TEACHING GUIDE
Didactics of Mathematics in Primary Education: Numbers and Operations

COURSE OUTLINE	
Name of the subject: Didactics of Mathematics in Primary Education: Numbers and Operations	
Module: Teaching and learning mathematics	
Code number: 202110211	**Curriculum year:** 2010
Type: Compulsory	**Academic course:** 2021-22
ECTS Credits: 6 **Course:** 2nd	**Semester:** 2nd
Language of clases: English	

TEACHING STAFF INFORMATION				
Coordinator: Lorenzo Castilla Mora				
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Knowledge area: Didactics of Mathematics				
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Office hours first semester: To be decided				
Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
Office hours second semester: To be decided				
Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**

CLASSES HOURS				
Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
			15:30-17:30	
17:45-19:45				

SUBJECT DESCRIPTION
PRE-REQUISITES AND RECOMENDATIONS:
None

BASIC COMPETENCES

CB1. Demonstrate to understand and have acquired knowledge about an area of study that starts from basic Secondary Education, and is often at supported by advanced textbooks, but also includes some aspects that involve knowledge related to the forefront of their field of study.

CB2. Know how to apply their knowledge to their work or vocation in a professional way. They should also possess the skills that are usually demonstrated through the elaboration and defence of arguments and in problem solving within their area of study.

CB3. Gather and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant social, scientific or ethical issues.

CB4. Be able to convey information, ideas, problems and solutions to both specialised and non-specialised audiences.

CB5. Develop the learning skills required to undertake further studies with a high degree of autonomy.

TRANSVERSAL COMPETENCES

TC1. Be completely fluent in English, mastering the different styles and the specific languages required to develop and communicate the acquired knowledge in the scientific and academic environment.

TC2. Develop a critical attitude, being able to analyse and synthesize.

TC3. Develop an attitude of inquiry that permanently enables to review and deepen in the knowledge.

TC4. Acquire Computer and Information Skills (CI2) and apply them working.

TC5. Master strategies for active job search and entrepreneurship.

TC6. To promote, respect and safeguard human rights, democratic values, social equality and environmental sustainability, without discrimination on the basis of birth, race, sex, religion, opinion or other personal or social circumstances.

Specific competences

S.4. Identifying learning difficulties and negotiating strategies to overcome them.

S.5. Awareness of current developments in learning competences.

S.13. Promoting cooperation and individual work and effort.

S.16. Designing, planning and evaluating teaching and learning.

S.19. Awareness and application of research methodology in education; designing projects for innovation, and designing indicators for evaluation.

S.30. Development and evaluation of curricular elements, using appropriate resources and encouraging the acquisition of basic competences in the

students.

S.37. Acquisition of basic mathematical competences (numerical, calculus, geometric, spatial representation, estimate and measure, organising and interpreting data etc.).

S.38. Awareness of mathematics curriculum. Analysing, explaining and communicating mathematical items.

S.39. Recognition of the central role played by mathematics in scientific thinking. S.49. Designing problems relating to everyday experience, and finding solutions.

LEARNING OUTCOMES:

O1. To develop understanding of the basic principles of school numbers and operations and the associations between different numerical items on the syllabus.

O2. To be able to expound on and provide solutions to geometry problems in various situations, showing awareness of implications for learning.

O3. To be able to analyse, reason through and effectively communicate mathematical arguments relating to geometry.

O4. To develop understanding of elements of geometry on the primary syllabus (objectives, contents, methodological recommendations, evaluation) taking a critical approach and devising appropriate teaching strategies.

O5. To be able to debate what geometry is most appropriate to primary education, providing reasons and methods, in a non-simplistic manner which includes consideration of the curriculum and relevant research.

O6. To learn to identify different situations, phenomena and representations relating to school geometry, and to differentiate aspects with regard to teaching and learning.

O7. To develop a critical approach to teaching materials and resources for primary geometry, paying attention to potential benefits and pitfalls.

O8. To practise creating materials and activities for teaching primary geometry and for evaluating learning outcomes, whilst being able to verbalise the issues involved and explain the decisions taken.

O9. To be able to deduce students' likely thought processes from their classwork when studying geometry, taking into account learning theories.

O10.To be able to identify varying modes of communication and strategies for interaction in the classroom and recognise their implications for learning.

