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Historical Review of the Theses Approved in the Venezuelan Master's Degree Programmes in Mathematics Education (1974-2016)

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ABSTRACT

Background: 1974 is the landmark of the launching of postgraduate studies in Venezuela and other Latin American countries. **Objective**: Answer the following question: (a) How can we detail the foundation of the PVMEMs and how have they evolved until now? **Design**: We carried out a multiple case study of a particular nature, developing it into three phases: (a) Pre-Active, considering previous studies related to the subject; (b) Interactive, corresponding to the fieldwork: identification of two active PVMEMs and semi-structured interviews with the people linked to the programmes above, who can provide information of interest to the study; this phase was closed with the organisation of the textual and oral corpora, fundamental for the study; and (c) Post-Active, when we proceed to: analyse and interpret the collected, reduced and organised information; organise the results obtained and provide the answers to the guiding questions of the research. **Data collection and analysis**: We saw that seven universities in Venezuela hold master's degree programmes in mathematics education. During the study period, 1,012 theses were approved, of which 973 (96.15%) were accepted; each thesis was coded to help locate it and, according to the interests of the study, the following aspects were considered: Author; Advisor; Qualification; Field, subjects, and objects; Paradigm/Methodical; Theories and Concepts. The oral corpus was submitted to narrative analysis, while a bibliometric analysis was conducted in the textual corpus. **Results:** (a) Regarding the details of the creation of postgraduate studies in mathematics education in Venezuela, we verified that on May 17, 1974, the PVMEM was created at the Caracas Pedagogical Institute, being also the first of the kind in Latin America; (b) Regarding the evolution of the Venezuelan master's degree programmes in mathematics education in Venezuela, we verified that 20 years passed between the

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creation of the PVMEM at the Caracas Pedagogical Institute and the National Experimental University of Guayana. Since the mid-1990s, advisors and authors of theses have increased interest in addressing questions related to the processes of teaching and learning mathematics but incipient adoption of theories specific to the area of mathematics education. **Conclusion:** For future studies, we organised a textual corpus of the master's degree theses approved by the PVMEMs between 1974 and 2016 to examine, identify the contributions with which they contributed to the Venezuelan scientific production in mathematics education, and recognise the trajectory of Venezuelan mathematics educators who, over time, achieved the status of scientific authority and developed academic genealogies.

Keywords: Social history of mathematical education, Cultural capital, Master's degree in mathematics education, Disciplinary frontiers.

Revisão histórica das dissertações aprovadas nos programas venezuelanos de mestrado em educação matemática (1974-2016)

RESUMO

Contexto: O ano de 1974 é o marco do lançamento da pós-graduação na Venezuela e em outros países latino-americanos. **Objetivo**: Responder à seguinte questão: (a) Quais foram os detalhes da fundação dos PVMEMs e como eles evoluíram desde então até agora? **Design:** Foi realizado um estudo de caso múltiplo de natureza particular, desenvolvido em três fases: (a) Pré-Ativa, consideração de estudos anteriores relacionados ao tema; (b) Interativa, correspondeu ao trabalho de campo propriamente dito: identificação dos PVMEMs atuantes e entrevistas semiestruturadas com as pessoas vinculadas aos referidos programas e que pudessem fornecer informações de interesse do estudo; esta fase foi encerrada com a organização dos Corpus Textual e Oral, básicos para o estudo; e (c) Pós-Ativa; nesta fase procedeu-se a: analisar e interpretar a informação recolhida, reduzida e organizada; organizar os resultados os resultados obtidos e propor as respostas às questões norteadoras da pesquisa. **Coleta e análise de dados:** Constatou-se que na Venezuela existem sete universidades onde são desenvolvidos Programas de Mestrado em Educação Matemática; no período do estudo foram aprovadas 1.012 dissertações, das quais 973 (96,15%) foram acessadas; cada dissertação foi codificada para facilitar sua localização e, de acordo com os interesses do estudo, foram considerados seus seguintes aspectos: Autor; Tutor; Título; Campo, sujeitos e objetos; Paradigma/Metódico; Teorias e Conceitos. O corpus oral foi submetido a uma análise narrativa, enquanto uma análise bibliométrica foi realizada no corpus textual. **Resultados:** (a) Em relação aos detalhes da fundação dos estudos de pós-graduação em Educação Matemática na Venezuela, foi possível verificar que foi durante os primeiros anos dos anos setenta, especificamente o 17 de maio de 1974, quando foi criado o primeiro PVMEM no Instituto Pedagógico de Caracas, sendo também o primeiro do gênero na América Latina; (b) em relação à Evolução dos Programas de Mestrado Venezuelanos em Educação Matemática na

Venezuela, verifica-se que entre a fundação do PVMEM do Instituto Pedagógico de Caracas e o mais recentemente fundado na Universidade Nacional Experimental de Guayana, transcorreram 20 anos; desde meados da década de 1990, houve um aumento do interesse de orientadores e autores de dissertações em abordar questões relacionadas aos processos de ensino e aprendizagem da matemática e a adoção incipiente de teorias próprias da área de Educação Matemática e surgiram linhas de pesquisa específicas para este campo. Como **prospectiva** do estudo, destaca-se a organização de um corpus textual das dissertações aprovadas nos PVMEMs no período 1974-2016, resta examiná-las, identificar as contribuições com as quais contribuíram para a produção científica venezuelana em Educação Matemática e reconhecer a trajetória dos educadores matemáticos venezuelanos que, ao longo do tempo, conseguiram alcançar o status de autoridade científica e desenvolver genealogias acadêmicas.

Palavras-chave: História Social da Educação Matemática, Capital Cultural, Mestrado em Educação Matemática, Fronteiras Disciplinares.

Revisión histórica de las disertaciones aprobadas en los programas venezolanos de maestría en educación matemática (1974-2016)

RESUMEN

Contexto. 1974 es el hito del lanzamiento de los estudios de posgrado en Venezuela y otros países de América Latina. **Objetivo.** Dar respuesta a las siguientes interrogantes: (a) ¿Cuáles fueron los pormenores de la fundación de los PVMEM y cómo han evolucionado desde entonces hasta ahora? **Diseño.** Se realizó un estudio de caso múltiple de carácter particularista, desarrollado en tres fases: (a) Pre-Activa, consideración de estudios previos relacionados con la temática; (b) Interactiva, se correspondió con el trabajo de campo propiamente dicho: identificación de los PVMEM activos y entrevistas semi-estructuradas a las personas vinculadas a dichos programas y que pudiesen aportar información de interés para el estudio, esta fase concluyó con la organización del Corpus Textual y del Corpus Oral, básicos para el estudio; e (c) Post-Activa; durante esta fase, se procedió a: analizar e interpretar la información recabada, reducida y organizada; organizar los resultados los resultados obtenidos y proponer las respuestas a las preguntas orientadoras de la investigación. **Recopilación y análisis de datos.** Se pudo constatar que en Venezuela existen siete universidades donde se desarrollan Programas de Maestría en Educación Matemática; durante el periodo en estudio han sido aprobadas 1012 disertaciones, de las cuales se tuvo acceso a 973 (96,15%); cada disertación fue codificada para facilitar su localización y, de acuerdo con los intereses del estudio, fueron considerados sus aspectos siguientes: Autor; Tutor; Título; Campo, sujetos y objetos; Paradigma/Metódica; Teorías y Conceptos. El corpus oral fue sometido a un análisis narrativo, en tanto que del corpus textual se realizó un análisis bibliométrico. **Resultados.** (a) En relación con los pormenores de la fundación, de los estudios de postgrado en Educación Matemática en Venezuela, se confirmó que fue durante los

