Chapter 9
Dynamical Software and the Derivative Concept

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ABSTRACT
Modern teaching trends impose the need of spending less time on the manipulative approach to differential and integral calculus, putting the accent on the conceptual understanding of the subject. This chapter presents the standard approach and method used to teach the derivative of a function and indicates some critical points in the teaching of the derivative, offering, at the same time, suggestions for overcoming them. As a supplement, the author gives e-resources that can make possible the implementation of a stimulating, visual, dynamic, and broadened method for teaching the derivative of a function.

INTRODUCTION
The National Council of Teachers of Mathematics (NCTM) Standards of America called for a mathematics curriculum that “emphasizes conceptual understanding, multiple representations and connections, mathematical modeling, and mathematical problem solving” (NCTM, n.d.).

The representation process includes the use of different models for organizing, memorizing and exchanging of math ideas with the aim of solving math problems and for a better interpretation of mathematics. Such models can be used for math-

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Mathematics to be “seen, touched, presented” by use of multimedia materials, diagrams, graphic reviews or symbolic expressions. Representation should become an important supplementary element in teaching mathematics; so every teacher should choose a particular type and amount of representation materials to enrich the conventional form of a math lesson.

Representation—graphic and otherwise—in the function of reasoning has been explored by many researchers. One conclusion is that switching representations may often be a key to problem solving (Samdani, 2009). The standard representational forms of some mathematical concepts, such as the concept of function, are not adequate for students to construct the whole meaning and grasp the whole range of their applications (Monoyiou & Gagatsis, 2008).

The question, i.e. “How can a mathematical concept or relation be represented?”, on the other hand, invites an answer to how a mathematical concept can be ‘represented as’ and it concerns our attempts to visualize the concept in a particular context for a particular problem solving task (Portides, 2008).

Finally, in order for future teachers to make an effective use of multiple representations in their teaching, they themselves need to experience and explore the potentials of technology as a learning resource rather than a computational device. As NCTM suggests, digital technologies provide visual models or representations that many students are unable to generate through their independent efforts (Ozmantar et al., 2010).

Calculus is the name for the symbolic calculation of the rate at which a function changes (differentiation). Derivatives and their applications are studied as a part of differential calculus which is one of the most important areas of mathematical analysis. In general, we can say that derivative is a measure of change, so its application helps in finding the area of monotony, concave monotony, finding the points of local extrema, and so on, which is extremely helpful in solving many engineering, financial and other real-life problems; Consequently, full mastery and understanding of the fundamentals of differential calculus is a requirement for every student.

BACKGROUND

The major obstacle to understanding the teaching of differential calculus is a large number of complex mathematical and dynamical concepts that the students did not encounter in their previous schooling. It is well known that students have great difficulty with the concept of the limit, derivative and integral, which are strongly linked. Currently many students are unprepared to study calculus, see no relevance in the topics taught, and fail the calculus course (Anderson & Loftsgaarden, 1988).
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