

**Mathematics and Mathematics
Education I: magnitudes and
measurement**

Pedro Nicolás Zaragoza

Contents

Chapter 1. Introduction	5
Chapter 2. Anthropological Theory of Didactic Phenomena	7
1. Mathematical praxeologies	7
2. Didactic moments	9
3. Epistemological Reference Model	10
3.1. Definition	10
3.4. Example	11
3.5. ERM and didactic moments	12
4. Glossary	12
Chapter 3. Measurement and magnitudes	15
1. Magnitudes: amount, measurement, unit and order	15
2. Situations of measurement	15
3. Precision and measuring errors	15
4. Measuring systems: regular/irregular, private/public	16
5. Fundamental or linear magnitudes vs. derivated or multilinear magnitudes	17
6. International System of Units (SI)	17
6.1. Tables	17
6.2. Metro	18
6.3. Second	18
6.4. Kilogram	18
7. Relationship between different magnitudes	18
7.1. Mass and weight	18
7.2. Volume and capacity	19
7.3. Area and surface	19
8. Glossary	20
Chapter 4. ERM about measurement of magnitudes	23
1. Description of the ERM	23
1.1. Initial praxeologies: MP_0 y MP_1	23
1.5. A transition praxeology: MP_2	26
1.6. Final praxeology: MP_3	28
2. Glossary	28
Chapter 5. Una organización didáctica en torno a la medida de magnitudes en Educación Primaria	31
1. Introducción	31

2. PM_0 y PM_1	31
2.1. PM_0	31
2.1.1. Tarea T_1	31
2.1.2. Tarea T_2	32
2.1.3. Limitaciones de la PM_0	33
2.2. PM_1	33
2.2.1. Paso de $S(G)$ a $MS(G)$	33
2.2.2. Limitaciones de las PM_0 y PM_1	35
2.3. PM_2	36
2.3.1. Tarea T_3	36
2.3.2. Tarea T_6	37
2.3.3. Tarea T_4	38
2.3.4. Tareas T_5 y T_7	39
2.3.5. Tarea T_6	42
2.4. PM_3	43
2.4.1. Tarea T_8	43
Bibliography	47

CHAPTER 1

Introduction

During the academic year 2012/13 the course *Mathematics and Mathematics Education I* was taught for the first time in the Degree of Primary Education of the University of Murcia. The subject is homologue to *Matemáticas y su Didáctica I* but, unlike this one, it is taught in English. Therefore, to elaborate new resources written in this language seems particularly convenient.

In Chapter 2 we include some materials of the Unit 1 in the official curriculum of the course. In particular, we explain the basics of the Anthropological Theory of Didactic Phenomena which will be subsequently used in Chapters 4 and 5.

In Chapter 3 we explain fundamental concepts about magnitudes and measurement of magnitudes. This chapter provides the required bit of cultural information the teachers in Primary Education should have in mind before designing a study process about measurement of magnitudes.

The aim of Chapter 4 is twofold:

- 1) To exemplify the rather abstract (and crucial!) notion of Epistemological Reference Model explained in Chapter 2.
- 2) To give the required bit of *scientific* (*i.e.* coming from the science Mathematics Education) information the teachers in Primary Education should have in mind before designing a study process about measurement of magnitudes.

Finally, in Chapter 5 we show, in a concrete example of a design of such an study process, how to integrate the notions and tools explained in the three previous chapters.

The material of Chapters 3, 4 and 5 is part of the Unit 3 in the official curriculum of the course.