primeros años de la década de los setenta, específicamente el 17 de mayo de 1974, cuando se creó el primer PVMEM en el Instituto Pedagógico de Caracas, siendo también el primero de su tipo en América Latina; (b) En relación con la Evolución de los Programas Venezolanos de Maestría en Educación Matemática en Venezuela, se verifica que entre la fundación del PVMEM del Instituto Pedagógico de Caracas y el más recientemente fundado en la Universidad Nacional Experimental de Guayana, transcurrieron 20 años; desde mediados de la década de 1990, se notó un incremento del interés de los orientadores y autores de las disertaciones, por abordar asuntos relacionados con los procesos de enseñanza y aprendizaje de las matemáticas y la adopción incipiente de teorías propias del campo de la Educación Matemática y han emergido líneas de investigación propias de este campo. Como **prospectiva** del estudio, se resalta la organización de un corpus textual de las disertaciones aprobadas en los PVMEM en el periodo 1974-2016, queda pendiente examinarlas, identificar los aportes con los que han contribuido a la producción científica venezolana en Educación Matemática y reconocer la trayectoria de los educadores matemáticos venezolanos que, con el pasar del tiempo, lograron alcanzar el estatus de autoridad científica y desarrollar genealogías académicas.

Palabras clave: Historia Social de la Educación Matemática, Capital cultural, Maestrías en Educación Matemática, Fronteras disciplinarias.

INTRODUCTION

The research reported in this article had, as a matter of investigative interest, the theses defended and approved in the Venezuelan master's degree programmes in mathematics education between 1974 and 2016. The initial year marks the beginning of postgraduate studies in mathematics education not only in Venezuela but in the entire Latin American region, as confirmed by Pacheco Moros and González (2021). Indeed, it was in Caracas (Venezuela) when, in 1974, the master's degree programme in mathematics education was created at the Pedagogical Institute of Caracas (Instituto Pedagógico de Caracas - IPC). The founder and first coordinator of the institute was Dr Mauricio Orellana Chacín.

The contextual reference framework of this research is the Social History of Mathematics Education in Ibero-America (Historia Social de la Educación Matemática en Iberoamérica - HISOEM-IB), developed in the PhD in Mathematics Education at the Libertador Experimental Pedagogical University (Universidad Pedagógica Experimental Libertador - UPEL, Venezuela) (González, 2014a; 2016).

As a science, history (Ferrater, 2011) allows us to situate events chronologically. Thus, when referring to events that have occurred during a

time other than the one we want to describe and interpret, it is necessary to assume a historical perspective to situate them in an adequate geographical and temporal framework. We assume that HISOEM

> takes into consideration the sociocultural practices (Mendes & Silva, 2017) associated with processes of teaching, learning, studying, evaluating, and creating mathematics –both academic and school and daily– carried out by both recognised or reference (Toulmin, 1972/1977) and anonymous authors/agents: classroom teachers, street vendors, artists from various areas, artisans, doll makers, sewists, etc.
>
> In this way, HISOEM is a perspective of the history of mathematics education that goes beyond the stories, the actions of two heroes, two didactic books and other materials used in mathematics education. It is a history of a disciplinary field that considers ideas, concepts, and theories originating from its own mathematics, history, sociology, epistemology, anthropology, philosophy and other human sciences. *The central aspect of this perspective is to examine the development over time (history) of the interactions between the protagonists (agents and authors of reference) of various situations and social practices (sociology) in multiple contexts (diffusion scenarios) where teaching practices are developed, learning, studying, and evaluating the different varieties of mathematics:* academic (created by professional mathematicians), school (taught in different educational institutions), daily (used by people in their various professionals and non-professional daily activities, such as carpenters, bricklayers, many other workers or technicians, artisans, and fishermen, etc.) (González, 2022, pp. 447-448).

Taking into account the central aspect of HISOEM, the study focused on one of the scenarios of diffusion of mathematics education in Venezuela (González, 2014b; Humbría & González, 2020), in this case, the Master's Degree Programmes in Mathematics Education (Programas de Maestría en Educación Matemática - PVMEM) that are developed in the country, emphasising one of its most relevant products: the theses, i.e., the systematic studies of theoretical or practical problems typical of mathematics education and that allow its author to demonstrate "mastery in the area of the master's degree award and its own research methods" (UPEL, 2016, p. 15). The

programmes mentioned are part of the "institutional forum" (Moreira, 2005) of Venezuelan mathematics education and "they have become one of the most relevant components of the disciplinary, institutional forum. Nowadays, it is almost impossible to separate research from postgraduate studies. Even in universities, commissions, councils, and vice-rectorates often exist for research and postgraduate studies" (Moreira, 2005, p. 187).

So, considering the fundamental role played by the master's degree programmes above in the growth and disciplinary consolidation of mathematics education in Venezuela, with this research, we intended to build answers to the following questions: (a) What were the details of the foundation of the postgraduate studies in mathematics education in Venezuela? (b) How did the PVMEM evolve?

REPERTOIRE OF THEORETICAL CONCEPTUAL REFERENCE COORDINATES

This section exposes the theoretical and conceptual location of the research, explaining its historical, sociological, epistemological, and systemic perspectives.

Historical Perspective

From the historical point of view, we considered Barros' (2008) approaches. Regarding the historical dimensions proposed by this author, the study assumes the history of the present time (Soto Gamboa, 2004). Regarding his approach, we adopted the archaeological-genealogical perspective, suggested by Álvarez-Uría (2008) and applied by Romero Pérez and Villasmil (2018a, 2018b) in the realm of mathematics education as a disciplinary field (Bourdieu, 2000, 2011), considering the HISOEM (González, 2022).

Why the history of the present time? As Venezuelan mathematics educators, we have been directly connected to the development of mathematics education in Venezuela. We were educated as mathematics teachers and later became teacher educators. We also graduated from one of the master's degree programmes that are the object of interest of this research. At present, we assume mathematics education as our field of professional activity and remain linked as professors and advisors to at least one of these programmes. Therefore, we are contemporaneous with our matter of investigative interest

and, consequently, agents and witnesses of the history we are currently telling (Soto Gamboa, 2004).

On the other hand, executing the work implied a process of "archaeological immersion and hermeneutical contemplation" (González & Villegas, 2009, p. 103); that is, we had to delve into the files, repositories, and documents to obtain robust and suitable information on which base we could build the guiding questions of this study. The archaeological nature of the study refers to searching, locating, obtaining, registering, describing, ordering, organising, tabulating, etc., the information from/in the theses approved in the PVMEMs during the period 1974-2016. The hermeneutic aspect concerns the authors' interpretation of the previously collected and organised information in the textual corpus of analysis. This characteristic of the study is genealogical (Álvarez-Uría, 2008), that is, explanatory. It is about examining historical aspects (in our case, the future of the PVMEMs) not from the past but from the present and thereby contribute to the historical reconstruction of mathematics education in Venezuela (González, 2015). By complementing the archaeological perspective with the genealogical one, it is possible to build a trajectory that links the genesis of the PVMEMs with their current situation and, from there, identify some of the factors that have conditioned the development as a disciplinary field of mathematics education in Venezuela (Malizia & González, 2013; González, 2014). So, by adopting the genealogical perspective in this work, according to Mendes and Silva (2014), we intend to study the origin and evolution of the PVMEMs from a substantial part of their scientific production represented by the theses approved since the first of the programmes founded in Venezuela.

