

Algebra for the Initial Training of Mathematics Teachers at Universidad Autónoma of Santo Domingo

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Abstract

This report deals with one of the problems that arise in the initial formation of Mathematics teachers at the Universidad Autónoma of Santo Domingo. Its main purpose is to characterize the educational process of Linear Algebra by making with emphasis on solving problems. The methods used were the historical-logical and the analysis-synthesis. Finally, the principal result was the accuracy of different theoretical approaches and the evolutionary stages of that process.

Keywords: approaches, trends, linear algebra, Mathematics student teacher.

I Introduction

Mathematics, as a science, plays a very important role in the knowledge that allows the development of students in society. It permits learners to acquire intellectual conditions such as induction, deduction, abstraction logical and orderly reasoning; which are essential for intellectual growth, solving situations inherent to human being actions, and establishing demands of today's world.

According to Garcia (2012), Mathematics student teachers did not receive training in the essential skills, nor the techniques that let them to model real situations. These lacks limit the formulation and resolution of problems related to Linear Algebra. This issue is mostly present in the Dominican Republic and is the main reason for carrying out this research. Therefore, the objective of this study is to characterize the educational process (PDE) of Linear Algebra by making emphasis on solving problems, in the initial training of Mathematics teachers at the Universidad Autónoma of Santo Domingo.

Besides, the characterization of the PDE of Linear Algebra, is a trend study that inquiries the significant aspects, such as approaches and theories of that specific process, in the initial formation of Mathematics teachers at the Universidad Autónoma of Santo Domingo(UASD).

Theoretical foundations and approaches of the PDE of Linear Algebra in the initial formation of Mathematics teachers.

The PDE is a formative process that in a systemic way directs the integral formation of the new generations, and from which the students receive instruction as well as develop skills through education. This integral approach should be the aim during the formation process of a person with both aspects, thoughts and feelings. From PDE the motivated student teacher must solve problems and convert his-her students' needs in mastery contents (Álvarez de Zayas, 1999).

When the taught content is linear algebra, there is a specific PDE of this singular branch; it has to be a proper PDE for teaching Linear Algebra during the initial formation or training of future Mathematics teachers. Linear algebra is part of algebra itself and other larger disciplines such as mathematics. This also includes four theories: matrices, system of linear equations, vector spaces on a body and algebraic forms. Moreover, all four theories are closely related, and the others (Maltsev, 1976) can interpret the problems studied in each of them.

The first two are the closest to everyday practice, but the vector spaces theory presents a greater degree of principles from which the rest can be explained (Yordi, 2004).

This branch of mathematics especially differs from the others by the large number of characterizations (propositions with necessary and sufficient conditions) that are present in its theories, which make the number of relationships between their objects very large. However, it is the opinion of the authors that many of the described features above require precision in terms of the inherent contradictions among the understandings of algebra. The following are the key approaches that affect the PDE of linear algebra and correspond to the next unpublished theses.

- The improvement of the teaching of Cuban higher mathematics. Experiences in Linear Algebra, Hernandez (1989).
- The teaching of Linear Algebra through computer systems of algebraic calculation, Ortega (2002).
- Methodology to train students.

II Historical trends of the PDE of Linear Algebra with emphasis on problems, in the training of teachers of Mathematics of the UASD University.

(Hernandez 1989, Sierpinska 2000, González 2000, Yordi 2003, Miyar, 2009, Garcia, 2012 and Mola, 2013) are studies considered for the evolutionary analysis of the Linear Algebra PDE. Also, based on the indicators offered by Mola (2013) some of the made modifications are the **organization and treatment of the contents of Linear Algebra and teaching methods and resources.**

The following aspects guided the analysis of teaching the educational process of linear algebra (PDE) in the Dominican Republic from 1973 to the present. To determine the stages, the used criteria considered the changes that have occurred in the PDE of linear algebra from the programs and lecture notes made by the professors. Moreover, there are three distinguished stages:

First stage: PDE of linear algebra towards the mathematical context (1973-1993).

Second stage: PDE of linear algebra to various contexts (1994-2013).

Third stage: PDE of the linear algebra towards the teaching profession (2014-present).

Next, description of the informational matrix that corresponds to each stage.

First stage: PDE of linear algebra towards the mathematical Context. Two moments (sub-stages) constitute this stage: at the beginning, when the PDE of the linear algebra performs with a structural approach (bourbakiano); and later, when it alternates with the operative approach, depending on the tradition or teacher training.

- The content corresponding to linear algebra is part of integral, differential calculus and equations subjects; these threatens the integration and generalization of knowledge. Therefore, the organization of the content scattered and depended directly on the textbook and the chair notes used by the teacher.
- The methods and resources in the didactic treatment of the content, independently of the approach used, were the expository and explanatory-illustrative, which did not favor the leading role of students when solving the problems; although it is good to clarify that under the second approach learners have greater participation.
- The sophistication and abstraction of theories, under the structural approach, made the applications of the content purely mathematical; that is, students intended to learn this science. This student teacher needs to maintain role with the operative approach that links with another context; unless, the mathematician considers itself insufficient. Finally, another found application was the usage of systems of equations in obtaining a multiple.

