
Evolución de la planificación del proceso enseñanza-aprendizaje de la Matemática en Didáctica de la Matemática ***Evolution of the planning of the process teaching learning of the Mathematics in Didactics of Mathematics***

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Resumen: La evolución de la planificación en el proceso de enseñanza-aprendizaje de la Didáctica de la Matemática es crucial para formar profesionales que dirijan la enseñanza de la Matemática en los diferentes niveles. Esta contribuye a desarrollar habilidades y enfoques necesarios para un mejor desempeño de estos. Este artículo es el resultado de la investigación realizada al comportamiento en los planes de estudio del tratamiento a la planificación en el proceso de enseñanza-aprendizaje de la Didáctica de la Matemática, fue efectuado cronológicamente, teniendo en cuenta tres aspectos fundamentales, la concepción del proceso; el contenido y la forma de tratamiento.

Palabras claves: Evolución histórica; Proceso de enseñanza-aprendizaje; Didáctica de la Matemática; Planificación.

Abstract: The evolution of the planning in the process of teaching learning of the Didactics of Mathematics is crucial to instruct professionals that direct the teaching of the Mathematics in the different levels. This contributes to developing abilities and necessary focus for a better performance of these. This article stems from the investigation accomplished to the behavior in the study programs of the treatment to the planning in the process of teaching learning of the Didactics of Mathematics, it was executed chronologically, taking three fundamental aspects into account, the conception of the process; the contents and the way of treatment.

Keywords : Historic evolution; I process of teaching learning; Didactics of Mathematics ; Planning

Introduction

The educational transformation in Cuba, beginning with the triumph of the Revolution (1959), marked the start of a significant era in the development and strengthening of the country's higher education system. This change initially focused on teacher training, recognizing education as a fundamental pillar for social and economic progress. The creation of the Pedagogical Institutes in 1964 symbolized a step toward consolidating an educational infrastructure capable of meeting the growing demand for teachers, especially at the secondary level. Therefore, in 1972, the Manuel Ascunce Pedagogical Detachment was created. Domenech, to provide a solution to the need for teachers.

The importance of these institutes lay not only in their contribution to educational expansion but also in their role in overcoming specific difficulties in teaching fundamental disciplines such as mathematics. The reliance on the methodological experience of the professors, who guided students during their work placements, highlighted the need for an integrated approach that encompassed the essential knowledge for effectively managing the teaching and learning process.

In response to these challenges, the Ministry of Higher Education (MES) was established in 1976. The founding of higher teacher training colleges in various provinces of the country not only built upon the experience accumulated by its predecessors but also expanded the capacity to meet the educational needs of the population.

This article presents a historical study of the evolution of the teaching and learning process of Mathematics Didactics in the various curricula through which the initial training of education professionals related to the teaching of Mathematics has passed; and it details how planning is addressed in these curricula. The study was conducted during the period from 1977, the year in which the first curriculum was established, until 2024, when curriculum E was in effect.

Development

The transformations that occurred in higher education led to the emergence of teacher training programs. The first, implemented in 1977 and known as Study Plan A, was a four-year program for pre-university graduates. It aimed to provide these students with a greater amount of scientific information, which proved excessive given the time available. Students began to engage with their

future profession primarily from the third year onward, as there was a need to address the teacher shortage in secondary education.

Practical teacher training lacked a pedagogical and methodological orientation for planning the teaching-learning process within the subject of Methodology of Mathematics Teaching. (Mined, 1990)

According to testimonies from students who graduated from that program, new curricula were introduced for the training of mathematics teachers in Basic Secondary and Pre-University Education. These curricula corresponded in form and content to the growing demands of society. Since there was no comprehensive representation of the content for the subject of Methodology of Teaching Mathematics, the guides and materials disseminated by the Ministry of Education and the Institute for Educational Improvement were taken into account. These materials had been developed from translations of textbooks produced in the German Democratic Republic (personal communication, Carbonell, June 14, 2022).

The teachers had little experience in the new subject, so study material was developed in the form of lectures and seminars, focused on the planning and evaluation of mathematics teaching, and seminars for the planning of thematic units and classes; this facilitated the preparation of the teachers for the design of teaching activities. (Jungk, 1979)

According to the testimony of living sources consulted about the period, teachers were concentrated in one school, and methodologists provided methodological training and lesson planning under a rigorous scheme to be followed in order to achieve a well-evaluated lesson; this hindered the organization of the lesson and, consequently, the professional development of the teachers. This led to working for several years with identical lesson plans, which limited attention to the problems of teaching and learning in students from the perspective of the teaching activity (personal communication, Camejo, June 14, 2022).