Finally, considering the PVMEMs as part of the Institutional Forum of Diffusion (Moreira, 2005) of mathematics education in Venezuela since they are scenarios of diffusion (Humbría & González, 2020), where the professional activity of their authors/agents of reference is manifested (Toulmin, 1972/1977). Furthermore, their interactions have contributed to the consolidation of the discipline in the country. In this study, we adopted the social history of mathematics education – (HISOEM), conceived as a narrative

> that considers notions, concepts, and theories from mathematics, history, sociology, epistemology, anthropology, philosophy and other diverse human sciences. The central aspect of this perspective is to examine the development over time (history) of the interactions between the protagonists (agents and authors of reference) of the different situations and

> social practices (sociology) in the multiple contexts (scenarios of diffusion) the teaching practice, learning, study and evaluation of the different varieties of mathematics develop: academic (created by professional mathematicians), school (the taught in the different educational institutions), daily (that people use in their various professional and non-professional daily activities), professional, such as carpenters, masons, and many other workers or technicians; as well as artisans, fishermen, etc.) (González, 2022, p. 448).

In summary, the research reported is located in the field of mathematics education, studied from the present time, from a historical-social perspective and approaching it from an archaeo-genealogical perspective.

Sociological Perspective

In its sociological dimension, in this study, we assumed Bourdieu's (2000) formations related to his idea of the scientific field, which he defines as:

> A system of objective relationships between positions acquired (in previous struggles), it is the place (that is, the game space) of a competitive struggle whose specific challenge is the monopoly of scientific authority, inseparably defined as technical capacity and social power or, if one prefers, the monopoly of scientific competence, which is socially recognised to a given agent, understood in the sense of the ability to speak and intervene legitimately, i.e., authorised and authoritative in matters of science (p. 12).

For the specific case of mathematics education in Venezuela, such an "objective relationship system" is manifested in the SOEMV. This allows illustrating relationships and positions assumed by the action in the different diffusion scenarios that constitute the institutional discussion forum of its actors of reference who, as social agents in the field and according to the opportunities they have to act, acquire scientific authority and, therefore, accumulate cultural capital, which manifests itself in different forms or states and consists

> [...] First, in the transmission and accumulation of experiences, values, knowledge, and attitudes (incorporated state); secondly, in possession of tangible cultural goods, such as books, paintings, sculptures, etc. (objectified state); and third,

> in a certificate endorsed by legitimising institutions (institutionalised state), in the form of institutional recognition of the cultural capital possessed by a specific agent, the school diploma also makes it possible to compare its holders and even "exchange" them (substituting one for the other in succession). It also makes it possible to establish convertibility rates between cultural capital and economic capital, guaranteeing the monetary value of a particular cultural capital. (Bourdieu, 2011, p. 220)

Paraphrasing what was exposed by this distinguished French sociologist, the incorporated state of the cultural capital is constituted by everything that an individual, as a social agent, "knows" (the knowledge they have) and "knows how to do" (skills, dexterities, abilities competencies) and the attitudes and values that govern their actions within their society; the objectified state is constituted by all the productions of the most varied nature that it has managed to generate throughout its existence and that is manifested in tangible goods; finally, the institutionalised state is made up of the recognitions that have been conferred on it due to its performance within organisations, institutions and other groups of a collective nature, whether academic, professional, political, religious, sports, etc.

Table 1

Cultural Capital of Mathematics Education of Venezuela, produced in the PVMEM

State	Description
Incorporated	Represented by the knowledge associated with mathematics education as a discipline acquired by master's degree students. Also, for their skills, abilities, and competencies to produce knowledge through different research strategies.
Objectified	Consisting of the theses or undergraduate projects prepared, presented, and defended publicly and approved by the students of the PVMEM.

Institutionalised	The master's degree obtained conferred on each student of a PVMEM who had their theses approved.

Thus, in this study, we consider it pertinent to use Bourdieu's notion of cultural capital as a category of interpretation and analysis of the theses approved in the PVMEM, conceiving them as "objectified cultural capital" of Venezuelan mathematics education as they are the result of the joint work of the postgraduate students and their advisors, tutors, or mentors developed within specific diffusion scenarios such as the master's degree programmes articulated in the SOEMV, making them creditors of the academic master's degree in mathematics education. Table 1 summarises the three states of the cultural capital of mathematics education in Venezuela, produced in the PVMEM.

Epistemological Perspective

The epistemological perspective of this study is Toulmin's (1972/1977) conceptual evolutionism. This author suggests that the formation of scientific concepts is not an exclusively individual matter of science makers, but rather that they evolve as they are used collectively (Siqueira Harres & Porlán Ariza, 2021).

The Toulminian model of "conceptual evolutionism" has its genesis in Lorenz's (1941) statement: "[...] knowledge should be considered (as) a biological phenomenon, product of the evolution of organisms (concepts)" (Lorenz, 1941, cited by Alsina Calvés, 2006, p. 232) (brackets added).

In this regard, Porlán (1989) points out that

> **The evolution of concepts and the intellectual ecology of people do not obey an exclusively individual process; on the contrary, they are the result of social communication at all levels (direct, written, audiovisual, etc.) and of its capacity to solve the individuals' most pressing problems and their cultural environment.** As a consequence of the continuous social production of conceptual varieties, it is possible to select and retain for their collective use those with more power to solve each type of specific problem. (Porlán, 1989, p. 58) (bold in the original)

In this study, Toulmin's concepts are considered insofar as they allow us to understand the process of disciplinary consolidation, applied to the case of mathematics education in Venezuela, understanding such a process not as paradigmatic revolutions, as Thomas Kuhn would say (2001), but rather as "conceptual evolutionary," as Toulmin affirms. In the words of Moreira and Massoni (2016):

> From Toulmin's standpoint, disciplines are also seen as evolving –not eternal– historical entities, and as rational enterprises in historical development. Intrinsic (or intellectual) and extrinsic (or social) factors condition this evolution, this development. For example, the creation of reference groups, associations, and recognised journals plays an important role in the maturation and disciplinary evolution. (Moreira & Massoni, 2016, p. 20) (authors' translation)[1]

Based on what is stated in this section, we estimate that the PVMEMs are spaces where the concepts that, in their evolutionary process, help to shape and consolidate mathematics education as a disciplinary field in Venezuela circulate and are collectively used (by master's degree students, professors, advisors, and researchers).

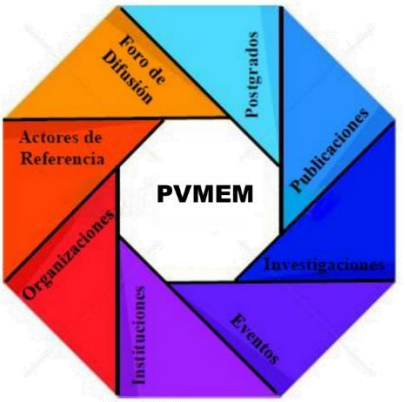
Systemic perspective

The study assumed the systemic vision of mathematics education in Venezuela proposed by Beyer (2001), expanded by Belisario (2015) and, later energised by Humbría and González (2020), in the so-called "Octocategorial System of Venezuelan Mathematics Education" (Sistema Octocategorial de la Educación Matemática Venezolana - SOEMV) (Figure 1).

