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Arithmetic's Published In Spain In The 18th Century

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Abstract:
Background*:Every day is more appreciate the recognition of the importance of knowing the history of mathematics and taking advantage of that knowledge to popularize, make public and use it in educational processes related to the teaching of mathematics. We present a study on printed arithmetic books published in Spain during the 18th century.*
Materials and Methods*: In this descriptive study, a documentary content analysis was carried out. To obtain the data, the bibliographic repositories of several Spanish universities and the National Library of Spain, the Miguel de Cervantes Virtual Library, the Digital Library of Madrid were consulted.*
Results*: Fifty arithmetic books printed in different Spanish cities were found. Some groups of authors who worked in professions other than teaching or mathematics were also identified.*
Conclusion: *It is known that there was an increase in this production compared to the previous century. Most of the books were published in Madrid and it is evident among the authors that there was a great variety of different professions and interests to carry out the work of write and publishing a work on arithmetic at that time.*
Key Word*: Mathematics education, old textbooks, Spain, history, 18th century*

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I. Introduction

The research on the history of mathematics is important because it allows us to observe not only the development of mathematics itself, but also other aspects associated with its teaching, teaching instruments, study plans, etc. [1][2]. Among these many aspects, it is important to know in depth not only the channels of dissemination of mathematical knowledge, but also the characteristics of these media [3] [4].

Research on the history of mathematics and mathematics education allows us to know and reveal situations, people, institutions, works, ideas, or themes from the past that at a certain moment represented a change or advance for these disciplines [5].

The contents and the didactic and social aspects of each era are investigated. Until a few years ago, the book was practically the only medium used to disseminate mathematical knowledge in society [6] and at present is being replaced by other types of virtual or digital media. Furthermore, there is evidence that little by little in many countries the history of mathematics is being introduced as another dimension in the school curriculum [7] because it searches to relate this history with the mathematical thinking. The expected result is to promote the appropriation of the meaning of mathematical concepts.

Spain in the 18th century was subdued to various social events that changed not only society but also the science that was carried out at that time.

Events that changed the Spanish scientific panorama were framed first by the implementation of a new dynasty, the Bourbons and with it the arrival of central European scientific ideas. On the other hand, the movement called *Novatores* is consolidated and aims to renew Spanish culture and finally the expulsion of the Jesuits from the Spanish kingdom.

During the 18th century, Spain experienced a period of significant changes in several areas, including the dissemination of mathematical knowledge through the printing of books [8]. The introduction of the printing press in the mid-15th century allowed the production of books more efficiently, which contributed to the dissemination of works on arithmetic and mathematics in general. Among the notable publications it can be find works by authors such as José de Torrubia and José Ortiz y Sanz, who deal with the arithmetic and algebraic topics in their writings. These works contributed to the advancement of mathematical education in Spain and reflected the growing importance of the printing press as a means of disseminating knowledge during the 18th century.

The original works of Spanish mathematicians of the period, available in libraries and historical archives, supply a direct insight into printed arithmetic and its role in the evolution of mathematical thought in 18th-century Spain. These works not only provided fundamental knowledge in arithmetic, but also encouraged logical reasoning and the practical application of mathematics in everyday life and in various disciplines.

In the 18th century, works of arithmetic carried out a crucial role in Enlightenment Spain by contributing to the advancement of mathematical knowledge and the development of education. During this period, a significant cultural change happened that promoted rational thinking, the dissemination of scientific knowledge, and the valuing of education to social progress. Works on arithmetic, printed thanks to the advance of the printing press, became essential instruments for the training of students and professionals in various fields.

Furthermore, the importance of arithmetic works in the 18th century was reflected in their contribution to economic and commercial progress. A solid knowledge of arithmetic was essential for activities such as commerce, bookkeeping and financial management, crucial areas for the economic development of the time. In summary, works of arithmetic in 18th century Spain not only achieved an educational role but were also a key element for the intellectual, economic and social development of the society of the Enlightenment.

The availability of printed books in 18th century Spanish society in comparison with the manuscripts provided various advantages that contributed to cultural, educational, and scientific development. The introduction of the printing press in Spain marked a significant change in the accessibility and dissemination of mathematical knowledge. Some of the key benefits include:

1. Higher Availability and Accessibility: The printing allowed for the mass production of books, resulting in higher availability and access to information. The population was able to access a wider range of works, including treatises on arithmetic, which might previously have been limited to manuscripts of more restricted circulation.
2. Democratization of Knowledge: Printing facilitated the democratization of knowledge by making works available to a broader audience. This contributed to the spread of enlightened ideas and the encouragement of education among different segments of society.
3. Conservation and Preservation: Printed books were more durable and less likely to deteriorate compared to manuscripts. This higher durability ensures the long-term conservation of the works, allowing future generations to have access to the information.

