12. GEOGEBRA AS A METHODOLOGICAL RESOURCE

Guiding Teachers to Use GeoGebra for the Construction of Mathematical Knowledge

The aim of this chapter is to stress the role of GeoGebra as a methodological resource. In particular, we contend that teachers need to become aware that an appropriate integration of GeoGebra within the classroom activities could foster the construction of mathematical knowledge. As a consequence, educators need to guide teachers to perceive GeoGebra as a methodological resource so that they would be able to effectively use it. As a theoretical framework we mainly refer to the “instrumental approach” and to the idea of “mathematics laboratory as a Renaissance workshop”. We also suggest that, when teachers are “immersed” in appropriate non-standard learning situations, they could experience by themselves that GeoGebra can be very useful for creating a meaningful mathematics learning environment.

INTRODUCTION

Many researchers are now offering greater educational opportunities using tools in the teaching and learning of mathematics (e.g., Lagrange et al., 2003). The ideas presented in this chapter are connected to an ongoing research study developed within a local institution for pre-service teacher training (SSIS) in Puglia in the South of Italy. This study focuses on the use of technological tools as methodological resources to support mathematics teaching and learning activities. In this paper, we aim to present this point of view; and according to the early results of our research, we will try to make some didactical suggestions.

Our main research assumption is that technological tools such as GeoGebra can assume a crucial role in supporting the teaching and learning processes because they allow teachers to create suitable learning environments with the goal to promote the construction of meanings for mathematical objects. In this sense, GeoGebra can be considered as a methodological resource.

However, as underlined by Mously, Lambidin, and Koc (2003), it cannot be taken for granted that technological advances alone can change essential aspects of teaching and learning simply because they can bring about opportunities for change in pedagogical practice.

The Italian Committee for Mathematics Education, for example, highlights in an official document (UMI-CIIM, 2004) that:

The meaning cannot be only in the tool per se, nor can it be uniquely in the interaction of student and tool. It lies in the aims for which a tool is used, in the schemes of use of the tool itself. (p. 32)

Innovative learning environments can result from the integration among educational and cognitive theories, technological opportunities, and teaching and learning needs (Bottino, 2000). We believe that teachers should recognise the need for an effective integration of technologies in classroom activities and will see new technologies as cultural tools that radically transform teaching and learning only if they become aware of the potential usefulness and effectiveness of a technological tool such as GeoGebra as a methodological resource, which enables them to foster the construction of a meaningful learning environment (Faggiano, 2009).

The basic use of GeoGebra, for example, can be easily and quickly learned; but, even though GeoGebra allows an interaction between the visual and theoretical aspects of geometry, it is often used to facilitate visualisation more than act in the solution process.

According to Borba (2005), there continues to be resistance to the use of technology in educational environments. Many scholars do not consider the potential role of computers in the reorganisation of thinking and the changes in contents or teaching strategies, and many teachers, too, consider computers only as a tool that expands human memory, increases the turnaround of feedback, and enhances the possibility of generating images.

If GeoGebra is used only as an auxiliary to show a graph or a dynamical geometrical construction, students would have no opportunities to learn mathematics with the computer because that is not part of mathematical contents.

THEORETICAL FRAMEWORK

A very important idea on which this study is based is the idea of “mathematics laboratory,” which comes from both empirical and theoretical studies and is summarised, for example, in the UMI-CIIM (2004) document as follows:

A mathematics laboratory is not intended as opposed to a classroom, but rather as a methodology, based on various and structured activities, aimed to [promote] the construction of meanings of mathematical objects. (p. 32)

In this sense, a laboratory environment can be seen as a Renaissance workshop, in which the apprentices learn by doing and communicating with each other about their practices. In particular, in the laboratory activities, the construction of meanings is strictly bound, on one hand, to the use of tools; and on the other, to the interactions between people working together, without distinguishing between the teacher and the students.

According to this approach, in the creation of suitable learning environments aiming to construct mathematical knowledge, technological tools assume a crucial role in supporting the teaching and learning processes. However, as claimed by Laborde (2002):