development of Logical-Mathematical Thinking within the study plan of Pre-School and Primary School
- Ensure that the children learn to deduce logically, to argue and to draw conclusions from the situations they are presented with
- Learn to work with different learning techniques

### Module 2. Arithmetic, Algebra, Geometry and Measurement Games with Numbers

- Be able to plan different games and activities
- Participate with pleasure in different types of games and regulate their behavior and excitement to the action
- Help students learn to count, to become familiar with numbers, to distinguish cardinal and ordinal numbers

### Module 3. Problem Solving and Mental Arithmetic

- Recognize situations in their usual environment for which the use of numbers is required
- Ensure that the children learn to deduce logically, to argue and to draw conclusions from the situations they are presented with
- Get the child to read and understand the problem statements

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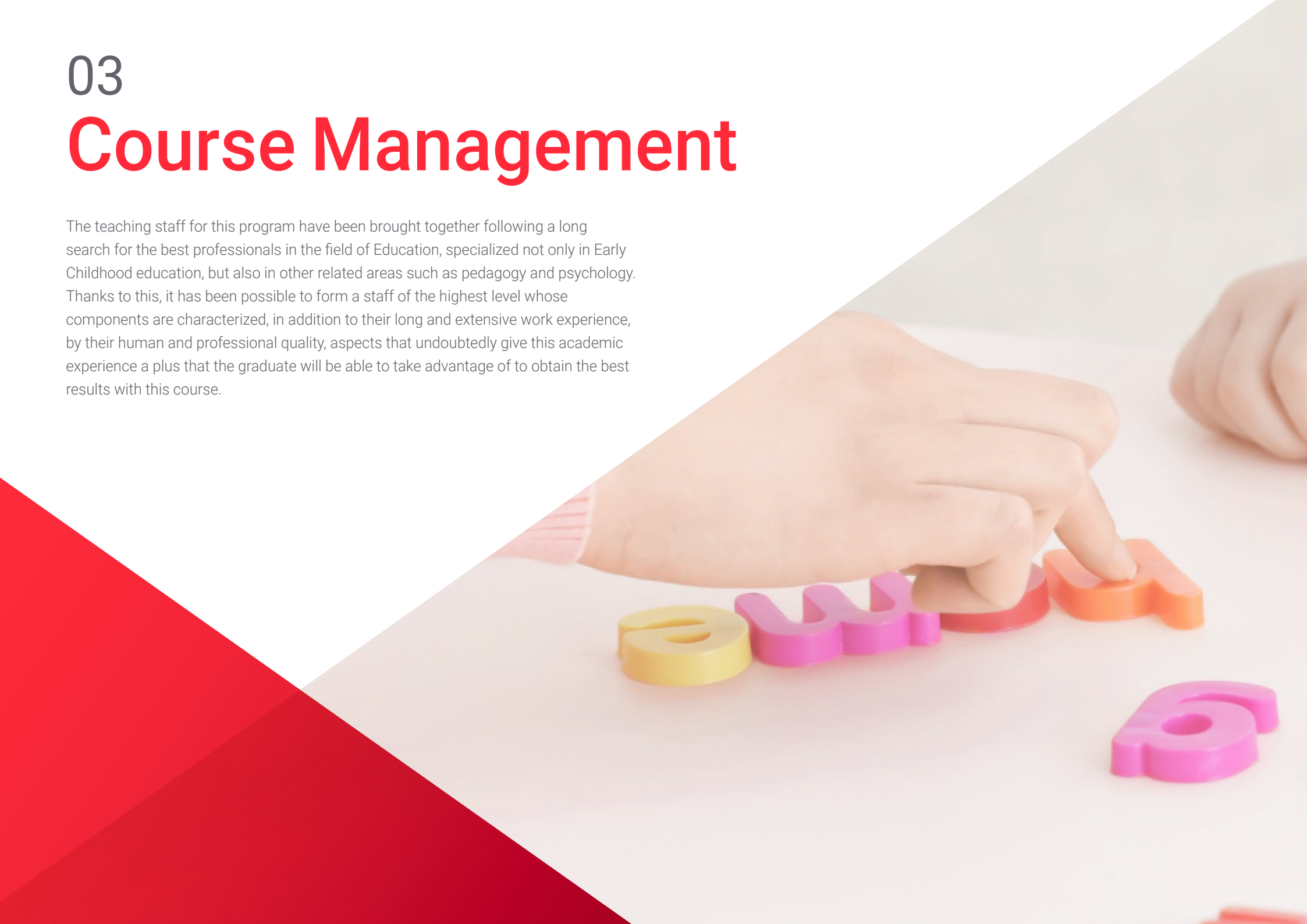
# Course Management

The teaching staff for this program have been brought together following a long search for the best professionals in the field of Education, specialized not only in Early Childhood education, but also in other related areas such as pedagogy and psychology. Thanks to this, it has been possible to form a staff of the highest level whose components are characterized, in addition to their long and extensive work experience, by their human and professional quality, aspects that undoubtedly give this academic experience a plus that the graduate will be able to take advantage of to obtain the best results with this course.



*The teaching team will be at your disposal to answer any questions you may have during the course this Postgraduate Diploma"*

## International Guest Director

Doctor Noah Heller is a leading professional in the field of **Education**, specializing in the teaching of **Mathematics** and **Science**. With a focus on **teaching innovation,** he has dedicated his career to improving **educational practices in the K-12 system**. In addition, his main interests include the **professional development of teachers** and the creation of **teaching strategies** to improve the understanding of **Mathematics**, in **Primary** and **High School** students, through **innovative didactic approaches**.

Throughout his career, he has held positions of great relevance, for example, as **Faculty Chair** of the **Leadership Institute** at the Harvard **Graduate School of Education**. He has also directed the **"Master Math for America" Teacher Fellowship Program**, where he has overseen the instruction and expansion of a program that has impacted over 700 math and **science** teachers in **New York** City, working closely with senior **mathematics and science professionals.**

At the same time, he has collaborated as a researcher in several publications on the **teaching of mathematics** and **new didactics** applied to **primary education**. He has also given conferences and seminars in which he has promoted **pedagogical approaches** that encourage critical thinking in students, making mathematics teaching a dynamic and accessible process.

