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INTERNATIONAL INITIATIVES IN CHILDREN'S MATHEMATICS EDUCATION IN THE EARLY 20TH CENTURY THROUGH THE TESTIMONY OF MARGARITA COMAS CAMPS

Summary: Margarita Comas Camps' (1892–1972) contributions in the years 1915–1934 to children's mathematics education offer a remarkable perspective on the international panorama of these studies and proposals in the early decades of the 20th c. Like many other young Spanish scholars, in the 1920s, she had the opportunity to travel as a graduate student to Great Britain and France thanks to scholarships from the council of the Junta de Ampliación de Estudios (JAE), a state institution inspired by the political-cultural program of the Europeanization of Spain. What were the research and action prospects that were offered to a young scholar between the two World Wars? Comas Camps developed a methodical body of documentation, supported by her study abroad, which constitutes a valuable historiographical source. Through her testimony, we can examine the intersection of proposals and studies from various national contexts, the varied contributions made by mathematical and pedagogical circles, and the attention to different aspects such as teaching methodology, the psychology of learning, and the nature of mathematical knowledge and its role in modern life.

Keywords: 20th century, history of mathematics education, children's mathematics education, New Education, Margarita Comas Camps

Introduction

Between the 1890s and the 1930s, the extension of numeracy became a political and cultural target in many European countries and the Anglosphere, to be implemented mainly thanks to the extension of children's schooling. Social concern, in an atmosphere of positivism and scientism, fostered an increasing number of contributions on the issue of teaching arithmetic[1].

The traditional 'learning path' of ciphering, paper-and-pencil four operations, and practical 'merchant' problems had been debated since the late 18th c. Awareness of the inadequacy of such educational practices for children had prompted several individual contributions during the following decades, which remained largely isolated, without converging into a productive debate at the national level, let alone a sustained discussion with a flow of proposals and guiding ideas at the international level[2]. In the late 19th c. and the beginning of the 20th c., there was increasing momentum regarding such things as an 'arithmetic for all' that needed to be addressed, interacting with the aspirations toward both the modernization of economic life and cultural democratization in different balances and degrees. Contributions came from different cultural areas, which can roughly be seen as part of the more general 'modern' or 'progressive' trend in school reform and renewal.

This momentum deserves further historiographic research into its structure at the national and international levels and across the various approaches stemming from different cultural areas. This paper focuses on analyzing the vision that a Spanish scholar, Margarita Comas Camps (1892–1972), offers of this fruitful period, as reflected in her contributions from the 1910s to the 1930s. Our thesis is

[1] See K. Bjarnadóttir, *History of teaching arithmetic*, [in:] *Handbook of the history of mathematics education*, ed. by A. Karp, G. Schubring, Springer, Cham 2014, p. 431–457. On the authors and contexts regarding discussions on mathematics for children briefly discussed in the present introduction, see A. Millán Gasca, *A hidden thread. Ideas and proposals on children's mathematics education in the Late Modern Age*, [in:] *History and Epistemology in Mathematics Education. Trends, practices, future developments*, ed. by E. Barbin, M.N. Fried, M. Menghini, F.S. Tortoriello, Springer, Cham 2025, p. 443–456, and the references herein; see also A. Millán Gasca, *A hidden thread: ideas and proposals on children's mathematics education throughout history*, [in:] *History and epistemology in mathematics education. Proceedings of the 9th European Summer University 18–22 July* 2022, ed. by É. Barbin, R. Capone, M.N. Fried, M. Menghini, H. Pinto, F.S. Tortoriello, Edizioni Nova Cultura Roma, 2023, p. 89–115, and A. Millán Gasca, *Zoel García Galdeano y las matemáticas para niños hacia 1900* [Zoel García Galdeano and mathematics for children around 1900], "La Gaceta de la Real Sociedad Matemática Española" 2017, vol. 20, no. 3, p. 611–634.

[2] Yet both in Europe and in the USA, Johann Heinrich Pestalozzi conveyed the idea of children's suitability for, and elective affinity with, number and form from early ages. On the integration of arithmetic and geometry, see A. Millán Gasca, *Mathematics and children's minds: The role of geometry in the European tradition from Pestalozzi to Laisant*, "Archives Internationales d'Histoire des Sciences" 2015, vol. 65, no. 2, p. 759–775.

that her methodical work of documentation constitutes a valuable historiographical source. Like many young scholars of that period in Spain (in South Europe), she was committed to understanding trends of thought in the European cultural milieu, a goal that could be reached thanks to grants for traveling abroad distributed from 1907 on by a new institution for scientific research and advanced studies, the Junta para la Ampliación de Estudios e Investigaciones Científicas [Board for Advanced Scientific Studies and Research, JAE][3].