[1]The disciplines, in Toulminian ethics, are also seen as historical entities in evolution, not eternal, and as rational enterprises in historical development. There are intrinsic (or intellectual) and extrinsic (or social) factors that condition this evolution, this development. For example, the creation of reference groups, associations, and recognized journals play an important role in maturation and disciplinary evolution. (Moreira and Massoni, 2016, p. 20).

Figure 1

Octocategorical System of Venezuelan Mathematics Education (SOEMV)
(Adapted from Humbría and González, 2020, p. 17)



The SOEMV emerges by incorporating into the dynamic categorical epistemic synergy (Sinergia Epistémica Categorial Dinámica - SECD) conceived by Belisario (2015), the category Forums or diffusion scenarios. In this way

> the category *Postgraduate courses*, that is, higher level education programmes, such as specialisation, master's degrees and doctoral studies, are related both to the *Institutions*, which are the spaces where these studies are developed [forming part *of the Institutional Diffusion Forum*, Moreira (2005)] and the *Actors of Reference*, who contribute to teacher education, turning towards the production of knowledge through *Research*, which are consigned as undergraduate completion papers, master's degree papers, and doctoral theses, whose results are made visible through *Publications* of scientific articles in specialised journals; or communications in *events* [promoted by local, national, regional, or worldwide *Organisations* related to mathematics education, such as the national societies of mathematics education, the Ibero-American Federation of Mathematics Education, the Inter-American Commission on Mathematics Education, or the Latin American Committee for Educational Mathematics]; In short,

> the Postgraduate courses category is related to institutions, actors of reference, research, and publications. (Humbría & González, 2020, p. 19) (brackets added)

The systemic perspective, synthesised in the SOEMV, in line with what was affirmed by Godino (2000), allows us to attribute to mathematics education in Venezuela the character of a disciplinary field the PVMEMs have contributed to consolidate.

METHODOLOGY

From the point of view of its *design*, the research can be characterised as *multiple case studies* (Yin, 1994) because it is based on the analysis of the approved master's degree works from several Venezuelan programmes in mathematics education (PVMEM). In this sense, it was *a particular study* since the theses are unique and unrepeatable. Although locating them demanded much effort, we could access them through different channels, some of which allowed us to obtain information from people who were –or are– directly linked to the PVMEMs.

Following the suggestion of Martínez Bonafé (1988) to develop the design of this type of research, the study was carried out in three phases: (a) Pre-Active; (b) Interactive; and (c) Post-Active.

Since the study is part of a long-term investigation related to the Social History of Mathematics Education in Venezuela (HISOEM-Ve) (González, 2014), during the *pre-active* phase, we had to define the inquiry target. Hence, we decided to continue with previous studies related to the PVMEMs (Table 2), assuming the theses as the focus and defining 1974 (the year of the foundation of the first PVMEMs) to 2016 as the period to be investigated.

Table 2

Previous studies related to PVMEMs within the framework of the HISOEM-Ve project

Author; Qualification; Type Of Job; Institution;	Year
González. F. E. *Apuntes Acerca de la Producción Cognoscitiva de la Educación Matemática en Venezuela Caso: Maestría en Matemática, Mención Docencia; Facultad de Humanidades y Educación de la Universidad del Zulia.*	2000

http://revistaparadigma.online/ojs/index.php/paradigma/article/view/252	
Aguilera, R. *Estudio Analítico de los Trabajos de Grado Presentados en los Programmeas de Postgrado sobre Enseñanza de la Matemática en Venezuela (1990 – 1999).* Master's degree (unpublished) Universidad Nacional Experimental Rómulo Gallegos, San Juan de los Morros, Estado Guárico, Venezuela	2000
Pestana, F. *Análisis de los Trabajos de Grado de la Maestría "Enseñanza de la Matemática" Universidad Nacional Experimental Rómulo Gallegos* Promotion work to qualify for the assistant category Universidad Pedagógica Experimental Libertador, Instituto Pedagógico Rural El Mácaro	2010
Pacheco Moros, V; Martínez, Oswaldo & González, F. E. *Análisis de los trabajos de grado de la maestría en Educación Matemática de la Universidad de Carabobo: 2005-2014.* Article published in the journal Unión Unión - Revista Iberoamericana De Educación Matemática, *14*(53), 1 ago. 2018	2018
Bencomo, D. & González, F. E. *La Investigación en los Programmeas de Formación del Educador Matemático. Caso: UNEG* Communication in the first online congress on the education of mathematics, sciences and technology teachers Primer Congreso Virtual sobre Formación de Profesores de Matemática, Ciencias y Tecnologías (I CONVIBE-FORPRO), Noviembre, 21, 22 y 23, 2018. pp 299 – 312 Evento Virtual	2019
Pacheco Moros, V. *Historia y Producción científica de las maestrías venezolanas en Educación Matemática.* PhD Thesis (unpublished) - PhD in Mathematics Education Universidad Pedagógica Experimental Libertador (Núcleo Maracay),	2020

The *interactive phase* corresponded to the fieldwork. The first step consisted of identifying the PVMEMs that were active and establishing contact with people linked to said programmes and who could provide information of interest to the study: coordinators, professors, administrative staff, students, and even service, support and security personnel, who were given details about the nature, objectives, and importance of the study. These first approaches, which progressively deepened, allowed access to the theses, many of which (due to the time elapsed since they were defended and approved) were found in the

"historical files," colloquially called "cold case files," given that, although they retain significant documentary value, they are no longer part of the dynamics of the programme's daily academic activities. These files were usually not stored in suitable sanitary conditions to safeguard researchers' health, forcing researchers to wear masks, gloves, and a flashlight. Moreover, several theses and other essential documents for research were stored in online repositories of the host universities of the PVMEMs.

During the interactive phase, we could also interview people who had relevant information about any of the programmes, such as Dr Mauricio Orellana, founding coordinator of the master's degree programme of the Pedagogical Institute of Caracas (Pacheco Moros, 2020);

The *interactive phase* concluded with the organisation of the textual corpus and the oral corpus. The first is constituted by two matrices, where the summaries and the minutes of approval of each located thesis were included. In the second, the official and historical documents of each PVMEM studied were included (official documents of the Venezuelan master's degree thesis in ME: study curriculum, study programmes, list of coordinators of the programmes (ordered chronologically), a historical review of the creation of the PVMEMs, redesign in the case of those programmes that changed their names or lines of research, and historical documents on the creation of the universities where the PVMEMs are developed. These documents were found in published books and articles).

The oral corpus was built from the transcripts of the testimonies offered by the interviewed people, coordinators of the master's degree programmes, advisors and examiners, i.e., chroniclers who knew the history of the PVMEM investigated. The data was collected through interviews conducted via email, WhatsApp text messages, Skype synchronous calls, video calls on mobile phones and Facebook messages.

Once both corpora were constituted and, to examine the traced theses, we proceeded to our respective narrative and bibliometric analysis.

Finally, during the *post-active phase*, we proceeded to: analyse and interpret the information collected, reduce and organise the results obtained, and propose the answers to the guiding questions of the investigation.