Internationally, Dr. Noah Heller has been recognized for his ability to implement innovative strategies in **STEM education.** In fact, his leadership in **"Master Math for America"** has positioned him as a key figure in teacher training, receiving accolades for his ability to connect academia with classroom practice. His work has also been instrumental in the creation of one of the most prestigious **professional development programs in education.**

## Dr. Heller, Noah

- Faculty Chair at the Harvard Graduate School of Education, Cambridge, United Kingdom
- Director of the "Master Math for America" Teacher Fellowship Program
- Doctor of Philosophy from New York University
- B.S. in Science, Physics and Mathematics from The Evergreen State College

*Thanks to TECH, you will be able to learn with the best professionals in the world"*

## Management

### Ms. Delgado Pérez, María José

- TPR and Mathematics teacher at Peñalar College
- Professor of Secondary and Baccalaureate Education
- 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

- Early Childhood and Primary School Teacher Specialized in Mathematics
- Pre-school and Primary Education Teacher
- Child English Department Coordinator
- Language qualification in English by the Community of Madrid

### Ms. Iglesias Serranilla, Elena

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

### Mr. López Pajarón, Juan

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

**Ms. Soriano de Antonio, Nuria**

- Language and Literature teacher for Secondary Education and High School at Colegio Montesclaros
- Language and Literature teacher for Secondary Education and High School at Colegio Montesclaros Madrid, Spain
- Spanish Philologist Specializing in Language and Literature

**Ms. Vega, Isabel**

- Specialized Teacher in teaching mathematics and learning disabilities
- Primary Education Teacher
- Primary School Education Cycle Coordinator.
- Specialization in Special Education and Mathematics Didactics
- Graduate in Teaching

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

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# Structure and Content

For the design of the structure and, in general, the content of this program, TECH has taken into consideration the criteria of the teaching team, since, being developed by professionals in the field of Early Childhood Education, they know in detail the aspects that the graduate must master to improve their academic skills. Based on their research work, the 540 hours of theoretical, practical and additional material included in the Postgraduate Diploma have been created, giving the student the opportunity to access it from any device with an Internet connection thanks to its convenient 100% online format.

*Thanks to the dozens of hours of additional material that you will find in the Virtual Campus, you will be able to expand each section in a personalized way according to your interests and requirements"*

## **Module 1.** Logical-Mathematical Thinking in Pre-School

1.1. Logical-Mathematical Thinking
- 1.1.1. What is Mathematical Logic?
- 1.1.2. How is Mathematical Knowledge Acquired?
- 1.1.3. The Formation of Logical-Mathematical Concepts at an Early Age
- 1.1.4. Mathematical Concepts
- 1.1.5. Characteristics of Logical-Mathematical Thinking

1.2. Training Skills Related to Logical-Mathematical Development
- 1.2.1. Cognitive Development (Piaget)
- 1.2.2. Evolutionary Stages
- 1.2.3. Division of Thought in Knowledge (Piaget)
- 1.2.4. Evolution of Logical-Mathematical Knowledge
- 1.2.5. Physical Knowledge vs. Logical-Mathematical Knowledge
- 1.2.6. Knowledge of Space and Time

1.3. Development of Logical-Mathematical Thinking
- 1.3.1. Introduction
- 1.3.2. Knowledge and Reality
- 1.3.3. Development of Mathematical Knowledge
- 1.3.4. Development of Logical Thinking by Age
- 1.3.5. Components of Logical Development
- 1.3.6. Mathematical Language
- 1.3.7. Logical-Mathematical Development and Core Curriculum

1.4. Psychopedagogical Foundations in the Construction of Mathematical Knowledge
- 1.4.1. Sensorimotor Intelligence
- 1.4.2. Formation of Objective Symbolic Thinking
- 1.4.3. Formation of Concrete-Logical Thinking
- 1.4.4. Reasoning and its Types
- 1.4.5. Bloom's Taxonomy in the Development of Logical-Mathematical Thinking

1.5. Logical-Mathematical Learning I
- 1.5.1. Introduction
- 1.5.2. Structuring of the Body Scheme
  - 1.5.2.1. Body Concept
  - 1.5.2.2. Body image
  - 1.5.2.3. Postural Adjustment
  - 1.5.2.4. Coordination

1.6. Notions of Order
- 1.6.1. Comparison
- 1.6.2. Correspondence
- 1.6.3. Quantifiers
- 1.6.4. Quantity Conservation
- 1.6.5. Sets or Groupings
- 1.6.6. Formation of Sets
- 1.6.7. Numerical Cardinality
- 1.6.8. The Number Concept
- 1.6.9. Comparison of Sets
- 1.6.10 Set Equivalence
- 1.6.11 Recognition of Natural Numbers
- 1.6.12 Ordinal Numbers
- 1.6.13 Mathematical Operations: Addition and Subtraction

1.7. Prenumerical Knowledge: Classification
- 1.7.1. What is Classification?
- 1.7.2. Processes
- 1.7.3. Types of Classification
- 1.7.4. Cross Classifications
- 1.7.5. Classification Games

1.8. Seriation Games
- 1.8.1. Importance of Making Series
- 1.8.2. Logical Operations in the Construction of Series
- 1.8.3. Types of Series
- 1.8.4. Seriation in Pre-school Education
- 1.8.5. Seriation Games

1.9. Prenumerical Knowledge: Enumeration
- 1.9.1. Conceptualization and Function of Enumeration
- 1.9.2. Logical Operations Involved in Enumeration
- 1.9.3. Enumeration in Pre-school Education Design of Activities
- 1.9.4. Design of Activities
- 1.9.5. Task-Based Achievements