Contributions from many countries in the areas of pedagogy and mathematics were considered equally by her, and in the 1930s, she acknowledged the rise of USA psychological research on teaching arithmetic, as well as on testing. The interplay between different approaches can thus be traced through her reflection. Moreover, she did not focus only on mainstream authors, cultural areas, or scientific schools, but enlarged her readings to an increasing number of countries, and paid attention to the contributions of individual scholars, such as two from Latin America.

Comas has gained recent recognition in Spain for her seminal contributions to the development of science education. Her production emerged in the context of a broader movement to renovate teacher education in Spain from the early 1920s, promoted by Normal Schools faculty, currently termed the 'Normalist movement'[4]. The 1931 'Professional plan', after the proclamation of the Second Republic, upgraded normal school studies to university status, with new courses including one devoted to the Methodology of Mathematics. Participants in this movement were familiar with European and international pedagogical trends through their scholarly readings and travels abroad, thanks also to the JAE fellowships[5]. In this context, the objective of this study is to elucidate the transnational networks and influences underlying Comas's scholarly work, positioning

[3] See *Margalida Comas Camps (1892–1972), científica i pedagoga*, ed. by M.Á. Delgado Martínez, Govern de les Illes Balears, Palma de Mallorca 2009.

[4] B.A. Escolano, *Las escuelas normales. Siglo y medio de perspectiva histórica* [Teacher Training Colleges. A century and a half of historical perspective], "Revista de Educación" 1982, no. 269, p. 55–77; A. Molero, *Una aproximación histórica a la educación española contemporánea: Las Escuelas Normales de Magisterio* [A historical approach to contemporary Spanish education: The Teacher Training Colleges], Escuela Universitaria de Formación del Profesorado de EGB de Valladolid, Valladolid 1978. For mathematics, see M. Sierra Vázquez, C. López Esteban, *Innovaciones en la formación en matemáticas y su didáctica de los maestros en el primer tercio del siglo XX: aportación del movimiento normalista español (1923–1936)* [Innovations in mathematics education and teacher didactics in the first third of the 20th century: the contribution of the Spanish normalist movement (1923–1936)], "Historia de la educación" 2011, vol. 29, p. 179–193.

[5] For example, José María Eyaralar (1890–1944), who worked in mathematics education and, as a member of the Normalist Movement, received a scholarship from the JAE in 1922, focused mainly on France; see F. Comas Rubí, *José María Eyaralar: la influencia francesa en la renovació de la didàctica de les matemàtiques* [José María Eyaralar: the French influence in the renovation of mathematics didactics], "Educació i Cultura: revista mallorquina de Pedagogia" 2005, vol. 18, p. 87–100.

her within a historically significant period marked by extensive intellectual discourse on mathematics education reform, and to trace the theoretical and methodological sources that shaped her pedagogical framework.

The origins of an engagement in primary mathematics education

Margarita (also known as Margalida) Comas Camps' higher education spanned from 1912 to1928, unfolding in two distinct stages. In 1912–1915, she attended the *Escuela de Estudios Superiores del Magisterio* [School of Higher Studies in Primary Education, EESM] in Madrid, a higher education institution that had been founded in 1909 to train teachers for the state network of normal schools where prospective primary school teachers were taught. There she obtained an advanced pedagogical education, oriented towards science teaching, and was introduced to scholarly pedagogical circles in the capital, which paid remarkable attention to foreign research.

Her degree dissertation was devoted to arithmetic instruction in primary schools in Madrid, following approach from Victor Vaney (1859–1938)[6]. The close attention her advisor, Anselmo González Fernández (b. 1870), paid to Binet's work – he even authored a biography – and, more generally, the interest in Binet's contributions in Spain is consistent with the broader cultural influence of French arts and sciences in the country, dating back to the Enlightenment period. This early experience in the field, and her familiarity with English-language

