Chapter 21

Construction of the Definite Integral Concept Using Open Source Software

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ABSTRACT

The objective of the investigation is for university students to achieve the construction of the definite integral concept using open source software. The teaching activity encompasses everyday life problems where the constant, linear and the non-constant change rate functions are present. The accumulated change is approached using the geometric approximation of the area under the curve. A qualitative analysis was made to identify the level of understanding acquired, its development and the mathematical learning objects implemented during the lesson plan activities, using worksheets where the participants record their observations and answers. The level of comprehension was different for each student; participants who were able to visualize the relationship between the area under the curve and accumulated change were identified, applying the concept to solve a problem, although the majority of students had difficulty applying the concept.

INTRODUCTION

The mathematics curriculum and teaching methods have been long since based on formal mathematics, memory based teaching materials and algorithmic abilities, which frequently result in the student not perceiving the connection between the mathematical procedures studied and real world application besides limiting the learning processes they can experiment themselves (Cantoral, 2001).

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Sciences like mathematics, taking aside the difficulty that arises because of the way of teaching and learning, are found to be unappealing for many students, who reject and fear them and even doubt their capacity to learn them (Rouquette & Suárez, 2013). Adaptations to the teaching methods that make mathematics appealing for all students, because it is a cultural resource, acquire meaning in a precise social and historical moment, which determines the use of mathematics according to the context and the available tools (D’Amore & Godino, 2007).

It is essential to design teaching-learning activities that in a practical way result in a tool that contributes to the solution and comprehension of different phenomena, showing its relevance and functionality so that it is not perceived as an obsolete or senseless knowledge (Coll, 2009). The construction of teaching situations in which scenarios are designed for the interaction of students, teachers and the environment, with the purpose of favoring the learning of mathematics is suggested by Brousseau (2007).

In today’s society knowledge construction processes can be augmented through Information and Communication Technologies (ICT) because of their characteristics such as: formality, interactivity, dynamism, hypermedia, multimedia and connectivity. They can also modify psychological functioning aspects of people by transforming the way of thinking, working, acting, relating and learning. The group of attributes that ICT contribute generates new ways of treatment, transmission, access and use of information (Bustos & Coll, 2010).

For this reason Ferreiro (2008), as well as Ferreiro and De Napoli (2008), mention that the design of new teaching environments must incorporate ICT for these resources potential to obtain higher participation, student-teaching content interactivity, student-student and student-teacher interactivity, and to encourage collaborative relations where the teacher functions as a mediator. The goal is to reach a higher quality of learning utilizing teaching strategies that better answer to the user’s characteristics and to the knowledge to be transmitted, using software tools that enable interaction, information and knowledge structures (Salinas, 2012).

Teaching management in a context that includes ICT benefits the rooting of mathematical concepts (Zaldívar, Cruz, & Gamboa, 2015) by consolidating what is learnt, demonstrating solidity and durability of the acquired learning. On the other hand in mathematics the objective is not only the know-how, which includes abilities and knowledge, but also the complex know-how, which means, metacognitive competences which are the foundation for the development of the capacity to learn and which can be brought further with technology (Peñalva, 2010).

Today’s society, with its ample technological development, should evaluate what to do and how to make mathematics be learned and become the instrument mankind created it for, which is a means to solve environmental problems optimizing resources that are increasingly scarce. There must be a transformation of the teaching and learning process from the algebraic calculation, decontextualized perspective, formalized by abstraction of mathematics to a discipline whose purpose is meaningful understanding of the concepts and the prevailing needs of engineering over the criteria of mathematicians (García, 2013).

Lois and Milevicich (2008) comment that the use of computers in the classroom as a teaching resource can be a means to facilitate the process of coordinating the various registers of representation of a mathematical concept. They also said that the greatest contribution of ICT is the creation of custom media according to educational requirements. However, the use of specific software, hypertext and multimedia equipment stimulate the process of exploration, development of algorithms and logic skills training. In turn, technology as a means of investigating and solving problems, promotes student motivation, makes it possible to propose different ways of solving rehearsing several answers, formulating hypotheses, and together contributing to the formation of a scientific and reflective thinking.
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