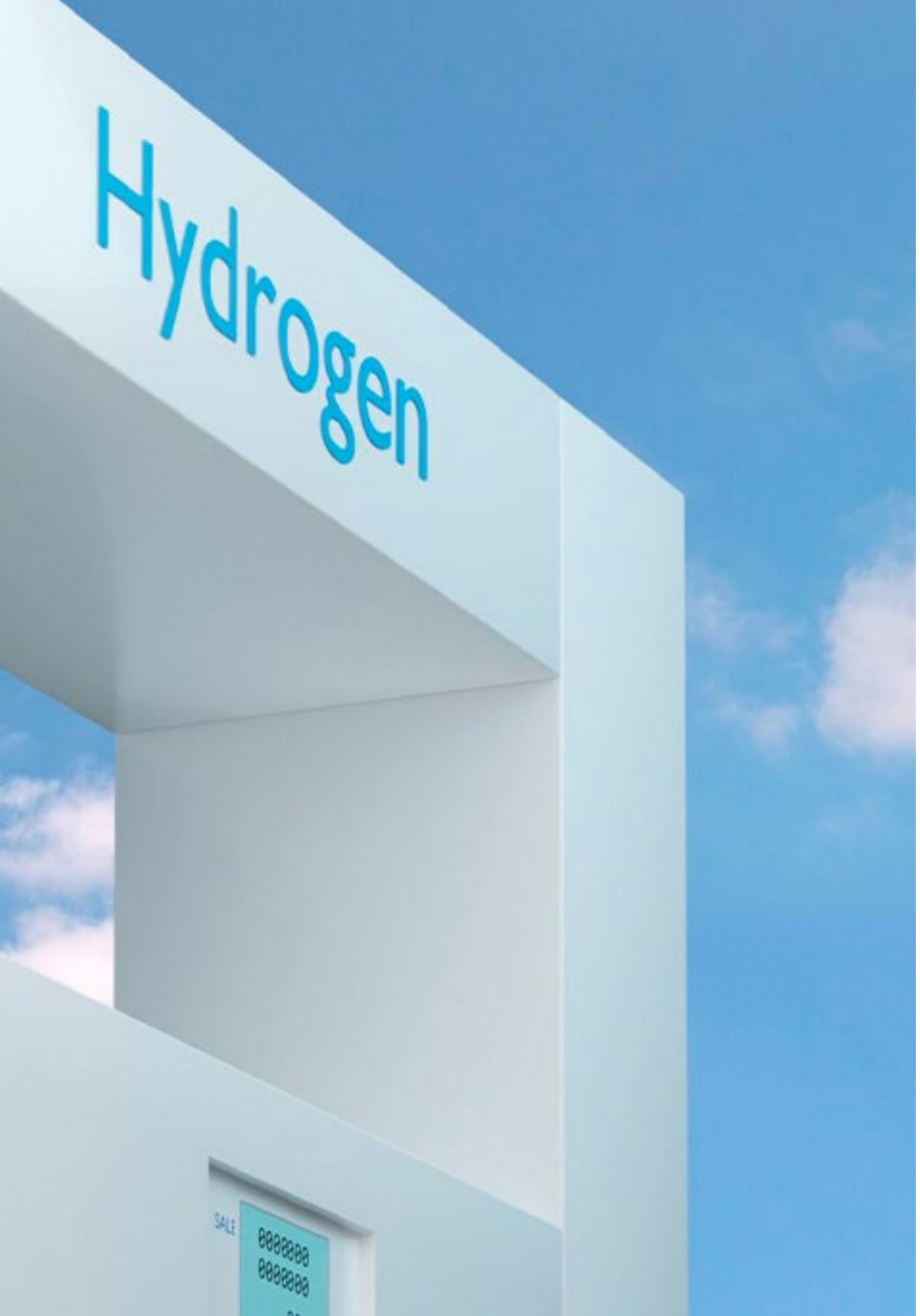
1.10. Representation and Manipulative Mathematics
- 1.10.1. Development of Logical-Mathematical Thinking Through the Senses
- 1.10.2. Representation, Visualization and Reasoning
- 1.10.3. Design of Activities Supported by Representation
- 1.10.4. Manipulative Mathematics: Functions and Resources
- 1.10.5. Design of Activities that Rely on Manipulation

## **Module 2.** Arithmetic, Algebra, Geometry and Measurement Games with Numbers

2.1. Initiation to Number
- 2.1.1. Number Concept
- 2.1.2. Construction of the Number Structure
- 2.1.3. Numerical Development: Counting
  - 2.1.3.1. Phases in Learning the Numerical Sequence
    - 2.1.3.1.1. Rope or String Level
    - 2.1.3.1.2. Unbreakable Chain Level
    - 2.1.3.1.3. Breakable Chain Level
    - 2.1.3.1.4. Numerable Chain Level
    - 2.1.3.1.5. Bidirectional Chain Level
- 2.1.4. Counting Principles
  - 2.1.4.1. One-to-one Correspondence Principle
  - 2.1.4.2. Stable Order Principle
  - 2.1.4.3. Cardinality Principle
  - 2.1.4.4. Abstraction Principle
  - 2.1.4.5. Irrelevance of Order Principle
- 2.1.5. Procedures used by the Child in Counting
  - 2.1.5.1. Term to Term Correspondence
  - 2.1.5.2. Subset to Subset Correspondence
  - 2.1.5.3. Purely Visual Estimation
  - 2.1.5.4. Subitization
  - 2.1.5.5. Count the Elements of a Collection
  - 2.1.5.6. Recount
  - 2.1.5.7. Discount
  - 2.1.5.8. Overcount
  - 2.1.5.9. Calculation Procedures
- 2.1.6. Fundamental Cardinal and Ordinal Situations
- 2.1.7. The Importance of Zero
- 2.1.8. Strategies to Enhance the Concept and Use of Number

2.2. Number Acquisition Process
- 2.2.1. Introduction
- 2.2.2. Number Concept
  - 2.2.2.1. Perception of General Quantities
  - 2.2.2.2. Distinguishing and Comparing Quantities of Objects
  - 2.2.2.3. Uniqueness Principle
  - 2.2.2.4. Generalization
  - 2.2.2.5. Summative Action
  - 2.2.2.6. Capture of Named Quantities
    - 2.2.2.6.1. Oral Numeric Series
    - 2.2.2.6.2. Counting Objects
    - 2.2.2.6.3. Cardinal Representation
    - 2.2.2.6.4. Compare Magnitudes
  - 2.2.2.7. Identification of the Name with its Representation
  - 2.2.2.8. Invariance of Named Quantities