O11.To foster appreciation for the analysis of teaching-learning situations in mathematics as a means of developing as a teacher.

O12. To foster appreciation for working with colleagues as a means of developing as a teacher.

TEACHING METHODOLOGY

Activities included in the programme:
• Diagnostic activities and introduction.
• Overview of bibliographic material.
• Group learning.
• On-line debate.
• Essential reading.
• Teaching practice via ICT.
• Oral presentations.
• Lectures.
• Problem-solving.
• Workshops.
• Guided assignments.

Learning and teaching activities	Hours	Presence percentage
Lecture hours (Large group)	33	100%
Supervised practical workshop (Small group)	12	100%
Independent learning hours (Self-directed or guided assignments)	105	0%
Other	0	

Theory sessions	x	Practical sessions	x
Seminars and discussion	x	Groupwork	x
Obligatory reading	x	Case studies, practical instances	x
Role-playing		Visits and trips	
Specialised tutorials	x	Research projects	

CONTENTS

Unit 1: Natural number construction

1.1 First numerical experiences. The succession of the numeric terms. Levels of domain of the numerical sequence. Enumerate and count.

1.2 The number as a synthesis of order and hierarchical inclusion.

1.3 The first conceptual structures: classify and seriate. Patterns.

1.4 Principles for the construction of the natural number: abstraction, stable order, biunivocity, cardinality and order irrelevance.

1.5 Numerical systems. Different systems of representation of the natural number (systems in other cultures and epochs). The decimal numerical system. Comparison between systems. Historical evolution.

1.6 Contexts and uses of the number: sequence, count, cardinal context, ordinal context, measurement, number as code and key. Importance of

the context.

1.7 Numerical competence in adulthood. Social function of numerical education. Numerical competence at work.

1.8 Natural number learning in Primary Education.

1.9 Representations of the natural number: discrete and structured manipulative material (Cuisenaire rods, base ten blocks, abacus), number line, notation

Unit 2: Basic arithmetic operations

2.1 Addition and subtraction.

2.2 Product and quotient.

2.3 Mental and written calculation. Mental calculation strategies.

2.4 Nature of N (Algebraic structure of N with the addition and product, Peano axiomatics and complete induction).

Unit 3: Integer numbers

3.1 History of negative numbers. The numbers with sign. The integer number as a mathematical object.

3.2 The natural number and the integer number: analysis of meanings. Contextual meanings. The integer number as useful and as an object. The inclution $\mathbb{N} \subset \mathbb{Z}$.

3.3 Arithmetic, algebraic and geometric models.

3.4 Operations with integers and their properties.

3.5 Learning the integer number in Primary Education: learning processes, difficulties and obstacles, indicators of learning.

3.6 Divisibility in Z.

3.7 Contexts and situations related to divisibility: learning processes, difficulties and obstacles, indicators of learning.

3.8 Algebraic structure of Z with the addition and the product.

Unit 4: Fractions, decimals y percentages. Operations

4.1 The concept of fraction. Meanings: parts of a whole (continuous or discrete), comparison or ratio, operator and quotient of integers. Proper and improper fractions. Equivalence and order. Irreducible fraction. The inclusion $\mathbb{N} \subset \mathbb{Q}^+$. Rational number concept.

4.2 Usual contexts and situations with fractions. Different models of representation of the fractions (continuous iconic -linear and area- and discrete, symbolic and with manipulative material) and relationships with their meanings.

4.3 Operations with fractions. Conceptual structure, algorithms and representation models.

4.4 Learning of fractions and their operations in Primary Education: learning processes, difficulties and obstacles, indicators of learning.

4.5 Decimal number concept. A first extension of the decimal numerical system. Social and cultural importance of the decimal number. Different types of decimals. Univocal identification of the rational number by its decimal representation.

4.6 Contexts and situations in which we use the decimal numbers: measure, integer division and approximation. Reading and writing of decimal numbers.

4.7 First approximation to proportionality: the percentages.

4.8 Operations with decimals and percentages. Conceptual structure, algorithms and representation models. Direct and indirect proportionality. The rule of three.

4.9 Learning of decimals, percentages and their operations in Primary Education: learning processes, difficulties and obstacles, indicators of learning.