One of the positive aspects achieved in Plan A was the initiation of scientific work by students, which continues to this day. It's most severe criticism was directed at the weak link between work, research, and academic pursuits, with the latter predominating. (Mined, 1990)

The topics taught did not guarantee a systemic approach. The subjects were designed with a heavy theoretical component and a high level of logical reasoning. The common characteristic was the in-

depth study of theory with a complex mathematical foundation; the proof of theorems was emphasized. Due to this conceptual nature, its instrumental value was neglected, which manifested itself in the explanation of simple examples decontextualized from their application. (Mined, 1990)

The expository method predominated, where the teacher played the main role, directing the student toward a receptive activity with an emphasis on perception, comprehension, and memory, which led to rote learning. Furthermore, the plans and programs were applied rigidly and uniformly, with little flexibility, without sufficiently considering the student's individual characteristics and the contextualization of the content. (Gamboa, 2007)

In 1982, Study Plan B began to be implemented in regular daytime courses. This plan was characterized by its focus on improving the scientific level of the subjects, which meant that less attention was paid to the development of professional skills. It did, however, feature a better design of pedagogical practices from the early years, linking them to psychological and pedagogical subjects and teaching methodologies (Mined , 1990).

The excessive emphasis on mastering mathematical knowledge and skills was reflected in the texts developed and others used in non-teaching universities. The texts **Lectures on the Methodology of Teaching Mathematics I, II, and III**, used as basic bibliography for the Methodology of Teaching Mathematics, were neither reprinted nor improved. The expository teaching method and rote learning persisted. However, there was an improvement in the precision of the content of practical classes, as specific types of exercises were recommended. Teachers were better prepared to teach the disciplines, but they were still not fully ready to develop typical mathematical situations in a planned manner. (Mined , 1990)

Research in the field of methodology for specific disciplines focused primarily on problem solving, the development of skills and logical procedures, content structuring, the methodological treatment of thematic axes, and the validation of programs for different types and levels of education; as a result, greater curriculum flexibility was achieved than in the previous plan.

Another advantage of this plan, according to (Fernández, 1986), is the appearance for the first time of a specialist model, the declaration of objectives at three levels (knowing, knowing and knowing how to do) and of professional skills subdivided into: organizational, constructive, cognitive and

communicative and, finally, the types of activity and qualities that the future professional must possess appear.

This improvement was mainly based on the organization of the current plan, making its structure more rational, which improved the precedence regime of the subjects, made their frequency more functional and consequently structurally optimized the programs.

In response to the need to train specialists in computer science education, the National Career Commission developed a new curriculum in 1987, called Curriculum C, for the Bachelor of Education degree specializing in Mathematics and Computer Science. Among the objectives of this plan was to ensure the harmonious integration of academic, professional, and research aspects, with a broad profile that would meet the demands placed by society on the training of this type of teacher. These objectives are broken down into educational and instructional aspects and undoubtedly represent a step forward in the professional development of educators. (Ministry of Education , 1990).

This plan maintains the discipline of Methodology of Mathematics Teaching, but for the first time it was structured in three levels through which the required theoretical and practical training was to be achieved gradually; in these levels, lesson planning was made explicit. (Mined , 1990)

The discipline of Methodology of Mathematics Teaching was structured into four subjects, where lesson planning was taken into account within the skills system, but guided by the teacher, based on typical teaching situations: formulating objectives, selecting content and determining methods, means, and forms of control. (Mined, 1990)

According to testimonies from valuable teachers who studied under this curriculum, they believe that the planning of teaching activities was rigorously centralized at the national level, without taking into account the particularities of the students or the peculiarities of each educational center; in addition to rigidly prescribing the time for self-preparation , by topic and organizational form; which was contrary to the suggestion of introducing Computing arbitrarily for each center (personal communication, Gamboa, September 23, 2022).

The bibliography included Cuban texts; the book Methodology of Teaching Mathematics was published, which from that moment on became the basic text of that discipline; in this text, an analysis is made of the need for efficient direction of learning, the planning and preparation of

teaching by the teacher plays a primary role, but it does not favor the need to carry out prior preparation to the activity of planning classes. (Ballester et al., 1994).

However, a thorough analysis of some important elements for lesson planning was lacking, based on the use of technologies, the linking of content with practical life, and the formulation and resolution of problems that are considered necessary to carry out this with greater quality.

Among the main characteristics of this plan, according to López et al. (2000), are the improvements of the curriculum design of degree programs, giving a fundamental role to the objectives of the degree, year, and discipline; and the definition of the skills to be achieved by graduates. In addition to the work component, the academic and research components are integrated.

The transformations in Basic Secondary Education, resulting from the socioeconomic conditions the country faced in the 1990s, led to the universalization of Higher Education. Thus, the degree program for Comprehensive General Secondary School Teachers emerged in 2002, and the degrees in Exact Sciences, Natural Sciences, and Humanities in 2003, developed through a modular learning model.