2.2.3. From Experimental Psychology
2.2.3.1. Distance Effect
2.2.3.2. Size Effect
2.2.3.3. Numerical Spatial Arrangement
2.2.4. From Developmental Psychology
2.2.4.1. Behavioral, Cognitive and Constructivist Theory
2.2.4.1.1. Exercise Law
2.2.4.1.2. Law of Effect
2.2.5. Theories on the Process of Number Acquisition
2.2.6. Piaget
2.2.6.1. Stages
2.2.6.2. Requirements for the Understanding of the Notion of Number
2.2.7. Dienes
2.2.7.1. Principles
2.2.7.1.1. Dynamic Principle
2.2.7.1.2. Constructive Principle
2.2.7.1.3. Economic Variability Principle
2.2.7.1.4. Constructive Variability Principle
2.2.7.2. Stages
2.2.7.2.1. Free Play
2.2.7.2.2. Game with Rules
2.2.7.2.3. Isomorphic Games
2.2.7.2.4. Representation
2.2.7.2.5. Description
2.2.7.2.6. Deduction
2.2.8. Mialaret
2.2.8.1. Stages
2.2.8.1.1. Action Itself
2.2.8.1.2. Action Accompanied by Language
2.2.8.1.3. Conduct of the Narrative
2.2.8.1.4. Application of the Story to Real Situations
2.2.8.1.5. Graphical Expression of the Actions already Reported and Represented
2.2.8.1.6. Symbolic Translation of the Studied Problem
2.2.9. Information Processing
2.2.9.1. Numerical Apprehension Model
2.2.9.2. Pre-Linguistic Numerical Skills
2.2.10 Counting Principles (Gelman and Gallistel)
2.2.10.1. Biunivocal Correspondence Principle
2.2.10.2. Stable Order Principle
2.2.10.3. Cardinality Principle
2.2.10.4. Abstraction Principle
2.2.10.5. Inconsequence of Order Principle
2.2.11 Comparison of Counting Principles between Piaget's, Gelman's and Gallistel's Theory
2.3. Informal Arithmetic I
2.3.1. Introduction
2.3.2. Towards an Informal and Intuitive Arithmetic in Pre-School Education
2.3.2.1. Recognize Quantities
2.3.2.2. Relate Quantities
2.3.2.3. Operate Quantities
2.3.3. Objectives
2.3.4. Early Arithmetic Skills
2.3.4.1. Preservation of Inequality
2.3.5. Arithmetic Skills and Chants
2.3.5.1. Preliminary Considerations
2.3.5.1.1. Socio-Cognitive Conflict
2.3.5.1.2. Role of the Language
2.3.5.1.3. Creation of Contexts
2.3.5.2. Procedures and Mastery of the Chants






2.4. Informal Arithmetic II
- 2.4.1. Memorization of Numerical Facts
  - 2.4.1.1. Activities to Work on Memorization
  - 2.4.1.2. Domino
  - 2.4.1.3. Hopscotch
- 2.4.2. Didactic Situations for the Introduction of Addition
  - 2.4.2.1. Dialed Number Game
  - 2.4.2.2. Race to 10
  - 2.4.2.3. Christmas Greeting

2.5. Basic Arithmetic Operations
- 2.5.1. Introduction
- 2.5.2. Additive Structure
  - 2.5.2.1. Phases of Mialaret
    - 2.5.2.1.1. Approach Through Manipulation
    - 2.5.2.1.2. Action Accompanied by Language
    - 2.5.2.1.3. Mental Work Supported by Verbalization
    - 2.5.2.1.4. Purely Mental Work
  - 2.5.2.2. Strategies to Add
  - 2.5.2.3. Initiation to Subtraction
  - 2.5.2.4. Addition and Subtraction
    - 2.5.2.4.1. Direct and Object Modeling
    - 2.5.2.4.2. Counting Sequences
    - 2.5.2.4.3. Recalled Numeric Data
    - 2.5.2.4.4. Strategies to Add
    - 2.5.2.4.5. Subtraction Strategies
- 2.5.3. Multiplication and Division
- 2.5.4. Arithmetic Problem Solving
  - 2.5.4.1. Addition and Subtraction
  - 2.5.4.2. Multiplications and Divisions

2.6. Space and Geometry in Pre-school Education
- 2.6.1. Introduction
- 2.6.2. Objectives Proposed by the NCTM
- 2.6.3. Psychopedagogical Considerations
- 2.6.4. Recommendations for Teaching Geometry
- 2.6.5. Piaget and his Contribution to Geometry
- 2.6.6. Van Hiele Model
  - 2.6.6.1. Levels
    - 2.6.6.1.1. Visualization or Recognition
    - 2.6.6.1.2. Analysis
    - 2.6.6.1.3. Sorting and Classification
    - 2.6.6.1.4. Rigor
  - 2.6.6.2. Learning Phases
    - 2.6.6.2.1. Phase 1: Consultancy
    - 2.6.6.2.2. Phase 2: Directed Guidance
    - 2.6.6.2.3. Phase 3: Explication
    - 2.6.6.2.4. Phase 4: Guidance
    - 2.6.6.2.5. Phase 5: Integration
- 2.6.7. Geometry Types
  - 2.6.7.1. Topological
  - 2.6.7.2. Projective
  - 2.6.7.3. Metrics
- 2.6.8. Visualization and Reasoning
  - 2.6.8.1. Spatial Orientation
  - 2.6.8.2. Spatial Structuring
  - 2.6.8.3. Gálvez y Brousseau
    - 2.6.8.3.1. Microspace
    - 2.6.8.3.2. Mesospace
    - 2.6.8.3.3. Macrospace