RESULTS

Organisation of the Information Collected

The research revealed seven universities developed master's degree programmes in mathematics education in Venezuela. Four programmes are based at the Libertador Experimental Pedagogical University (Universidad Pedagógica Experimental Libertador – UPEL - Pedagogical Institutes of Caracas, Barquisimeto, Maracay, and Maturín). The remaining three are based at the University of Carabobo (Universidad de Carabobo - UC), the Rómulo Gallegos National Experimental University (Universidad Nacional Experimental Rómulo Gallego*s* - UNERG), and the National Experimental University of Guyana (Universidad Nacional Experimental de Guayana - UNEG). Of these programmes, 973 of the 1,012 catalogued theses were located (Table 3).

Table 3

Number of dissertations per university.

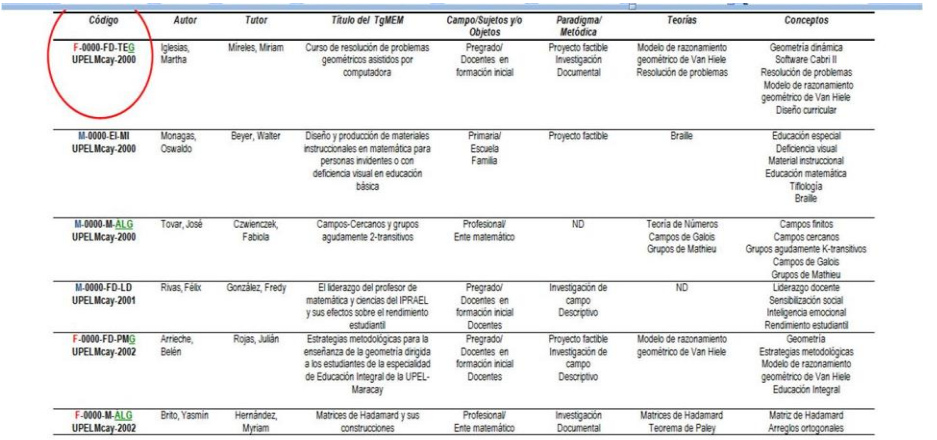
University	*Catalogued Theses*	*Located Theses*	*Missing Theses*
UPEL (Instituto Pedagógico de Caracas)	84	79	5
UPEL (Instituto Pedagógico de Maracay)	106	95	11
UPEL (Instituto Pedagógico de Barquisimeto)	140	139	1
UPEL (Instituto Pedagógico de Maturín)	158	155	3
UC	326	315	11
UNERG	179	174	5
UNEG	19	16	3
Total	**1,012**	**973**	**39**

Notes: Universidad Pedagógica Experimental Libertador (UPEL); Universidad de Carabobo (UC); Universidad Nacional Experimental Rómulo Gallegos (UNERG); Universidad Nacional Experimental de Guayana (UNEG).

Each thesis was coded to facilitate its location and, according to the interests of the study, the following aspects were considered, as shown in Figure 2: Code; Author; Advisor; Qualification (Title); Field/Subjects and/or Objects; Paradigm/Methodology; Theories; and Concepts.

Figure 2.

Sample of the coding and aspects considered in the theses



Código	Autor	Tutor	Título del TgMEM	Campo/Sujetos y/o Objetos	Paradigma/ Metódica	Teorías	Conceptos
F-0000-FD-TEG UPELMacay-2000	Iglesias, Martha	Mireles, Miriam	Curso de resolución de problemas geométricos asistidos por computadora	Pregrado/ Docentes en formación inicial	Proyecto factible Investigación Documental	Modelo de razonamiento geométrico de Van Hiele Resolución de problemas	Geometría dinámica Software Cabri II Resolución de problemas Modelo de razonamiento geométrico de Van Hiele Diseño curricular
M-0000-EI-MI UPELMacay-2000	Monagas, Oswaldo	Beyer, Walter	Diseño y producción de materiales instruccionales en matemática para personas invidentes o con deficiencia visual en educación básica	Primaria/ Escuela Familia	Proyecto factible	Braille	Educación especial Deficiencia visual Material instruccional Educación matemática Tiflología Braille
M-0000-M-ALG UPELMacay-2000	Tovar, José	Czwienczek, Fabiola	Campos-Cercanos y grupos agudamente 2-transitivos	Profesional/ Ente matemático	ND	Teoría de Números Campos de Galois Grupos de Mathieu	Campos finitos Campos cercanos Grupos agudamente K-transitivos Campos de Galois Grupos de Mathieu
M-0000-FD-LD UPELMacay-2001	Rivas, Félix	González, Fredy	El liderazgo del profesor de matemática y ciencias del IPRAEL y sus efectos sobre el rendimiento estudiantil	Pregrado/ Docentes en formación inicial Docentes	Investigación de campo Descriptivo	ND	Liderazgo docente Sensibilización social Inteligencia emocional Rendimiento estudiantil
F-0000-FD-PMG UPELMacay-2002	Arrieche, Belén	Rojas, Julián	Estrategias metodológicas para la enseñanza de la geometría dirigida a los estudiantes de la especialidad de Educación Integral de la UPEL-Maracay	Pregrado/ Docentes en formación inicial Docentes	Proyecto factible Investigación de campo Descriptivo	Modelo de razonamiento geométrico de Van Hiele	Geometría Estrategias metodológicas Modelo de razonamiento geométrico de Van Hiele Educación Integral
F-0000-M-ALG UPELMacay-2002	Brito, Yasmín	Hernández, Myriam	Matrices de Hadamard y sus construcciones	Profesional/ Ente matemático	Investigación Documental	Matrices de Hadamard Teorema de Paley	Matriz de Hadamard Arreglos ortogonales

Narrative Analysis and Bibliometric Analysis

We conducted a narrative analysis supported by the information provided by the people interviewed to identify some of the historical milestones of the Venezuelan master's degree programmes in mathematics education (PVMEM).

Authors such as González (2014) suggest that the founding milestone of mathematics education as a disciplinary field in Latin America was the holding of the First Inter-American Conference on Mathematics Education (Primera Conferencia Interamericana de Educación Matemática - I CIAEM), in December 1961 in Bogotá, Colombia. In this event, Prof Manuel Balanzat was the only member of the Venezuelan delegation. In the other editions of the CIAEM, the number of Venezuelan delegates increased to such an extent that the IV CIAEM was held in Caracas under the coordination of Dr Mauricio Orellana, founding coordinator of the master's degree programme in mathematics education of the PI of Caracas, whose project was approved on May 17, 1974, starting its first cohort on September 2, 1974. The details of the founding process of this programme, considered the first in Latin America, are exposed in Pacheco Moros and González (2021).