The design of the common and profile-specific disciplines focused on the object of the profession and the development of professional skills. In this new teaching modality, the need to provide students with resources that allow them to independently seek knowledge becomes more important, suggesting methods of independent work without specifying the procedures. (Ochoa, 2014)

In this modification of curriculum C, the Methodology of Teaching Mathematics ceased to exist as a separate discipline, becoming instead content within the discipline of Mathematics and its Methodology. According to Castro (2005), new methods (video lessons, lessons using educational software) emerged to prepare teachers who would teach all the content, aiming to guarantee an engaging and high-quality mathematics education. However, the treatment given to this topic within the planning of the discipline of Mathematics and its Methodology proved insufficient.

In this curriculum, the books published in the previous plan were retained as basic reference material. This necessitated aligning the textbook content with the curricula established for the different educational levels. More contextualized supplementary documents were developed in digital format, which facilitated the study of the curriculum content. Once again, the teacher was seen as direct and authoritarian, while the student was passive and primarily focused on rote memorization (Gamboa, 2007).

With the aim of improving the preparation of student teachers, the need for substantial modifications to the teacher training system for different levels of education was determined in the 2009-2010 school year, taking into account historical experience and the new conditions under which education is developing in the country (Mined , 2010). This led to the development of Study Plan D (2010-2011), with a broad scope of action and a dual focus on Mathematics and Physics.

This study plan is structured on the basis of guaranteeing the Integration of academic, professional, and research aspects . The curriculum includes the discipline of Didactics of Mathematics. Its inclusion is justified because it: offers specific theoretical and methodological foundations for guiding the educational process and the teaching and learning of mathematics; and contributes to reinforcing convictions about the role of research and professional development in ongoing training. (Mined, 2010).

The discipline of Didactics of Mathematics is organized into three subjects. Its essential content is structured in three stages. The first stage focuses on general didactic aspects related to objectives, content, methods, resources, forms of organization of learning activities, and the assessment and evaluation of student performance. This includes the use of heuristic resources for working with groups and managing the classroom, applied to the planning and direction of the teaching and learning process of school mathematics based on the performance of didactic functions. (Mined , 2010)

The second stage includes the systematization of heuristic solution procedures and essential aspects of addressing typical situations in mathematics teaching, in accordance with the requirements of school mathematics curricula. The general heuristic program is presented as an alternative for the strategic configuration of typical situations in mathematics teaching, with a problem-solving approach and as an element to consider in planning. (Mined , 2010)

The third phase focused on deepening and systematizing general didactic aspects and typical situations in mathematics teaching through their application in the treatment of selected subject matter complexes. The analysis of teaching units in the curricula of lower and upper secondary education, along with the corresponding lesson planning and lesson systems, based on the conscious application of the knowledge, skills, and abilities developed in the discipline, constitutes a characteristic element of this phase. (Mined , 2010)

The program for the discipline and subject states among the general objectives that students, upon completion of their training in the discipline of Didactics of Mathematics, must demonstrate knowledge, skills and abilities to:

To direct the teaching-learning process of Mathematics, based on the training of the students, using the resources provided by the discipline regarding planning and evaluation, the methods for carrying out the didactic functions and the typical situations of the teaching of Mathematics, in the fulfillment of their professional functions with originality and creativity, in order to enhance the developmental characteristics of the learning of their students . (Ballester et al., 1994, pp. 5)

Furthermore, within the contents of the discipline of Didactics of Mathematics is found “The planning of teaching in the subject of Mathematics. The use of the program of the subject Mathematics and other basic and complementary documents and bibliography in the planning, and the extra-curricular work in the teaching of Mathematics” (Ballester et al., 1994, p. 6).

It is also important to highlight that planning mathematics classes and lesson systems is considered an essential skill within the program, with the aim of identifying the problems that affect their quality, and developing proposals for their solution, based didactically and methodologically in order to direct the teaching-learning process of Mathematics in education, considering the requirements set out in the corresponding programs; however, it is considered necessary to implement within this, ways that allow to favor the quality of its planning.

In summary, this plan introduces the Mathematics-Physics degree and incorporates the discipline of Didactics of Mathematics, dedicated to the study of general didactic aspects for the methodological treatment of the units worked on in Secondary Education, as well as the planning of classes, this being the form of final evaluation of the subjects that make up this discipline.

Teaching planning and achievement conducting classes that gradually demonstrate a superior quality, in The teaching and learning process of school mathematics in Basic and Upper Secondary Education is the guiding thread of teaching activities in discipline.

Regarding teaching resources, reference is made to the use of textbooks, video lectures, methodological videos, mathematical assistants, course software, and other materials. As for the bibliography, the same text from the previous curriculum is used as the core text; therefore, a group

of authors is working on the development of the book that will serve as the core text for this discipline.