2.7. Magnitudes and their Measurement
- 2.7.1. Introduction
- 2.7.2. Construction of the Notion of Magnitude in the Child
  - 2.7.2.1. Piagetian Phases in the Construction of Magnitudes
    - 2.7.2.1.1. Consideration and Perception of a Magnitude
    - 2.7.2.1.2. Conservation of Magnitude
    - 2.7.2.1.3. Ordering with Respect to Magnitude
    - 2.7.2.1.4. Correspondence of Numbers to Quantities of Magnitude
  - 2.7.2.2. Stages in the Construction of the Measure
    - 2.7.2.2.1. Direct Perceptual Comparison
    - 2.7.2.2.2. Displacement of Objects
    - 2.7.2.2.3. Operability of the Transitive Property
  - 2.7.2.3. Stages in the Teaching-Learning of Magnitudes
    - 2.7.2.3.1. Sensory Stimulation
    - 2.7.2.3.2. Direct Comparison
    - 2.7.2.3.3. Indirect Comparison
    - 2.7.2.3.4. Choice of Unit
    - 2.7.2.3.5. Irregular Measurement System
    - 2.7.2.3.6. Regular Measurement System
- 2.7.3. Measuring Magnitudes
- 2.7.4. Length Measurement
- 2.7.5. Length Measurement
- 2.7.6. Measurement of Capacity and Volume
- 2.7.7. Measurement of Time
- 2.7.8. Phases of the Different Magnitudes
  - 2.7.8.1. Preparation Phase
  - 2.7.8.2. Measurement Practice Phase
  - 2.7.8.3. Consolidation Phase of Techniques and Concepts

2.8. Play in Pre-school Education
- 2.8.1. Introduction
- 2.8.2. Objectives
- 2.8.3. Playing Features
- 2.8.4. Evolution of the Game
  - 2.8.4.1. Types of Games
    - 2.8.4.1.1. Functional Game
    - 2.8.4.1.2. Imitation or Symbolic Play
    - 2.8.4.1.3. Game with Rules
    - 2.8.4.1.4. Construction Game
- 2.8.5. Chance and Strategy
- 2.8.6. Competition in the Games
- 2.8.7. Didactic Considerations on the Game

2.9. Didactic Resources of the Game
- 2.9.1. Games and Logical Thinking
  - 2.9.1.1. Three in a Row
  - 2.9.1.2. Quarto
  - 2.9.1.3. Portrait Games
- 2.9.2. Quantitative Games
  - 2.9.2.1. Number to Compare
    - 2.9.2.1.1. Home!
  - 2.9.2.2. Number to Calculate
    - 2.9.2.2.1. Couples
    - 2.9.2.2.2. No more!
    - 2.9.2.2.3. Cat and Mouse
- 2.9.3. Games and the Structure of Space
  - 2.9.3.1. Puzzles
    - 2.9.3.1.1. Two-Color Paintings
    - 2.9.3.1.2. The Hex

2.10. Games in Different Spaces
- 2.10.1. Introduction
- 2.10.2. Games in the Classroom
  - 2.10.2.1. The Butterfly Game
  - 2.10.2.2. The Partitioning Game
  - 2.10.2.3. Image Trains
  - 2.10.2.4. The Newspaper
  - 2.10.2.5. Flat Figures
  - 2.10.2.6. The Containers
- 2.10.3. Games in Psychomotor Skills
  - 2.10.3.1. Working with Sizes
  - 2.10.3.2. Classify
  - 2.10.3.3. We Play with the Hoops
- 2.10.4. Outdoor Games
- 2.10.5. Mathematical Games with ICT
  - 2.10.5.1. Playing with the Turtle's Mind
  - 2.10.5.2. Geometric Figures
  - 2.10.5.3. For 3-Year-Old Students
  - 2.10.5.4. Variety of Activities
  - 2.10.5.5. Didactic Unit

## **Module 3.** Problem Solving and Mental Arithmetic

3.1. Problem in Pre-School Education
- 3.1.1. Methodological Considerations
- 3.1.2. Psychopedagogical Considerations of the Initiation of Problem Idea Representation
- 3.1.3. What is a Problem?
- 3.1.4. How to Pose Problems in Pre-School?

3.2. Idea of a Problem to be Introduced in Pre-School Education
- 3.2.1. Why do We Solve Problems?
- 3.2.2. Perspectives for the Inclusion of Comprehension and Problem Solving in Pre-school Education
- 3.2.3. Specific Didactic Contract for Problem Solving in Pre-School Education
- 3.2.4. Most Appropriate Models for Introducing the idea of Problem in Pre-School Education
- 3.2.5. Reading and Understanding Statements
  - 3.2.5.1. Factors of Understanding Statements
- 3.2.6. Didactic Variables of the Statements

3.3. Towards a Didactic Approach to the Introduction to the idea of Problem in Pre-School Education
- 3.3.1. Factors to be Taken into Consideration in the Approach and Resolution of Problems in Pre-School
- 3.3.2. Learning Logical-Mathematical Concepts Through Problem Solving
  - 3.3.2.1. Heuristic Strategies
  - 3.3.2.2. Technique Most Commonly Used at These Ages for Problem Solving
  - 3.3.2.3. Numerical Strategies
- 3.3.3. Various Situations for the Teaching of Proposition and Problem Solving
- 3.3.4. Problem Solving Constituent Elements of a Problem
  - 3.3.4.1. Problems that Serve as Exercises to Practice the Problem Idea
- 3.3.5. Main Recommendations for Approaching the Problem Idea in Pre-school Education

3.4. Mathematical Value of Stories
- 3.4.1. Pre-school Learning and Mathematics
- 3.4.2. Stories and Mathematics
- 3.4.3. Examples of Stories and Mathematical Learning
  - 3.4.3.1. Logical Development
  - 3.4.3.2. Numerical Development
  - 3.4.3.3. Development of Magnitudes and their Measurement
  - 3.4.3.4. Development of Geometric Thinking
  - 3.4.3.5. Problem Solving

