Chapter 3
Computer-Based Mathematics Education: Historical Excursus

ABSTRACT

In this chapter, the authors mention, briefly, the attempts made from the 1970s to today to insert modern technologies in the teaching/learning of mathematics. They start with the first pocket calculators in the 1970s, which had a rapid technological diffusion that still exists. They focus on the impact that digital electronic technology has had on teaching/learning math. They will not follow a strictly chronological order, preferring to dwell on what, in their opinion, are the fundamental stages. So, the advent of the PC and programming languages—Logo, Basic, Pascal—CAI programs, DGS software, CAS. They conclude with their MatCos Project, after mentioning the new coding languages, including Scratch.

"Programming the computer, not being programmed by it" ~S. Papert

"I think, I program, I learn" ~F. A. Costabile

1. INTRODUCTION

In the previous chapters we have set the bases for what is more than a methodology of teaching or/and learning mathematics: Modern technology in Mathematics education. In fact, the advent of digital electronic technology has given impetus to new mathematical ideas and vigour to new applications which before then were unthinkable. It was natural, and perhaps indispensable, to use it also in learning and teaching in primary and secondary school (Korenova, 2015). However, this happened with a wide cultural and pedagogical debate. Without going into details, we will only mention some salient aspects.

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For example Preiner J. in its thesis on Mathematics Education wrote (Preiner, 2008): "Students can benefit in different ways from technology integration into everyday teaching and learning. New learning opportunities are provided in technological environments, potentially engaging students of different mathematical skills and levels of understanding with mathematical tasks and activities (Hollebrands, 2007). Additionally, the visualization of mathematical concepts and exploring mathematics in multimedia environments can foster their understanding in a new way. Van Voorst (Van Voorst, 1999) reports that technology was useful in helping students view mathematics less passively, as a set of procedures, and more actively as reasoning, exploring, solving problems, generating new information, and asking new questions. Furthermore, he claims that technology helps students to visualize certain math concepts better and that it adds a new dimension to the teaching of mathematics. Technology environments allow teachers to adapt their instruction and teaching methods more effectively to their students' needs (NCTM, 2000). By integrating educational tools into their everyday teaching practice, they can provide creative opportunities for supporting students' learning and fostering the acquisition of mathematical knowledge and skills. On the one hand, gifted students can be supported more effectively than ever by nurturing their individual interests and mathematical skills. On the other hand, weaker students can be provided with activities that meet their special needs and help them to overcome their individual difficulties. Thereby, students may focus more intently on computer tasks" and "may benefit from the constraints imposed by a computer environment. Additionally, students can develop and demonstrate deeper understanding of mathematical concepts and are able to deal with more advanced mathematical contents than in 'traditional' teaching environments ".

The application of electronic technology in secondary and primary education began in the 1970s with the advent of the pocket calculators (Costabile F. A., 1983) (Costabile F. A., 1986). Expectations concerning changes in pedagogy and mathematical content were very high (Weigand & Weth, 2002) and the usage of pocket calculators in schools was expected to:

- increase the importance of experimental and discovery learning,
- strengthen modelling and mathematical concepts,
- enhance application tasks,
- reduce the importance of manual computational skills,
- increase the importance of algorithms.

Furthermore, the introduction of pocket calculators raised a lot of pedagogical questions which are very similar to the ones discussed concerning the introduction of computers and mathematical software (Weigand & Weth, 2002).

- How can basic objectives of mathematics education be reached more effectively?
- What is the meaning of 'traditional' mathematical skills?
- What are we supposed to do with the additional time gained?
- How is using this new technology going to affect weaker students?

Since many schools and teachers were not really prepared for the introduction of this new tool for teaching and learning mathematics, the full potential of pocket calculators could not be tapped at all in the beginning. Nevertheless, new and innovative ideas were implemented and the effective usage of pocket calculators increased in schools over the next decades. The use of pocket calculators for teach-