4.10 Introduction to the irrational number. Meanings associated with the irrational number: ratio and comprehension. Some types of irrational numbers: contexts and situations in which irrational numbers appear.

4.11 Relations between fractions, decimals and percentages.

4.12 Some misconceptions concerning rational and irrational numbers.

4.13 Nature of $\mathbb{Q}^+$ (Algebraic structure of $\mathbb{Q}^+$ with the addition and product. Archimedean property).

Unit 5: Real numbers

Unit 6: Design and critical analysis of teaching proposals for the numerical contents in Primary Education

BIBLIOGRAPHY

General

Alsina, C. et al. (1996). *ENSEÑAR MATEMÁTICAS*. Barcelona: Graó.

Cascallana, M.T. (1988). *MATERIALES Y RECURSOS DIDÁCTICOS. INICIACIÓN A LA MATEMÁTICA*. Madrid: Santillana.

Castro, E. (ed.) (2001). *DIDÁCTICA DE LA MATEMÁTICA EN LA EDUCACIÓN PRIMARIA*. Madrid: Síntesis.

Chamorro, M.C.(Coord.) (2003) *DIDÁCTICA DE LAS MATEMÁTICAS. EDUCACIÓN PRIMARIA.* Madrid: Pearson.

Dickson, L.; Brown, M. & Gibson, O. (1991). *EL APRENDIZAJE DE LAS MATEMÁTICAS.* Madrid: M.E.C. & Labor.

Fernández, J. (1989). *JUEGOS Y PASATIEMPOS PARA LA ENSEÑANZA DE*

LA MATEMÁTICA ELEMENTAL. Madrid: Síntesis.

Grupo Cero (Valencia). *MATERIALES CURRICULARES PARA LA EDUCACIÓN PRIMARIA. I, II, III y IV*. MEC-Edelvives.

Hughes, M. (1987). *Los niños y los números: las dificultades en el aprendizaje de las matemáticas*. Barcelona: Planeta.

Hernán, F. y Carrillo, E. (1989). *RECURSOS EN EL AULA DE MATEMÁTICAS*. Madrid: Síntesis.

Proyecto Albanta. Matemáticas 3º-6º Primaria. Libros del alumno y del profesor. Ed. Alhambra-Logman. 1994.

Specific

Askew, A. (1998). *TEACHING PRIMARY TEACHERS*. London: Hodder & Stoughton.

Baroody, A. (1988). *EL PENSAMIENTO MATEMÁTICO DE LOS NIÑOS.* Madrid: Visor.

Bermejo, V. (1990). *EL NIÑO Y LA ARITMÉTICA*. Paidós: Barcelona.

Billstein, R. ; Libeskind, S. & Lott, J.W. (1993). *A PROBLEM SOLVING APPROACH TO MATHEMATICS FOR ELEMENTARY SCHOOL TEACHERS.* New York: Addison-Wesley P.C.

Carrillo, J. et al. (2016). *DIDÁCTICA DE LAS MATEMÁTICAS PARA MAESTROS DE EDUCACIÓN PRIMARIA*. Madrid: Paraninfo.

Castro, E. et al. (1988). *NÚMEROS Y OPERACIONES*. Madrid: Síntesis.

Centeno, J. (1988). *NÚMEROS DECIMALES. ¿POR QUÉ?¿PARA QUÉ?* Madrid: Síntesis.

Gómez, B. (1989). *NUMERACIÓN Y CÁLCULO*. Madrid: Síntesis.

Kamii, C. (1982). *EL NÚMERO EN LA EDUCACIÓN PREESCOLAR*. Madrid: Visor.

Kamii, C. (1985). *EL NIÑO REINVENTA LA ARITMÉTICA*. Madrid: Visor.

Kamii, C. (1993). *REINVENTANDO LA ARITMÉTICA* II. Madrid: Visor.

Kamii, C. (1995). *REINVENTANDO LA ARITMÉTICA* III. Madrid: Visor.

Lesh, R. y Landau, M. (Ed.) (1983). *ACQUISITION OF MATHEMATICS: CONCEPTS AND PROCESSES*. New York: Academic Press.

Llinares, S. Y Sánchez, M.V. (1988). *FRACCIONES*. Madrid: Síntesis.