3.5. Logical Basis of Mental Arithmetic in Pre-school Education
- 3.5.1. Logical Operations
  - 3.5.1.1. Classifications
  - 3.5.1.2. Relationships of Order
- 3.5.2. Mental Arithmetic, Written Arithmetic and Estimated Arithmetic
- 3.5.3. Counting Process
- 3.5.4. Phases for Learning the Counting Activity

3.6. Informal Arithmetic
- 3.6.1. Arithmetic Strategy
- 3.6.2. Comparison and Equivalence
- 3.6.3. Composition and Decomposition
- 3.6.4. Initiation to Operational Activity: Adding, Subtracting, Folding and Distributing

3.7. Mental Arithmetic in Pre-school Education
- 3.7.1. Calculation Examples for Pre-school Education
- 3.7.2. Perform Calculation by Manipulating Material
- 3.7.3. Calculation Without Material Handling
- 3.7.4. Proposal for Mental Arithmetic in Pre-School Education
  - 3.7.4.1. Guessing Game
  - 3.7.4.2. It Is Learned by Heart
- 3.7.5. Mechanics Acquired at the End of Pre-School Education
- 3.7.6. Resources to Achieve Apprenticeships
- 3.7.7. Practical Issues

3.8. Resource Bank for Calculation in Pre-School Education
- 3.8.1. Abacus
  - 3.8.1.1. Description
  - 3.8.1.2. Possibilities for Didactic Use
  - 3.8.1.3. Classroom Didactic Situations
- 3.8.2. Multibase Blocks
  - 3.8.2.1. Description
  - 3.8.2.2. Possibilities for Didactic Use
  - 3.8.2.3. Classroom Didactic Situations
- 3.8.3. Cuisenaire Strips
  - 3.8.3.1. Description
  - 3.8.3.2. Possibilities for Didactic Use
  - 3.8.3.3. Classroom Didactic Situations
- 3.8.4. Domino
  - 3.8.4.1. Description
  - 3.8.4.2. Possibilities for Didactic Use
  - 3.8.4.3. Classroom Didactic Situations
- 3.8.5. Battle Game
  - 3.8.5.1. Description
  - 3.8.5.2. Possibilities for Didactic Use
  - 3.8.5.3. Classroom Didactic Situations

3.9. Open Calculation Method based on ABN Numbers
- 3.9.1. What is the ABN Algorithm Method?
  - 3.9.1.1. Quantity and Cardinality of Sets
  - 3.9.1.2. Number Structure and Set Comparison
    - 3.9.1.2.1. Figurative Representation
    - 3.9.1.2.2. Symbolic Representation
    - 3.9.1.2.3. Symbol-Sign Representation
    - 3.9.1.2.4. Representation by Signs
  - 3.9.1.3. Counting Well Over Ten
  - 3.9.1.4. Number Transformations First Operations
- 3.9.2. Background of the ABN Method
- 3.9.3. Intuitive Approach vs. Traditional Approach

3.10. ABN Method Activities Proposal
- 3.10.1. Block 1: Numerical and Cardinal
  - 3.10.1.1. Search for Equivalent Sets
  - 3.10.1.2. Establishment of a Physical Pattern
  - 3.10.1.3. Pattern Sorting
  - 3.10.1.4. Numeric String Start of Counting
  - 3.10.1.5. Subitization
  - 3.10.1.6. Estimate
- 3.10.2. Block 2: Number Structure and Comparison
  - 3.10.2.1. Introduction to the Ten
  - 3.10.2.2. Ordering, but not Counting
  - 3.10.2.3. Arrangement of Disordered Sets
  - 3.10.2.4. Interaction of Missing Elements
  - 3.10.2.5. Arrangement with Non-Manipulable Material
  - 3.10.2.6. Comparison of Real Objects
  - 3.10.2.7. Comparison of Figurative Elements
- 3.10.3. Block 3: Number Transformations
  - 3.10.3.1. Number Transformations
  - 3.10.3.2. Addition with the Number Line
  - 3.10.3.3. Subtraction with Toothpicks
  - 3.10.3.4. Finding the Double with Grid
  - 3.10.3.5. Finding Half with the Number Line
- 3.10.4. Assessment

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.