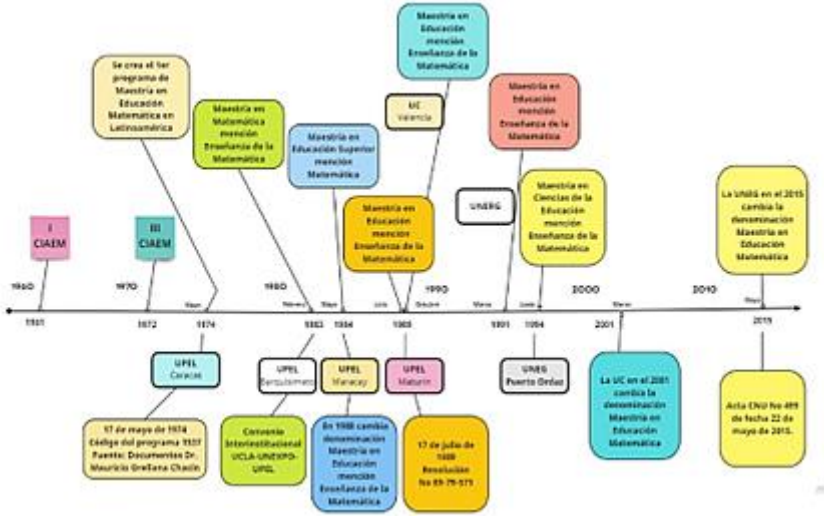
Almost a decade later, in 1983, the inter-institutional master's degree programme in mathematics education was created in Barquisimeto (Lara state), which, through an agreement signed by the three most important higher education institutions in that region, awarded three mentions: pure mathematics, applied mathematics, and mathematics teaching, which would be conferred by the Lisandro Alvarado Central Western University (Universidad Centroccidental Lisandro Alvarado - UCLA), the Antonio José de Sucre National Experimental Polytechnic University (Universidad Nacional Experimental Politécnica Antonio José de Sucre - UNEXPO) and the Libertador Experimental Pedagogical University (Universidad Pedagógica Experimental Libertador - UPEL, PI of Barquisimeto).

In 1984, in UPEL – PI of Maracay, the master's degree programme in higher education, mention in mathematics, was created. This programme approved some theses that addressed specific mathematical topics on differential equations, algebra, and mathematical analysis. However, given the low number of students, it was practically deactivated and, being the object of a curricular reform, gave way, in 1988, to the master's degree programme in education, mention in mathematics teaching, beginning its first cohort with this denomination in 1989. On July 17 of this same year, a similar programme was created at UPEL – PI of Maturín.

According to the exposed data, we can infer that the Universidad Pedagógica Experimental Libertador has contributed since the 1970s by laying the foundations for the development of postgraduate studies in mathematics education in Venezuela. This pioneering work continued in other universities in the country. For example, in October 1989, the Universidad de Carabobo created its master's degree programme in education, mention in mathematics teaching, which, in 2001, turned into a master's degree programme in mathematics education. In 1991, UNERG also created a master's degree programme in education, mention in mathematics teaching. Finally, in 1994, UNEG of Puerto Ordaz, Bolívar state, created the master's degree programme in mathematics educational sciences, mention in mathematics teaching, which changed its name in 2015, becoming a master's degree programme in mathematics education. The chronological trajectory of the creation of the PVMEMs is illustrated in Figure 3.

Figure 3

The chronological trajectory of the creation of MME programmes in Venezuela.



Bibliometric Analysis

The bibliometric analysis studies the organisation of scientific and technological sectors through bibliographic sources to identify the actors (researchers) and their relationships and reveal research –theoretical-conceptual and methodological– trends (Spinak, 1996). To do so, it was necessary to previously define bibliometric indicators referring to the activity of the PVMEMs linked to the theses approved in these programmes during the period 1974-2016.

Indicators applied in the bibliometric analysis of the PVMEM activity associated with the production of theses

1. ***Productivity indicators***:
    a. Regularity: this indicator shows, in triennials, the number of theses approved in the PVMEMs from 1974 to 2016.
    b. Gender of the author of the thesis: this indicator has two options (male or female)
2. ***Indicators of the study context:*** Levels of the Venezuelan educational system

a. Early education
b. Elementary education
c. Secondary education
d. Undergraduate studies
e. Postgraduate studies

3. Theoretical-conceptual indicators

(a) *Theories:* theories adopted in the theses approved from 1974 to 2016. Own theories or specific theories of the discipline, or general theories that are not own but that are assumed in the investigative process.

(b) Mathematical Topics:
TO[2]: Arithmetic, Elementary Arithmetic, Arithmetic Calculation, and others.
ALG: Algebra, Linear Algebra, Vector Algebra, Abstract Algebra, and others.
AM: Mathematical Analysis, Calculus, Differential Calculus, Integral Calculus, Topology, and others.
G: Geometry, Analytical Geometry, Descriptive Geometry, Differential Geometry, Euclidean Geometry, and others.
E/P: Statistics, Descriptive Statistics, Inferential Statistics/Probability, Probability Calculation, Classical Probability, and others.
TMnoE: Unspecified Mathematical Topic.

(c) *Disciplinary Frontiers of Research in Mathematics Education* (Fronteras Disciplinarias de la Investigación en Educación Matemática - FDIEM):

> Theoretical perspectives assumed by the authors of the theses (master's degree student and advisor). These emerge from mathematics education research and are fed by this disciplinary field; they are not included in ME because they are somehow independent regarding their structure for research. Moreover, they show the evolution of the research trend.

[2] The acronyms are as in the original, in Portuguese.

a. **Mathematical Object (MO / OM[3])**: FDIEM that ontologically assumes to guide the teaching and learning of a specific mathematical object.
b. **Other Sciences (Osc / OC):** FDIEM that ontologically considers guiding the teaching and learning of mathematics from other areas such as engineering, accounting, economics, agronomy, architecture, aviation, physics, chemistry, and biology, among others.
c. **Especially inclusive (EI / EI)**: FDIEM that ontologically assumes to guide the teaching and learning mathematics in special education, terminology attributed to Martínez (2018).
d. **Scientific Field (ScF / CC):** FDIEM ontologically directs the study of the social behaviours of research in mathematics education, seen from the cultural capital produced in the SEMV (Beyer, 2001).
e. **Mathematics Education (ME / EM):** FDIEM that ontologically supposes to guide the teaching and learning of mathematics, describing the study processes and designing and developing educational resources (playful games, concrete material, instructional material, Web pages).
f. **Teacher Education (TE / FD):** FDIEM that supposes ontologically guiding the teaching and learning of mathematics from teacher education: initial and continuing education of mathematics teachers or elementary school teachers.
g. **Mathematics (M / M):** as an interdisciplinary field, these studies focus only on the mathematical entity. In this investigative category, mathematics is studied as a science.

[3] NT. After the slash is the acronym in Portuguese.

Results of the Bibliometric Analysis

Productivity indicators

(a) Regularity

During the interactive phase of the study, we came across 973 of the 1,012 theses approved from 1974 to 2016, in the seven PVMEMs examined in this study. Figure 4 shows the distribution by institution and triennials

Figure 4

Distribution, by institution and year, of the theses approved in the PVMEMs from 1974 to 2016.