III Conclusions

The historical analysis showed above, mentioned the unintentional usage of problem formulation applied to the content of Linear Algebra. In addition, there was a strong character of abstraction and generalization reflected in numerous definitions, theorems and properties of the objects of this science, which stops ensuring the development of logical and rational thinking of students. This implies the necessity to consolidate the application of the content to different situations, as a way to enhance the construction of problems by the student teacher.

Bibliografy

- Álvarez de Zayas, C. (1999). *La escuela en la vida*. La Habana, Cuba: Editorial Pueblo y Educación.
- Diéguez, R. (2001). *Un Modelo del proceso de solución de problemas matemáticos contextualizados en la matemática básica para la carrera de Agronomía*. Disertación doctoral no publicada, Centro de Estudios "Manuel F. Gran", Santiago de Cuba.
- Dorier, J. L. (2000). *Epistemological Analysis of the Genesis of the Theory of Vector spaces*. En J. Dorier (Ed.), *On the Teaching of Linear Algebra* (pp. 3-81). Dordrecht: KluwerAcademic Publishers.
- García, J. (2014). *El contexto cultural y la resolución de problemas: vistos desde el salón de clases de una comunidad NñuuSavi*. *RevistaLatinoamericana de Etno-matemática*, 7(1), pp.50-73.
- García, M. (2005). *La formación de profesores de matemáticas. Un campo de estudio y preocupación*. *EducaciónMatemática*, 17(2), 153-166.
- González, D. (2001). *La superación de los maestros primarios en la formulación de problemas matemáticos*. Disertación doctoral Instituto Lineal Pedagógico "Enrique José Varona", La Habana, Cuba.
- Gracia, M. (2012). *Formando docentes de matemática para la enseñanza del álgebra lineal*. *Revista Integra Educativa*, 3(2), versión on-line, ISSN 1997-4043.
- Hernández, H. (1989). *El perfeccionamiento de la enseñanza de la matemática superior cubana. Experiencias en el Álgebra Lineal*. Disertación doctoral no publicada, MES, Ciudad de la Habana, Cuba.
- Máltsev, A. (1976). *Fundamentos de Algebra Lineal*. Moscú: Editorial Mir.
- Mateus, J. (2008). *La enseñanza y el aprendizaje del Álgebra: una concepción didáctica*. Disertación doctoral no publicada, Universidad de Camagüey, Camagüey mediante sistemas informáticos. Disertación doctoral no publicada, Instituto Superior Pedagógico "Enrique José Varona", La Habana, Cuba.
- Miyar, I. (2009). *Metodología para el perfeccionamiento conceptual de estudiantes universitarios en el Álgebra Básica con el empleo de las tecnologías de la información y las, Cuba*.
- Mola, C. (2013). *Tesis doctoral: Estrategia didáctica para la comprensión de los objetos del álgebra lineal en las carreras de ingeniería de la Universidad de Camagüey*. Cuba.
- Ortega, P. (2002). *La enseñanza del Álgebra Lineal mediante sistemas informáticos de cálculo algebraico*. Disertación doctoral no publicada, Universidad Complutense de Madrid, España.
- Protti, O. (2002). *La historia de las matemáticas como instrumento pedagógico*. Costa Rica
- Réshetova, Z. A. (1978). *Formación del pensamiento teórico de los estudiantes en el estudio del curso de Química General en la Educación Superior*. *La Educación Superior Contemporánea*, vol(3), 23-78.
- Rojano, T. et al (1996). *Developing Algebraic Aspects of Problem Solving within a Spreadsheet Environment*. London: KluwerAcademic Publisher.
- Sálmína, N. G. (1989). *La actividad cognoscitiva de los alumnos y el modo de estructurar la asignatura*. Ciudad de la Habana, Cuba: UH-CEPES.
- Santos Trigo, M. (1997). *La Resolución de Problemas Matemáticos: Avances y Perspectivas en la Construcción de una Agenda de Investigación y Práctica*. Centro de Investigación y de Estudios Avanzados, Cinvestav.
- Sierpínska, A. (2000). *On Some Aspects of Students Thinking in Linear Algebra*. En J. L. Dorier. (Ed.), *On the Teaching of Linear Algebra* (pp-209-246). Dordrecht: KluwerAcademicPublishers.
- Torres, C. (2011). *Formared*. Recuperado el 22 de Abril de 2014, de <http://formared.blogspot.com/2011/02/ventajas-ydesventajas-de-los.html>
- Yordi, I. (2004). *Metodología para formar en los estudiantes de Ingeniería Eléctrica la habilidad de calcular en Álgebra Lineal con sentido amplio*. Disertación doctoral no publicada, Universidad de Camagüey, Camagüey, Cuba.