[6] V. Vaney, *Mesure du degré d'instruction des élèves en calcul* [Measurement of students' level of reckoning skills], "L'année psychologique" 1904, vol. 11, p. 146–162. The title of the dissertation was *Instrucción en cálculo de los escolares madrileños, siguiendo las pruebas de Vaney* [Instruction in reckoning of pupils from Madrid, following Vaney's tests] (see M.Á. Delgado Martínez, *Margarita Comas Camps (1892–1972) científica y pedagoga*, [in:] *Margalida Comas Camps (1892–1972): científica i pedagoga*, ed. by M.Á. Delgado Martínez, Govern de les Illes Balears, Palma de Mallorca 2009, p. 47–141). There was an intense activity of translation of French scholarship into Spanish, which included Vaney: V. Vaney, *La pedagogía de los anormales: las clases para niños atrasados, su reclutamiento, organización y ejercicios de ortopedia mental* [The pedagogy of the abnormal: classes for backward children, their recruitment, organization and exercises in mental orthopaedics], transl. by L. Amorena y Blasco, Toledo 1913. On Vaney and his role in Binet's contributions to the creation of a scientific pedagogy through their work at the Paris state primary school on Rue Granges-aux-Belles, see A. Klein, *Méthodes nouvelles pour diagnostiquer l'idiotie, l'imbécillité et la débilité mentale* [Introduction to New methods for diagnosing idiocy, imbecility and mental debility], "Bibnum. Textes fondateurs de la science analysés par les scientifiques d'aujourd'hui. Sciences humaines et sociales" 2018, https://journals.openedition.org/bibnum/1063 [accessed 10.01.2025]; and B. Andrieu, *Arrièrés pédagogiques: naissance de l'élève capacitaire dans les dernières recherches de Binet dans les écoles parisiennes en 1908–1910* [Pedagogical Backward Children: Birth of the Capacity-Based Pupil in Binet's Latest Research in Parisian Schools in 1908–1910], "Revista Iberoamericana do Patrimonio Histórico-Educativo" 2016, vol. 2, no. 3, p. 67–82. See A. Binet, T. Simon, V. Vaney, *Recherches de pédagogie scientifique* [Research in scientific pedagogy], "L'année psychologique" 1905, vol. 12, p. 233–274.

scholarship developed in the 1920s, made her attentive to the standardized arithmetic tests that would subsequently be developed mainly in the USA.

In 1915, she began her career as a teacher in the state network of Normal Schools for Women, where future primary school teachers were trained, and she remained there until 1933, when she became a professor of Infant Biology at the University of Barcelona, her last academic position before her exile from the country at the end of the Civil War.

The second phase took place between 1918 and 1928, in the field of natural sciences at the Universities of Madrid and Barcelona and at the Sorbonne in Paris, culminating in her doctorate, based on research developed at the Paris *Laboratoire d'évolution des êtres organisées* [Laboratory of evolutionary biology] led by Maurice Caullery (1868–1958). During those years, she was awarded two JAE scholarships, in 1921 to visit the UK (London) and in 1926 to study in France (Paris)[7]. Between 1929 and 1933, she attended three pedagogical meetings organized by the cultural area of New Education (the World Federation of Education Associations IV Geneva Congress, V Dublin Congress, and the 1932 VI Congress of New Education at Nice). Thus, she emerged as a scholar of pedagogy and child studies (often called 'pedology'), with a solid background in natural sciences and a keen attention to the international context.

After her first stay abroad in England, and while she was carrying out her undergraduate studies in natural sciences, she began to contribute to the "Revista de Pedagogía" [Journal of Pedagogy, RP], a pedagogical journal and publishing house recently founded by Lorenzo Luzuriaga (1889–1959) that represented the modern education movement in Madrid. She would become the Luzuriaga's journal's main reference in the field of mathematics education (see Table 1)[8]. She authored an arithmetic textbook for 10 to 13-year-old pupils, published in 1928 in its series "The active school", and two methodological textbooks for primary school teachers, *Cómo se enseña la aritmética y la geometría*[9] [How to teach arithmetic

[7] Her international exposure began early in her career, initially through travels with her father, Gabriel Comas i Ribas (1864–1942), to France, Belgium, and Switzerland when she was only nineteen. Her advisor had also travelled abroad with a JAE grant, as it had become quite common in that period among young scholars, especially those working in Madrid, thanks to the JAE cultural policy.

[8] As the biographer María Angeles Delgado recalls, in 1921 she had tried to obtain the chair of Mathematics at the Normal School for Women in Madrid (see M.Á. Delgado Martínez, *Margarita Comas Camps (1892–1972) científica y pedagoga*, [in:] *Margalida Comas Camps (1892–1972): científica i pedagoga*, ed. by M. Á. Delgado Martínez, Govern de les Illes Balears, Palma de Mallorca 2009, p. 47–141). In the Normal schools where she taught, her positions were in natural sciences. For mathematics in the journal "Revista de pedagogía", see J. Dolera, E. Sánchez Jiménez, *Las matemáticas en la Revista de pedagogía* [Mathematics in Journal of Pedagogy], "Revista Colombiana de Matemática Educativa" 2020, vol. 5, no. 1, p. 71–92.

[9] M. Comas Camps, *Cómo se enseña la aritmética y la geometría*, Publicaciones de la Revista de Pedagogía, Madrid 1923.

Table 1. Margarita Comas Camps: A short chronology 1912–1933 around her research on early mathematical education.