Arenzana (1987) indicates that between 1700 and 1809, 170 mathematical works were published in Spain.

In the Spanish fields, since 2011, the History of Mathematics and Mathematics Education group has been working with the purpose of find and identify the works of mathematical content that were published in Spain during the 18th and 19th centuries. Since the history of mathematics education in Spain, various studies have been carried out on the authors of mathematical works of the past [9][10][11].

The passing of the years and the advancement and updating of Google books has allowed us to have knowledge and access to many more works than in previous times, which is why unknown works are coming to light, some from editions restricted in number and others that are printed for specific groups such as religious congregations, military academies or schools of arts and crafts.

For this reason, the purpose of this study is to carry out an updated inventory of the information available on the arithmetic books that were published in Spain in the 18th century.

II. Material And Methods

This is a descriptive work of a documentary and ex post facto. During the month of June, the websites of the National Library of Spain, the Miguel de Cervantes Virtual Library, the Digital Library of Madrid, Google Books and various Spanish university libraries (University of Córdoba, University of Salamanca, University of Valladolid), University of Granada, University of Valencia), were consulted.

Inclusion criteria:

1. Topic: mathematics or arithmetic.
2. Spanish Language.
3. Type: Printed book.
4. Dates: 1700 to 1800.

Procedure methodology

Once a list of works was obtained, a debugging manual was carried out in order to select only those that correspond to arithmetic's due to their content, even if their title does not indicate it. All information was dumped into an ad hoc database.

After an exhaustive search, 50 works were found that deal with arithmetic in their content. Some had reprints in the same century, but these we only consider once.

With this information, the titles of the books, the names of the authors, the year of publication, the city and the name of the printer were transcribed. The topics addressed. After reading the prologues or introductions, the purpose of the book and to what sector of the population it was directed was determined: military, religious, merchants, etc.

Figure 1. Covers of some arithmetic's.

III. Result

The first arithmetic book published in Spain in the 18th century corresponds to the Book of Extraordinary Accounts, by Martín de Ezpeleta, printed in the city of Zaragoza in 1704 (Table 1). This work looked for offer basic arithmetic elements to facilitate practical aspects of daily life at the time [12].

Table 1. Arithmetic books published in Spain in the 18th century.

Year	Autor	Title
1704	Martín de Ezpeleta	Libro de cuentas extraordinarias
1705	Andrés Puig	Arithmetica especulativa, y practica…
1707	Tomás Vicente Tosca	Compendio Mathematico
1708	Manuel de Zubiaur y Eizaga	Arithmetica practica, para instruir la jubentud
1711	Andres Puig Server	Arithmetica especualtiva…
1718	Manuel de Zubiaur y Eizaga	Arithmetica practica, para instruir la jubentud
1719	Juan Bautista Corachán	Aritmetica demostrada ….
1719	Bartolome Ferrer	Curiosidades utiles: arithmetica, geometrica….
1724	Jerónimo Cortés	Aritmética practica y muy util…
1727	Juan Aznar de Polanco	Arithmetica inferior..
1732	José Fernández de Anuncibay Urreta Basurto	Platicas de Arithmetica y palestra de contadores…
1732	Juan Joseph de Padilla	Noticia breve de todas las reglas mas principales de la arithmetica practica
1732	Miguel Jeronimo de Santacruz	Dorado contador
1733	Francisco Javier García	Arithmetica especulativa y practica…
1735	Juan Bautista Corachán	Aritmetica demostrada ….
1736	Antonio Bordázar de Artazu	Proporción de monedas, pesos i medidad con: …
1737	José Ventura Cordero	Compendio arithmetico y…
1745	Andres Puig Server	Arithmetica especualtiva…
1738	Casandro Mames de La Marca y Araioa	Tyrocinio artithmetico…
1752	Juan Pérez de Moya	Arithmetica practica y especulativa
1751	Juan Sánchez Reciente	Tratado de arithmetica theorica…
1753-1756	Pedro Padilllo y Arcos	Curso militar de mathematicas… Tomo I
1754	Miguel Jeronimo de Santacruz	Dorado contador
1756	Sebatián Labayru y Azagra	Tratado de la arithmetica numerica ..
1758	Luis Godin	Compendio de mathematicas..
1758-1760	Tomás Cerdá	Liciones de mathemática
1761	José Rodríguez del Barco	Tablas arithmeticas..

