Mobile Apps as a Learning Space for Teaching Math: A project on Mexico's public high school system

Marco Negrete, Javier Alatorre, Daniela Madrigal and Melissa Santoyo

Abstract

In Mexico there is a lag in math learning from the basic education to high school and even in higher education. This situation is reflected in the poor performance that Mexican students have in standardized tests, both national and international, where results situate them under the OECD average, showing problems in basic abilities such as expressing problems in mathematical language and relating variables in a given situation. In this work we present a set of learning units focused on the curricula of math courses of a public high school system. This set of learning units is composed of several macro projects where students must apply mathematical high school-level concepts to solve a problem using the same tools that a professional should use. Our main goal is to form a complex learning environment where students assimilate concepts not just by solving exercises or isolated problems, but by getting involved in a human activity of professional level. Our proposal is designed taking as foundation the Leontiev's Activity Theory. We present the results obtained from the first year of application and discuss the future work and expected results.

1 Introduction

Justificación (social): bajo rendimiento en los alumnos de bachillerato. Resultados de PISA de 2015 y PLANEA.

2 Background

[1]: The best way to learn an activity is to perform it. The work of Piaget and his School does not represent an analysis of mathematics as an activity. The re-invention method: interpreting and analyzing mathematics as an activity. [2]: Mathematics is a mental activity.

Idea sobre razonamiento matemático. Ligar la definición de razonamiento matemático y analizar cómo se reinterpretan los objetivos de aprendizaje de la ENP en el marco del razonamiento matemático.

Idea de entornos de aprendizaje. Se conjungan la idea del razonamiento matemático con entornos de aprendizaje

3 Objectives

4 Method

5 Results and Analysis

6 Discussion

Ideas sobre la matemáticos: Platón (ideas) Bertrand Russell Fregue: Las matemáticas desde el número Gödel.

7 PISA

7.1 Definition of mathematical literacy

Mathematical literacy is an individual's capacity to formulate, employ and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena. It assists individuals to recognise the role that mathematics plays in the world and to make the well-founded judgements and decisions needed by constructive, engaged and reflective citizens [3].

7.2 Mathematical processes

- Formulating situations mathematically: being able to recognize and identify opportunities to use mathematics.
- Employing mathematical concepts, facts, procedures and reasoning: able to apply mathematical concepts, facts, procedures and reasoning to solve mathematically formulated problems to obtain mathematical conclusions.
- Interpreting, applying and evaluating mathematical outcomes: being able to reflect upon mathematical solutions, results, or conclusions and interpret them in the context of real-life problems.

7.3 Mathematical capabilities

- Communication
- Mathematising
- Representation
- Reasoning and argument
- Devising strategies for solving problems
- Using symbolic, formal and technical language and operations
- Using mathematical tools

7.4 Contexts

- Personal: activities of one's self, family or peer group.
- Occupational: activities of the world of work.
- Societal: activities of one's community whether local, national or global.
- Scientific: application of math to the natural world and issues and topics related to science and technology.

8 Mathematical Modeling

According to [4], mathematical modeling is performed in seven steps:

1. Constructing. The problem situation has to be understood and a situation model has to be constructed. The result of this step is a situation model.
2. Simplifying/structuring: Once the situation is understood, it has to be simplified and structured to be more precise. The result of this step is a real model.
3. Mathematising: The problem solver transforms the real model of the previous step into a mathematical model.
4. Working mathematically: Solve equations, make calculations, etc. The result of these step is a set of mathematical results.
5. Interpreting: The problem solver translates the mathematical results into real results.
6. Validating: Checking the results. The result of this step is a decision of going around the loop a second time.
7. Exposing: Communicating the results.

9 Related Work

Authors of [5] introduce the concept of praxeology. They state that PISA mathematical capabilities are focused on the *know-how*, but mathematical competences should also include a *know* part, forming so a *praxeology* (praxis + logos). Teaching mathematics should include a practical part (know-how) and a theoretical part (know).

References

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[4] W. Blum and R. Borromeo, "Mathematical modelling: Can it be taught and learnt?," *Journal of mathematical modelling and application*, vol. 1, no. 1, pp. 45–58, 2009.

[5] J. B. Búa Ares, M. Fernández Blanco, and M. Salinas Portugal, "Competencia matemática de los alumnos en el contexto de una modelización: aceite y agua," *Revista latinoamericana de investigación en matemática educativa*, vol. 19, no. 2, pp. 135–164, 2016.