The experience gathered through the systematic process of validating curricula and programs, student feedback, and considering the continuous improvement of the school curriculum and the need to prioritize learning by ensuring that students can dedicate more time to self-directed learning, led to the decision to design Study Plan “E” (2016). In this plan, instead of training Mathematics and Physics teacher in five years, two programs are offered in both modalities: a four-year program in the full-time course and a five-year program in the part-time course, one to train Mathematics teachers and the other to train Physics teachers. Professional profile, Study Plan “E” (2016).

This curriculum introduces the conception of the discipline of Research Labor Training (FLI) as the main integrating discipline, with a substantial change in its contents . In the particular case of the Bachelor's Degree in Education, Mathematics, the contents of Work Practice, Didactics of Mathematics and Methodology of Educational Research are included.

For the efficient implementation of this professional pedagogical approach in different contexts, it is necessary that the main integrating discipline foster the development of the professional pedagogical skills required to assume, from scientific, creative, and innovative positions, the professional tasks that involve teaching-methodological, educational guidance, and research-improvement functions, through the identification, formulation, and solution of professional problems, with increasing independence and scientific rigor. (MES, 2016)

The content of General Didactics is systematized. It offers specific theoretical and methodological foundations for directing the pedagogical process, and in particular the teaching and learning of Mathematics in Middle and Upper Secondary Education; it provides knowledge, skills, and abilities for diagnosing and monitoring learning in the subject from a developmental approach; it makes available to students teaching pathways, methods, and procedures, including those based on ICT, alternatives for the use of teaching aids that support understanding, as well as the criteria for their selection in diverse contexts, applicable to the fields of action and spheres of performance of the professional to be trained. (Discipline Program, 2016)

Most of the essential knowledge in the subject of Didactics of Mathematics is maintained from the previous plan, highlighting as part of the planning of the teaching-learning process in the subject of

Mathematics, the use of the subject program and other documents; basic and complementary bibliography, and extracurricular work in the teaching of Mathematics.

The essential skill is to direct the educational and teaching-learning process of Mathematics in Middle and Upper Secondary education, in accordance with Cuban educational policy and the general methodological approach of the subject at these levels (Program of the discipline Research Labor Training, 2016).

This is based on the interaction of professional pedagogical skills related to the planning, development and evaluation of classes and the professional actions of their specialty, in the fulfillment of professional pedagogical, teaching-methodological, educational guidance and research-improvement functions. (Program of the discipline Research Labor Training, 2016).

However, the use of contextualization of planning from the design of the work in the subject program is insufficient, taking into account the third improvement of the aforementioned educations, (Study Plan of Basic Secondary and Pre-University Education, 2016), for example:

The conception of a teaching- learning process characterized by the inclusion and participation of each of the students as subjects of their own learning and training. The conception of the forms and methods of methodological work in a way that allows for the preparation of educators and other educational agents and agencies. The formulation of the objectives and content of the study plans and programs based on the nine components of the Cuban educational content to achieve the comprehensive development of the student. These are:

Patriotic education; civic and legal education; scientific and technological education ; health and sexuality education with a gender focus; aesthetic education; polytechnical, labor, economic and professional education; communication education; environmental education for sustainable development and education for social guidance and projection.

Likewise, new forms of work (educational projects, complementary programs, interest groups, scientific societies, among others) are considered necessary in the preparation of the teacher in training, with the objective that they master the essential actions of teaching and methodological preparation not only from the content of Mathematics, but from all components, which will favor a greater preparation to direct the pedagogical process in general and in particular, the teaching-learning process of Mathematics.

Conclusions

The Methodology of Teaching Mathematics constitutes an important antecedent of the Didactics of Mathematics characterized by: an insufficient bibliographic production of support, a strengthening of the methodological treatment of the contents, and an eminently theoretical approach to the planning of teaching, which influenced the conception of the discipline (subject) Didactics of Mathematics, where learning and teaching form a unit in which through teaching not only learning is enhanced, but also the development of the students.

The treatment of planning content in the teaching-learning process of Mathematics from the discipline (subject) of Didactics of Mathematics in the reviewed curricula had different requirements in relation to the components of didactics. In Plan E, these elements have a better conception; however, the design of lesson planning (short term), lesson systems (medium term), and unit planning (long term) from the teaching-learning process of the discipline (subject) of Didactics of Mathematics in the programs corresponding to the historical study carried out are limited, lacking didactic foundations to achieve the adequate internalization and application of the new aspects of the third improvement carried out in Basic Secondary and Pre-University education where the student in training will work professionally. These are elements to be taken into account in the planning of the teaching-learning process of Mathematics from this subject.

The approach to planning in the teaching-learning process of Mathematics Didactics reflected an effort to develop skills relevant to teaching Mathematics. In these curricula, notable progress could be seen in the way planning was addressed; however, challenges persist in terms of practical application, contextualization to the transformations carried out in different educational systems, and the effective integration of knowledge in real teaching situations.

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