

# A STUDY ON THE FUNDAMENTAL CONCEPT OF “MEASURE” AND ITS HISTORY<sup>1</sup>

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## SUMMARY

*This paper exhibits a small part of a PhD degree project on the theme: “The fundamental concept of Measure: epistemological and pedagogical aspects related with the first six years of schooling”.*

*It aims at presenting the analysis of the fundamental concept of measure at the so called elementary levels of schooling, in Portugal. We intend to: 1) distinguish elementary concepts and fundamental concepts; 2) explain why do we look at the mathematical concept of measurement as not only an elementary concept but, and above all, a fundamental concept in mathematics; 3) foresee implications of this distinction for teaching at the elementary level.*

**Key words:** concept of measure, teaching of mathematics, history of mathematics.

## ELEMENTARY AND FUNDAMENTAL CONCEPTS

Concepts play a key role in the construction of mathematical knowledge with, certainly, different importance levels. At Elementary Mathematics’ schooling we are dealing with the so called elementary and fundamental concepts, deserving a special attention since their learning will influence the learning in higher levels.

In contrast to Ma (1999) (*Elementary Mathematics is fundamental mathematics*), we think that elementary and fundamental have different meanings, although a concept may be, at the same time, elementary and fundamental. On the one hand, a concept taught and learnt in elementary Mathematics created by Man to build a complex structure as a whole, or as a specific theme, is an elementary concept (Caraça, 2000). On the other hand, we say that a fundamental concept, emerges over time, its genesis is inherent to human activity and it is presented in many areas of mathematics as well as in several other areas of knowledge, both in the school context and in society, in general.

## THE FOCUS OF THIS POSTER

### Measure: Elementary and Fundamental concept

We consider the specific mathematical concept of *Measure*! Through its history we understand that this is a concept emerging over time, its genesis is inherent to human activity (Astronomy, Agriculture, Economy) and it presents itself in many areas of mathematics (Trigonometry; Arithmetic; Probability) as well as in several other areas of knowledge, both in the school

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context and in society in general (Nanotechnology; Medical issues; Biology). Therefore it is considered a fundamental concept. It also is an elementary concept since it is taught and learnt at an elementary level.

### **Possible implications for the Teaching of Mathematics**

We intend to answer the research question: *What is the approach of Measure in the Programs of Mathematics for Elementary Education, and in which way is History of Mathematics used to promote it as a fundamental concept?* To this end, we analyzed official portuguese mathematics programs (Mathematics Program for the 2<sup>nd</sup> Cycle of Basic Education, 1991; 1<sup>st</sup> Cycle Program for Mathematics, 1990 and the new Program of Mathematics for Basic Education, 2007), looking, in particular, at the role played by the history of *Measure*. Important works (Schubring (1998), Swetz (1995) and Siu (1996), among others) supported this analysis. We conclude that those programs present mainly the Geometric dimension of *Measure* and reduce the use of History of Mathematics related with this concept, to curiosities, examples, “historical aspects”. Seeing *Measure* as a seed of a future mathematical knowledge at a higher level, this approach may cause difficulties to the learning of mathematics. Namely, children may experience problems to integrate or to define units, develop misconceptions about measure/distance/length, fractions or when relating hours and angles in Trigonometry, misunderstanding measure statistics as measures, develop poor sense of money or work with temperature. This situation may aggravate if teachers aren’t aware of its importance to the development of mathematical knowledge and are unable to provide richer approaches.

Please recall that this is not a work developed directly with children, but meant to alert teachers, textbooks authors, programs and curriculum designers.

### **BIBLIOGRAPHY**

- Caraça, B. J. (2000). *Conceitos Fundamentais da Matemática*. Gradiva. Lisboa.
- Fischbein, E. (1993). The theory of figural concepts, *Educational Studies in Mathematics*, 24, 139-162.
- Kramer, S. N. (1985). *A História Começa na Suméria*. Publicações Europa-América. Lisboa.
- Man-Keung, Siu. (1996). *The ABCD of Using History of Mathematics in the (undergraduate) Classroom*. Department of Mathematics University of Hong Kong. 01/07/2010 < <http://hkumath.hku.hk/~mks/ABCD.pdf>>.
- Ma, L. (1999). *Knowing and Teaching Elementary Mathematics: Teachers’ understanding of fundamental Mathematics in China and United States*. Lawrence Erlbaum Associates, Inc. Copyrighted Material.
- Neugebauer, O. (1969). “The Exact Sciences in Antiquity”. Dover Publications.
- Robson, E. (1996). From Uruk to Babylon: 4,500 Years of Mesopotamian Mathematics. *Historia e Educação Matemática*, I: pp. 35-44.