1762	Joseph Biel y Aznar	Arithmetica especualtiva, y practicas..
1763	Francisco Cassany	Arithmetica deseada
1765	No Name	Curso de arquitectura civil para la instruccion de los discipulos de la Real Academia de San Fernando
1768	José Atienza	Methodo nuevo, facil, breve,…
1770	Francisco de Barreda	El aritmetico inferior…
1776	Miguel de Jesús María Hualde	Arithmetica demonstrada…
1776	José Atienza	Methodo nuevo, facil, breve,…
1777	Juan antonio González Cañaveras	Aritmética especulativa y practica
1779-1804	Benito Bails	Elementos de matemáticas T. I
1780	Luis de Luque y Leyva	Arithmetica de ..
1780	Ventura de Avila	Reglas generales que de la arithmetica…
1781	Jaime Conde	Rudimentos de arismetica
1782-1840	Josef Biel	Aritmetica especulativa…
1782	Juan Justo García	Elementos de aritmetica
1784-1787	Francisco Jacier Rovira	Compendio de matematicas T. 1
1784	Juan Antonio Taboada y Ulloa	Antorcha arithmetica practica…
1784	José Atienza	Methodo nuevo, facil, breve,…
1786	Manuel Poy y Comes	Elementos de aritmetica…
1786	Fermin de los Arcos	Aritmetica teórica y practica..
1789	No Name	Tratado de aritmética,
1790	Diego Narciso Herranz y Quirós	Aritmetica pura y comercial
1790	Francisco Martín Maldonado	Manual de contadores: arithmetica..
1794-1798	Tadeo Lope y Aguilar	Curso de matemáticas. T. I
1794	Juan Justo García	Elementos de aritmetica
1795	Gabriel Ciscar	Tratado de aritmetica
1795	Francisco Verdejo González	Compendio de aritmetica teorica y practica para comerciantes, artesanos y negociantes
1797	Paulino de San Joseph	Instituciones aritmeticas
1797	Joseph Biel y Aznar	Arithmetica especualtiva, y practicas..
1797	Lucas María Romero y Serrano	Lecciones de aritmética puestas en forma de diálogo
1798	Juan Gerard	Tratado de Aritmética
1799	Esteván Carratalá	Aplicacion de la aritmetica a las operaciones mas usuale

Focusing attention on the chronological aspect of the publications, the period of greatest production of arithmetic occurred during the reign of Carlos III, an enlightened king who promoted the implementation of modern ideas in society and science in 18th century Spain (Figure 2).

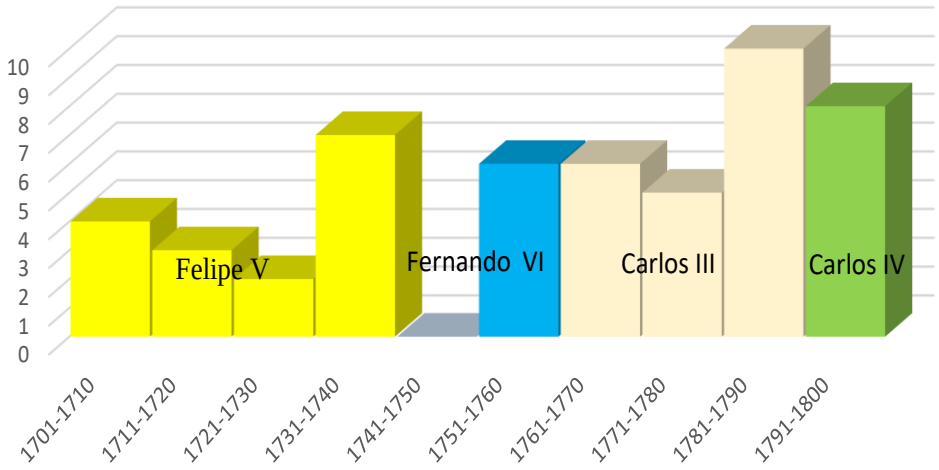

Figure 2. Production of arithmetic in Spain in relation to the periods of the Spanish kings.

Printing location

A prominent aspect is that more than half of the books were printed in Madrid and Zaragoza. 39.2% were printed in Madrid and 13.7% in Zaragoza, while 11.7% in Cádiz (Figure 3). This boom in book printing in these

cities was due, first of all, to the Enlightenment, an intellectual movement that advocated for the reason, science and education, which had a significant impact in the 18th century in Spain.

In this increase in the value of education and scientific knowledge, mathematics was considered a fundamental discipline and the printing of mathematical books answered to the need to disseminate this knowledge among the population. In these cities appeared the Academies, in this Academies there is a favourable environment for the generation and dissemination of mathematical knowledge, which facilitated and promoted the publication of new mathematics books and the arithmetic.