Maza, C. (1989). *CONCEPTOS Y NUMERACIÓN EN LA EDUCACIÓN INFANTIL.* Madrid: Síntesis.

Maza, C. y Arce, C. (1990). *ORDENAR Y CLASIFICAR.* Madrid: Síntesis.

Maza, C. (1991a). *ENSEÑANZA DE LA SUMA Y DE LA RESTA.* Madrid: Síntesis.

Maza, C.(1991b). *MULTIPLICAR Y DIVIDIR.* Madrid: Síntesis.

Nieto, P. Et al. (1994). *NÚMEROS. PRIMER CICLO DE ESO.* Barcelona: Octaedro

Puig, L. y Cerdán, F. (1988). *PROBLEMAS ARITMÉTICOS ESCOLARES.* Madrid: Síntesis.

Segovia, I. et al. (1989). *ESTIMACIÓN EN CÁLCULO Y MEDIDA.* Madrid: Síntesis.

Udina, F. (1989). *ARITMÉTICA Y CALCULADORAS.* Madrid: Síntesis.

ASSESSMENT

Final grades will be calculated as the total of the scores obtained in each of the assignments below:

Activity	Weighting (%)
Essay (examination)	75%
Guided assignments on quantitative experimental studies or design of teaching units	20%
Homework and research tasks, class participation	5%

NOTES:
a. Persistent spelling, punctuation and grammatical errors will be penalised and in extreme instances could result in a fail grade being issued.

b. Basic errors in numeracy could result in a fail grade being issued for the course. More than 3 basic errors in an examination test (final exam, assignments, practical work...) would lead to 0 in that test.

c. In order to pass the course, students are required to achieve a minimum of 3.5 marks (out of 7.5) in the examination (essay task), a minimum of 1 mark (out of 2) in the guided assignments, and a minimum of 5 marks for the total evaluative tasks. Where students do not achieve any of the required minimum grades, the maximum grade they will receive for the course will be 4 marks. There is a minimum attendance requirement of 80% during the practical section of the course in order to be eligible for the evaluation of this section. Students failing to meet this requirement will be obliged to take a corresponding additional practical section in the final examination. For the essay part of the exam the students will be given between 90 and 120 minutes, and between 30 and 60 minutes for the practical part.
The mark "Matrícula de Honor" is given when a student gets 10 points. In the need of discrimination amongst several students, a new exam could be posed to them.

d. Assignments can be handed in at any time before the final examination in June. Generally speaking, the deadline for assignments will be the final week of the teaching period, although these dates are subject to review and may be brought forward. In the case of resists for

assignments and class participation (25%), there will be an additional section in the examination covering practical aspects. Pass grades achieved in either the February examination or the practical section will be carried over to the September and other convocations

e. Evaluation of students fulfilling the conditions set out in article 8 of the rules for evaluation of degree courses at the University of Huelva (which must be duly accredited at the start of the course, or within a week of the occurrence of the events bringing the student within the scope of the article) will be exclusively by means of a final examination, which will include a section of practical questions relating to the topics covered in the guided assignments.

Tutorials: all tutorials will take place by appointment at the scheduled times; students are requested to confirm through the established channels.

Evaluation criteria

- Showing a grasp of the most important items in the programme.
- Showing depth of analysis of texts and teaching situations (authentic or simulated).
- Demonstrating originality and involvement in the ideas which arise.
- Using sound foundations and rigour to build arguments.
- Being able to find relations between ideas.
- Using critical reasoning.
- Demonstrating organisation and clarity in spoken and written discourse
- Using summarising elements appropriate to the genre: indexes, introductions, conclusions, graphs, tables, illustrations, etc.
- Respecting the conventions of academic writing: spelling and grammar, organisation, quotations, citing authors, etc.
- Showing knowledge of background reading and ability to use it appropriately.

Techniques and instruments

- Tracking the development of assignments
- Talks demonstrating knowledge: presentations of topics and activities.
- Writing of reports.
- Participation in tutorials and specific seminars.
- Individual and group interviews following agreed agenda.
- Problem-solving.
- Tests and examinations.

Systems for registering attendance and participation

- Occasional contact via virtual media.
- Observations and journals to organise data and other information.
- Class review sessions for negotiating adjustments to work.
- Qualitative and negotiated evaluative reports: group tutorials.