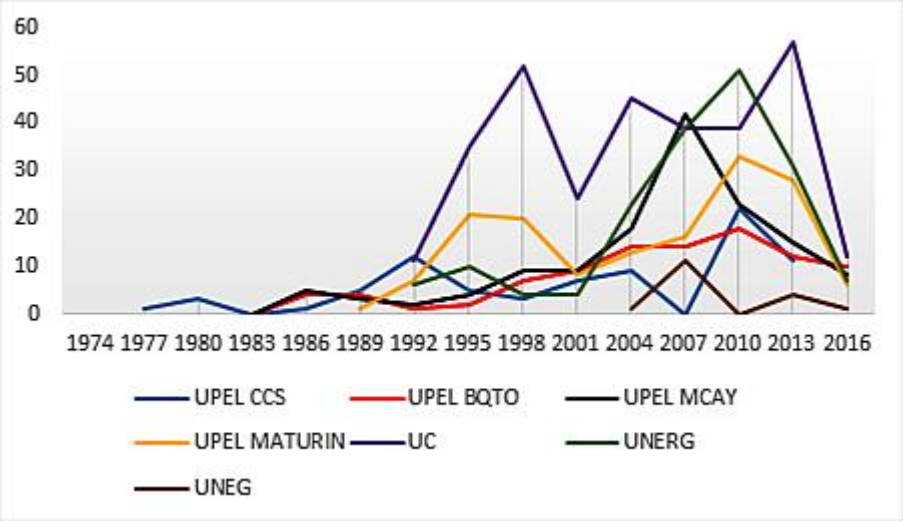


Figure 4 shows that the first thesis was approved in 1974 at the PI of Caracas and that from the 1990s, there was a notable increase in approved works. The programme of the Universidad de Carabobo showed the greatest productivity (314 of the 1,012, equivalent to 31.02%).

(b) Author's gender

Figure 5.

Authors' gender.

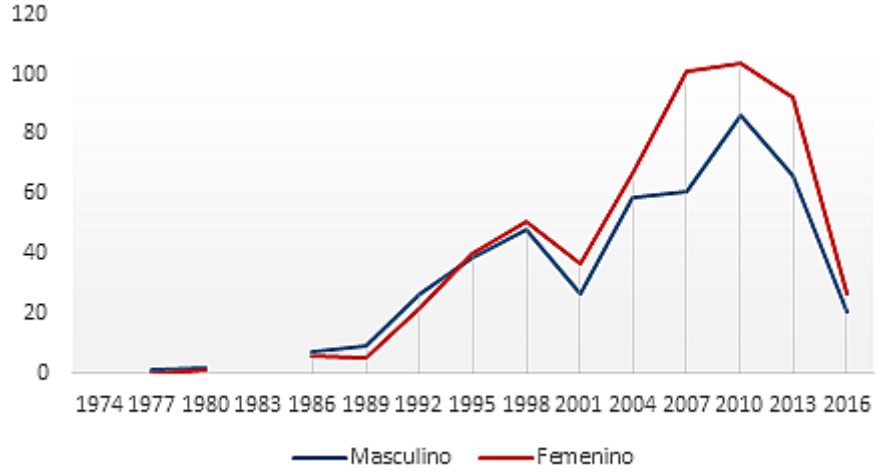
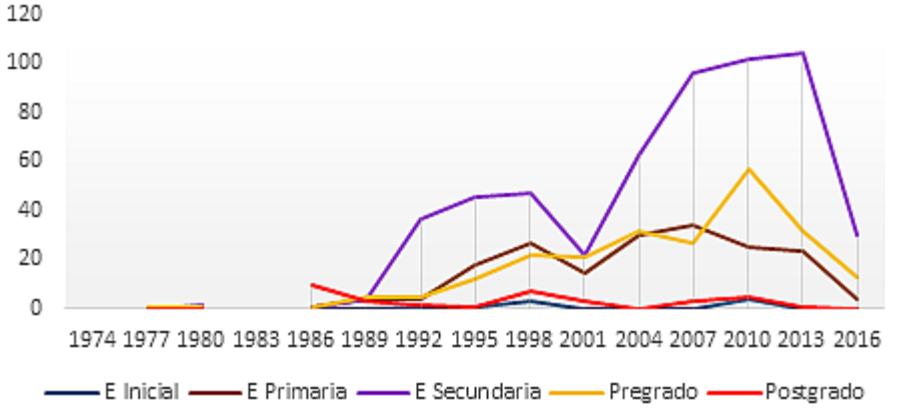


Figure 5 shows that from 1974 to the end of the 1980s, there was no predominance of male or female authors. The situation was maintained during the 1990s when a substantial increase in the approval of theses was noted, maintaining a balance of productivity by gender. The beginning of the first decade of the 21st century saw an increase of 14% in favour of female compared to male authors. However, in 2016, gender incidence was balanced again. In general, we conclude that there is homogeneity in productivity by gender.

Indicators of the study context

Figure 6.

Levels of the Venezuelan educational system to which the theses refer



During the 1970s and 1980s, the theses focused predominantly on higher education (undergraduate and postgraduate). However, since the 1990s, secondary education predominated, followed by higher education. Thus, the most studied educational level between 1974 and 2016 was secondary education, with 554 incidents, equivalent to 54.74%.

Theoretical-conceptual indicators

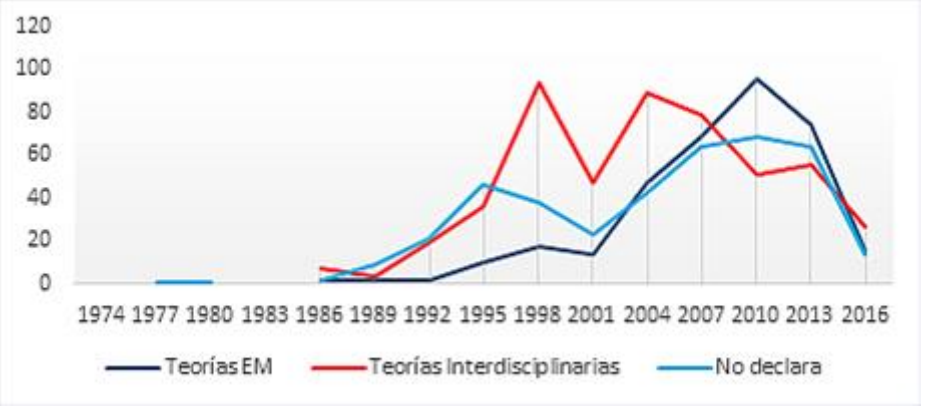
(a) Theories adopted in the theses

Figure 7 shows the theories adopted in the theses, which are classified into (a) Theories of mathematics education; (b) Interdisciplinary theories - psychological, pedagogical, sociological, philosophical, curricular and others; and (c) Theories not stated by the investigator. We observed that, from the second half of the 1980s, theories of mathematics education began to be adopted incipiently at first but boosted from the first decade of the 21st century. The authors of the theoretical proposals, in order of incidence, are: George Polya, Juan D. Godino, Dina van Hiele-Geldof and Pierre van Hiele, Guy

Brousseau, Yves Chevallard, Hans Freudenthal, David Tall, Ubiratan D'Ambrosio, Ole Skovsmose, Luis Rico, and Raymond Duval.

Figure 7.

Theories adopted in the theses

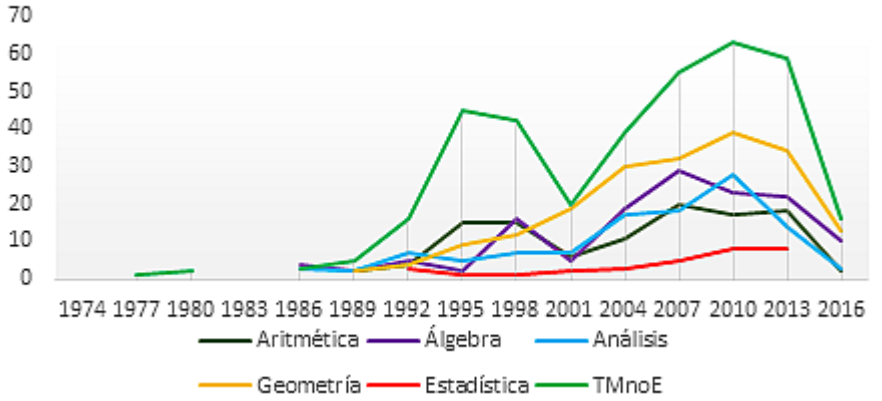


At the same time, the tendency to appeal to interdisciplinary theories continues, with the following authors predominating: David Ausubel, Jean Piaget, Lev Vygotsky, Jerome Bruner, Robert Gagné, Burrhus Frederic Skinner, Joseph D. Novak, Sergio Tobón, Hendrik Radazt, and Edgard Morin, among others.