*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:**

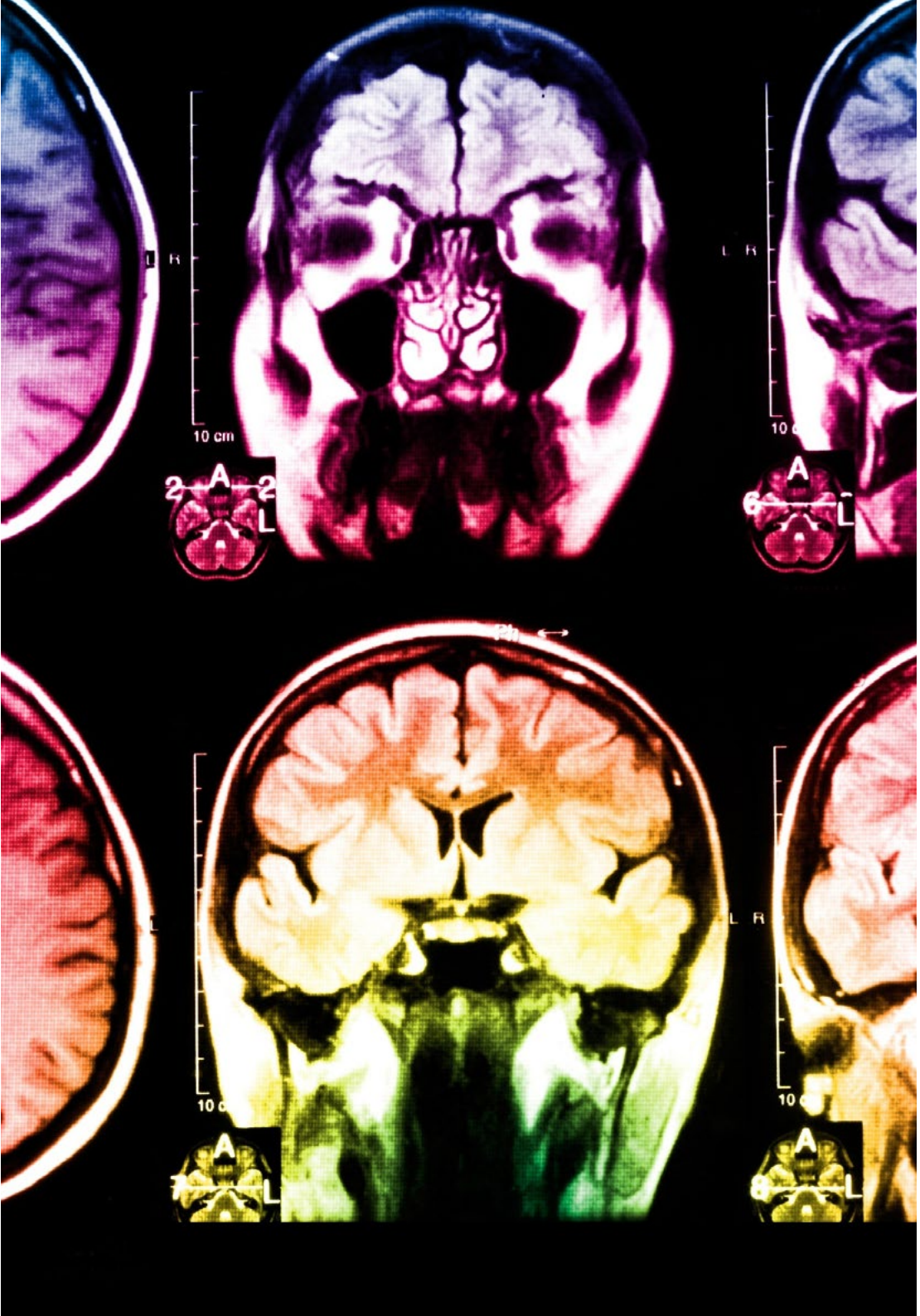
1. Educators who follow this method not only grasp concepts, but also develop their mental capacity, by evaluating real situations and applying their knowledge.
2. The learning process is solidly focused on practical skills that allow educators to better integrate the knowledge into daily practice.
3. 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.

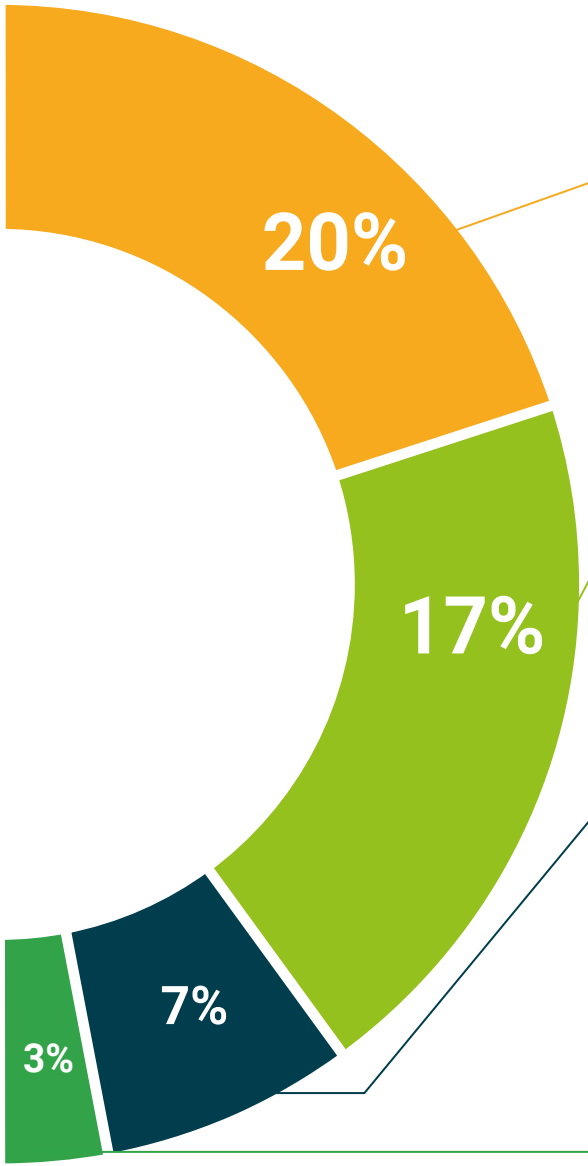
### Interactive Summaries

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 Diploma in Problem Solving and Mental Arithmetic in the Early Childhood Classroom guarantees students, as well as the most rigorous and up-to-date education, access to a Postgraduate Diploma endorsed by TECH Global University.

*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 the title of **Postgraduate Diploma in Problem Solving and Mental Arithmetic in the Early Childhood Classroom** endorsed by **TECH Global University**, the largest digital university in the world.

**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.

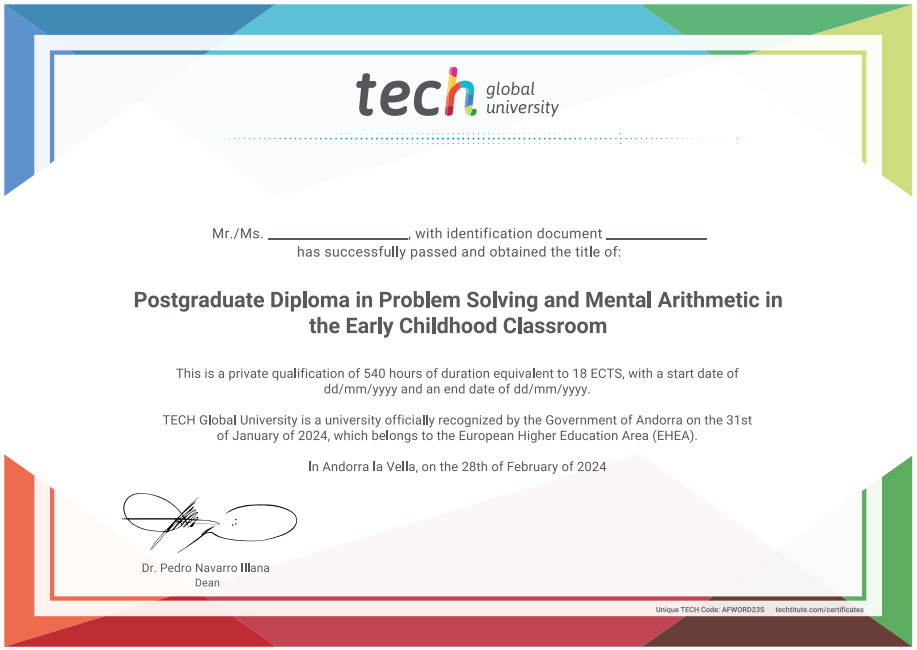
This **TECH Global University** private qualification, is a European program of continuing education and professional updating that guarantees the acquisition of competencies in its area of knowledge, providing a high curricular value to the student who completes the program.