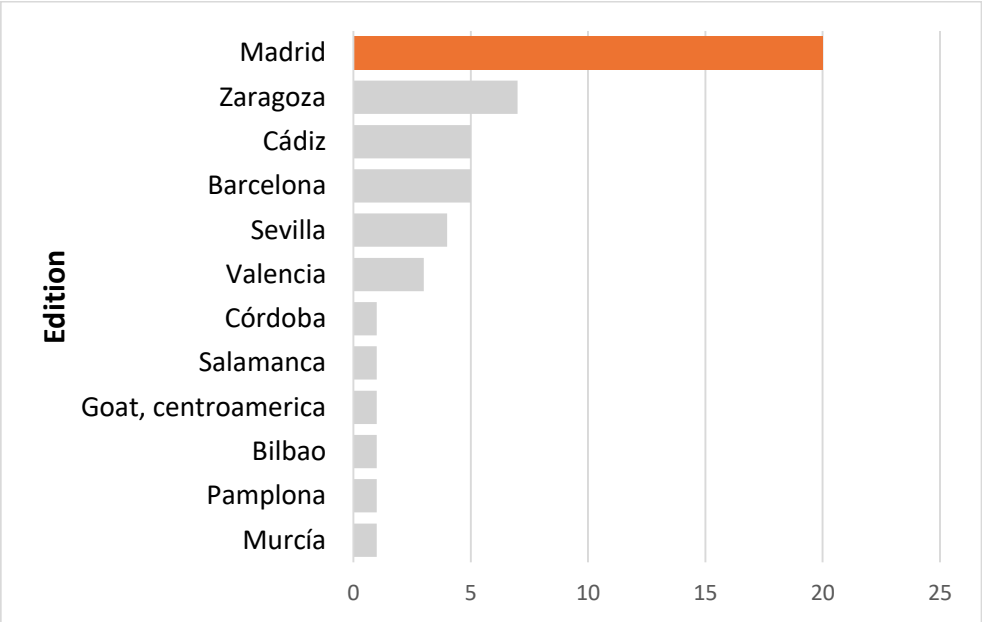

Figure 3. City of edition of arithmetic's in Spain in the 18th century.

The authors

51 different authors were identified and many of the authors were religious from various congregations, but mostly Jesuits. As an example, among these religious we find Vicente Tosca, Fermín de los Arcos and Manuel Zubiaur y Eizaga.

Another notable group was the military, among whom were marines and infantrymen such as Gabriel Ciscar, Francisco Javier Rovira and Fernández de Mesa.

Among the architects we find Bartolomé Ferrer, Juan Claudio Aznar de Polanco. On the other hand, a remarkable group of authors are those who, in addition to being mathematicians, carried out professions or trades related to calligraphy and lexicon, Juan Claudio Aznar.

Another prominent group was the military, among whom were marines and infantrymen such as Pedro Padillo, Gabriel Ciscar or Tadeo Lope y Aguilar.

Some were also dedicated themselves to astronomy, astrology, or cartography, such as Juan Bautista Corachán, Antonio Bordázar de Artazu. Among those who served as primary school teachers, Royal schools, or academies: Diego Narciso Herranz y Quirós, Andrés Puig Servet, Esteván Carratalá, Francisco Cassany, Francisco de Barreda.

Finally, university professors include Juan Justo García, professor of Arithmetic, Geometry and Algebra at the University of Salamanca, and Juan Bautista Corachán at the University of Valencia [13].

The process of writing and publishing a mathematics book in the 17th century is a difficult arduous and long task, and it represented a high financial cost by the part of the author. For this reason, there is an interest to try to understand the reasons that motivated these well-known persons to write a mathematical work, even more so when many of them carried out professional activities that were not teaching mathematics.

The prologues of the works offer clues and reasons given by the authors themselves. In some cases, they answered to concern about mathematical learning the part of their students, this being the case of Tomás Cerda and Lucas María Romero y Serrano.

On other occasions, the authors' interest is to disseminate new ideas and concepts that are being developed outside the kingdom and therefore, they directly copy and translate part of books published abroad just as Benito Bails does [8].

There are also cases in which for certain authors it is the adulation, pressure or request of friends, colleagues or disciples that compels them to undertake the work of writing the mathematics book, as expressed by Geronimo

Cortes [14] "I say that the reasons for undertaking such an arduous undertaking have moved me; they have been requests from friends, persistence's from Disciples, and the respect from elders"

IV. Conclusion

The dissemination of mathematical knowledge has always been important in all societies and in particular arithmetic has been crucial in order to provide the basic elements to carry out the elementary operations that were present and necessary for the activities of the 18th century, especially those related to commerce.

The highest boom in the production of arithmetic in Spain happened under the Kingdom of Charles III, perhaps because he was a clear defender of Enlightenment ideas and promoted the creation of various scientific spaces such as academies and scientific societies. Through these organizations, the aim was to promote research, teaching and the practical application of knowledge in several areas, contributing to the cultural and technical development of Spain in the 18th century.

With these arithmetic's, the purpose was to update knowledge, as well as to offer practical and necessary tools for a certain sector of Spanish society in their daily life.

The effort to disseminate mathematics was shared by authors from different professions, but all of them with the aim and purpose of answered to the educational and cultural needs of a society that was experiencing significant changes in its way of thinking and deal with education and scientific knowledge.

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