

NEWTON'S PRINCIPIA MATHEMATICA IN A TWENTY FIRST CENTURY CLASSROOM

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ABSTRACT

In this paper we present a didactic activity developed under the Project Based Learning approach. We wanted that our students experienced the way the seventeen-century scientists did calculations without using computers or electronic calculators. The didactic activity involved the use of Lemma V included in Newton's Principia Mathematica. We discuss our experience applying this activity to Engineering students and a group of in service teachers of high school and university. We also show some results of our students concluding that the main goals stated when we designed the activity were fulfilled.

1 Introduction

In our classrooms students live with electronic calculators and computers without any idea of how scientist made their discoveries in the past. Most students do not imagine how Archimedes, Pythagoras, Pascal, Newton, Euler or every famous mathematician and physicist did the calculations they needed. To be honest neither we did as students. Many of us do not imagine how ancient scientist could work without calculator or computers, or even without the Calculus and a gravitational theory like Newton's.

We designed our activity with three main goals; the first is to discover the way scientist worked in the past centuries. The second goal is to justify the need of numerical methods and the third one is to rediscover one of the most famous books in the History in a twenty first century classroom. In addition we want students to solve a problem that is not included in pre-calculus classes.

Project Based Learning (PjBL) approach was used to design the activity, we gave a short context and a set of real data to be used.

2 Origin of the activity

By 2005 two colleagues of us were working with Taylor's Series and its original source when they were told about some interpolation techniques proposed by Newton in his Lemma V included in "Principia Mathematica" (part of Proposition XL Theorem XXI, Book 3). After some time, one of the authors of this paper was researching about numerical series and its origins as part of his PhD thesis (Rosas, 2007) and Lemma V was mentioned again.

In Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM for short) Engineering students must learn mathematics based on "real world applications". This way teachers need to apply some didactic techniques like Problem Solving, Problem Based Learning, Cases Study, Project Based Learning and others. After some years of using these techniques students feel fine with this kind of learning (at least we think they feel fine). As a result of our technological era our students think that only computer solutions are good and sometimes they do not respect ancient methods.