Title: **Postgraduate Diploma in Problem Solving and Mental Arithmetic in the Early Childhood Classroom**

Modality: **online**

Duration: **6 months**

Accreditation: **18 ECTS**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Mr./Ms. _____, with identification document _____
has successfully passed and obtained the title of:

**Postgraduate Diploma in Problem Solving and Mental Arithmetic in the Early Childhood Classroom**

This is a private qualification of 540 hours of duration equivalent to 18 ECTS, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

TECH Global University is a university officially recognized by the Government of Andorra on the 31st of January of 2024, which belongs to the European Higher Education Area (EHEA).

In Andorra la Vella, on the 28th of February of 2024

Dr. Pedro Navarro Illana
Dean

Unique TECH Code: AFWORD23S techtitute.com/certificates

*Apostille Convention. In the event that the student wishes to have their paper diploma issued with an apostille, TECH Global University will make the necessary arrangements to obtain it, at an additional cost.

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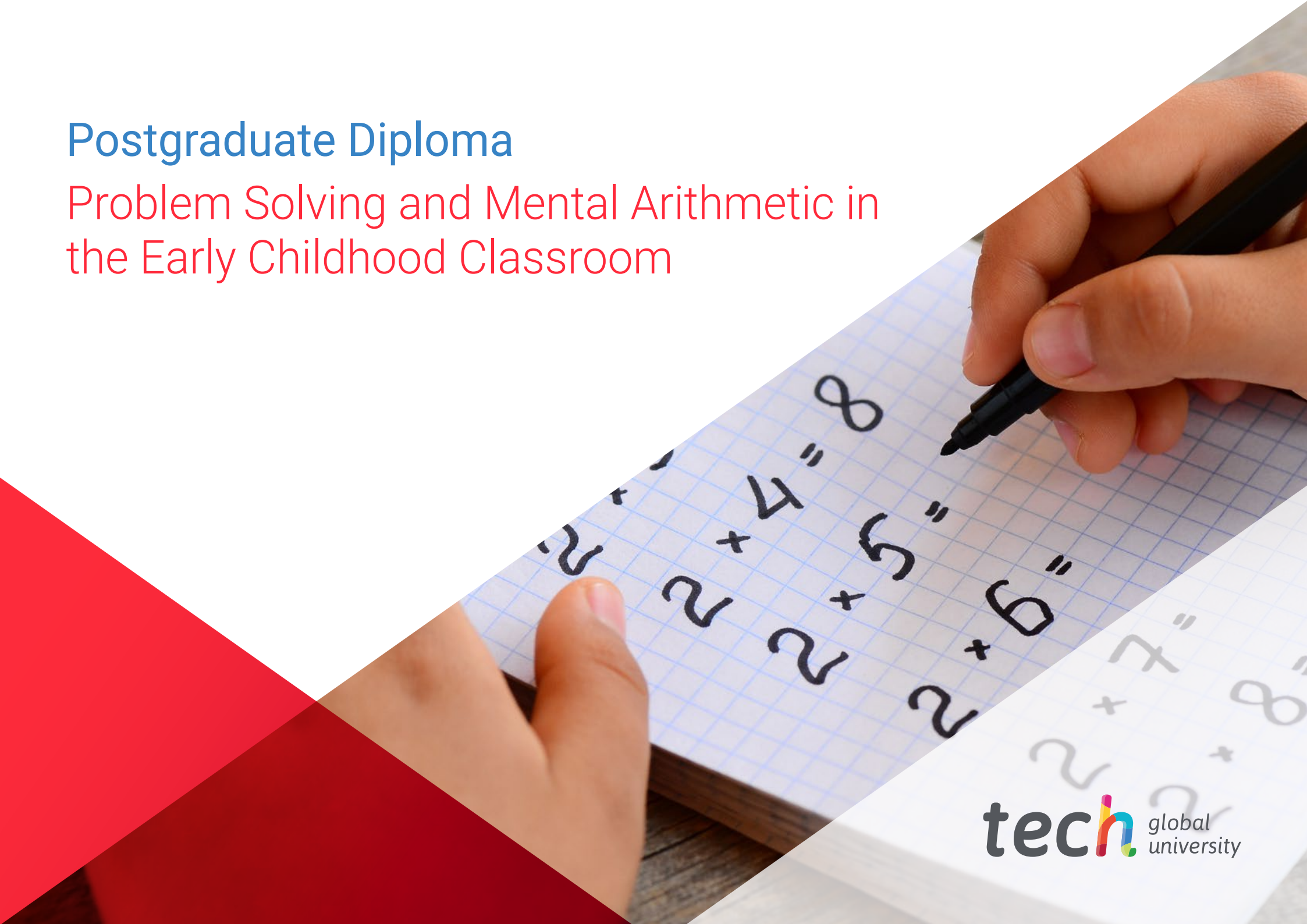
# Postgraduate Diploma

## Problem Solving and Mental Arithmetic in the Early Childhood Classroom

- Modality: **online**
- Duration: **6 weeks**
- Certificate: **TECH Global University**
- Accreditation: **18 ECTS**
- Schedule: **at your own pace**
- Exams: **online**

# Postgraduate Diploma

## Problem Solving and Mental Arithmetic in the Early Childhood Classroom



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