(b) Mathematical topics examined in the theses

Figure 8.

Mathematical topics examined in the theses



According to what is shown in Figure 8, Geometry (Loci, Conics, Trigonometric ratios, Geometry of space) is the most researched mathematical topic, with 194 incidents (19.17%), followed by Algebra, Mathematical Analysis, Arithmetic, Statistics and Probability. Regarding the Unspecified Mathematical Topic indicator, there is an incidence of 366 theses (36.16%) in which the examined mathematical entity is not explicit. This issue deserves to be studied in greater depth because this absence of mathematics in research within the field of mathematics education weakens them.

(c) Disciplinary Frontiers of Research in Mathematics Education (Fronteras Disciplinarias de la Investigación en Educación Matemática - FDIEM)

Figure 9.

Disciplinary Frontiers of Research in Mathematics Education (Fronteras Disciplinarias de la Investigación en Educación Matemática - FDIEM)

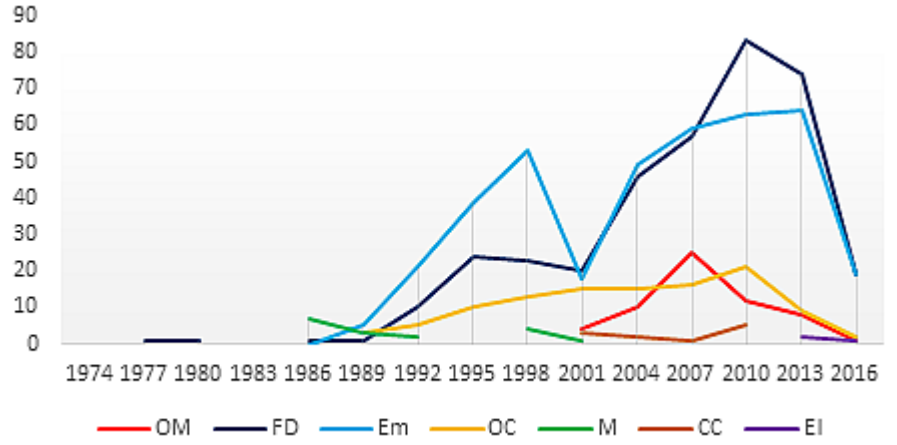


Figure 9 shows that the FDIEM with the highest incidence is Teacher education, with 359 (35.47%) cases. As of the first decade of the 21st century, a more significant explicit presence of mathematical entities is noted in the theses, taking the following elements as reference for them: epistemological analysis of the mathematical object, own theories of mathematics education, and supporting theories from other fields, which implies the recognition of the need to expand and strengthen the investigative processes in mathematics education.

CONCLUSIONS

Based on the narrative and bibliometric analysis of the information obtained, answers to the guiding questions of the research reported in this article are offered below.

(a) Foundation of Postgraduate Studies in Mathematics Education in Venezuela

Concerning the details of the creation of postgraduate studies in mathematics education in Venezuela, we confirmed that on May 17, 1974, the first PVMEM was created in the PI of Caracas, also being the first of its kind in Latin America (Ávila, 2016; Fiorentini, 1994; Pacheco Moros, 2020; Pacheco Moros and González, 2021; Orellana, 1973).

(b) Evolution of Venezuelan Master's Degree Programmes in Mathematics Education in Venezuela

The three master's degree programmes in mathematics education, created after the UPEL - Caracas Pedagogical Institute programme were: (1) in 1983, the Inter-Institutional Master's Degree in Mathematics in Barquisimeto, Lara State, through an agreement signed by UCLA, the UNEXPO and UPEL - Barquisimeto Pedagogical Institute, mention in Mathematics Teaching; (2) in 1984, UPEL - Maracay Pedagogical Institute, with the denomination of Master's Degree in Higher Education, mention in Mathematics; and (3) in 1989, a programme analogous to that of the Maracay Pedagogical Institute was founded at UPEL - Maturín Pedagogical Institute. However, even though these programmes were conceived to strengthen the education in research of mathematics teachers to prepare them to respond to the problems detected in the teaching and learning of mathematics at secondary and higher education levels, the master's degree students were more inclined to study specific topics of the so-called pure mathematics, leaving mathematics education at the background.

Between 1989 and 1994, the other three PVMEMs were founded (Universidad de Carabobo, in 1989; Universidad Nacional Experimental Rómulo Gallegos, in 1991; and Universidad Nacional Experimental de Guayana, in 1994); Since the mid-1990s, the interest of advisors and authors of theses boosted in addressing issues related to the teaching and learning processes of mathematics at the different educational levels, predominantly in secondary education and, although in this decade the theses still addressed topics typical of pure mathematics, this interest gradually faded. In addition, we perceived an incipient adoption of theories from the field of mathematics education: Problem solving (G. Polya and A. Schoenfeld); Reasoning model (Van Hiele spouses), Ethnomathematics (U. D'Ambrosio), Ontosemiotic Approach (J.D. Godino), Didactics of Mathematics (R. Douady), Advanced

Mathematical Thinking (D. Tall), Theory of Didactic Situations (G. Brousseau and collaborators), Anthropological Theory of the Didactic (I. Chevallard), Curriculum Organizers (L. Rico), Ethnomathematics (U. D'Ambrosio), Socioepistemology (R. Cantoral), Conceptual Fields (G. Vergnaud), Realistic Mathematics (H. Freudenthal), Mathematical Enculturation (A. Bishop), Text Analysis (G. Schubring), among others.

Another aspect worth mentioning in this evolution is the emergence of several lines of research, among them: Critical Mathematics Education, Epistemological Conceptions of Mathematics Education, Problem Solving in Mathematics, History of Mathematics Education in Venezuela, Perspectives of the Approach Anthropological Semiotics for the Didactics of Mathematics, Numerical and Algebraic Thinking, Mathematics as an essential source of Didactic Propositions, Sociocultural Perspectives in Mathematics Education, among others.

PROSPECTION

A relevant product derived from this study was the organisation of a textual corpus of the theses approved in the PVMEMs from 1974 to 2016. That corpus included 1,012 catalogued theses, of which we localised 973 that we chronologically organised and coded (see Figure 2).

The theses defended and approved in the PVMEM must still be examined from the perspective of their contributions to Venezuelan scientific production in mathematics education.

In the same way, it is interesting to recognise the trajectory of Venezuelan mathematics educators who, over time, achieved the status of scientific authorities and developed academic genealogies. For this, it is necessary to examine their personal and social origin, educational history, professional development, academic and scientific performance, and contribution to other mathematics educators' education to transmit from generation to generation the cultural and scientific heritage of mathematics education in Venezuela.

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