1912–1915	Undergraduate studies in educational sciences at the *Escuela de Estudios Superiores del Magisterio*, section on natural sciences Degree dissertation *Instruction in reckoning of pupils from Madrid, following Vaney's tests*
1915	Professor at the Normal Schools for (female) primary school teachers in Santander, Tarragona, and Barcelona
1918–1925	Undergraduate studies in natural sciences at the Universities of Madrid and Barcelona
1920–1921	JAE grant, visiting fellow in the United Kingdom (educational sciences)
1922	*The teaching of mathematics*, paper in the newly founded "Revista de Pedagogía"
1923	*How to teach arithmetic and geometry* (2nd ed. 1928, 3rd ed. 1929, 5th and 6th eds. 1932)
1925–1928	Graduate studies in natural sciences (Barcelona, Central University, Madrid, and the Sorbonne, Paris)
1926	JAE grant, visiting fellow at the Sorbonne (Paris, France) (Evolutionary Biology)
1928	PhD in natural sciences, Central University (Madrid, Spain) with the dissertation *Contribution to the knowledge of the biology of Chironomus thummi and its parasite Parmermis contorta* *Arithmetics* (series "The active school", "Revista de Pedagogía")
1929–1933	Pedagogical congresses in Geneva, Nice, and Dublin
1932	*Methodology of arithmetic and geometry* (2nd ed. 1934; 6th ed. Buenos Aires 1965)
1933	Professor of Infant Biology, University of Barcelona
1934	Two papers on children's mathematics education
1938	Comas's books were banned by the Department of National Education under Franco's government*

Note: The authors' translations of her book titles and the title of the 1922 paper.

* Her name appears in a list of authors and books prepared to comply with the urgent reforms regarding the organization of primary school, including a 'rigorous depuration of school materials for primary education'. See C. Diego Pérez, *Intervención del primer Ministerio de Educación Nacional del franquismo sobre los libros escolares* [Intervention by Franco's first Ministry of National Education on school texts], "Revista Complutense de Educación" 1999, vol. 10, no. 2, p. 59 ff, see footnote on p. 61.

and geometry] (1923) and *Metodología de la aritmética y la geometría*[10] [Methodology of arithmetic and geometry] (1932), all of them published by RP.

The two books, including their several revised editions, constitute a kind of 'unique book'. In these books she addresses prospective and in-service primary school teachers using a readable, direct style (also intended for self-education)[11] combining educational principles with examples of lessons, activities and syllabi: the first one puts forward a draft syllabus in arithmetic and geometry for three school grades (ages 6–12) combining the style of modern schools with current teaching in Spanish schools, including some examples of lessons; the second one, longer and more detailed, was intended as a textbook for the new syllabus of normal schools (see above). Her emphasis was on intellectual autonomy and the initiative and decision-making of school teachers:

> We would like this workbook to allow the preparation of the class to be easier and more fruitful for the teacher, especially for the rural teacher, who, because of his isolation, is the one who especially needs support and help, by suggesting ideas, problems, approaches, but in no way replacing his own personality: never making him a mere repeater. Teaching is a science [...] but above all it is an art.[12]

A good education for a future mathematics teacher should include: a solid scientific basis (both conceptual and pedagogical), practical suggestions such as lessons, materials, and activities (see Fig. 1), and the offer of a plentiful and well-selected bibliography, because reading is a way to be independent of methods and to be able to be creative.

Keywords in her pedagogy of mathematics in childhood were[13]: dynamism and cyclical organization of contents, interplay between real life/usefulness and abstraction/generalization, interplay between oral and written work, intuitive basis, and gradation of demonstrations. As a trained researcher in evolutionary biology, she emphasized that 'the acquisition of first-hand data, observation, experimentation, and field excursions should occupy a position of primacy'[14], applying these ideas to the case of mathematics:

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[10] M. Comas Camps, *Metodología de la aritmética y de la geometría*, Publicaciones de la Revista de Pedagogía, Madrid 1932.

[11] See A. Millán Gasca, *Educational writing by women in the early 20th century: mathematics for children in Mary Everest Boole, Maria Montessori, Grace Chisholm Young and Margalida Comas Camps*, [in:] *Women on women. De-gendering perspectives*, ed. by R. Leproni, Franco Angeli, Milano 2021, p. 141–153.

[12] M. Comas Camps, *Metodología*, p. 5 (translation by the authors).

[13] See M. Sierra Vázquez, C. López Esteban, *Margarita Comas (1892–1973) y su aportación a la Educación Matemática* [Margarita Comas (1892–1973) and her contribution to Mathematics Education], "Epsilon. Revista de Educación Matemática" 2011, vol. 28, no. 1(77), p. 23–37.

[14] M. Comas Camps, *Contribución a la metodología de las Ciencias Naturales* [Contribution to Natural Sciences methodology], Dalmau Carlos, Pla.EC Editores, Gerona 1937.

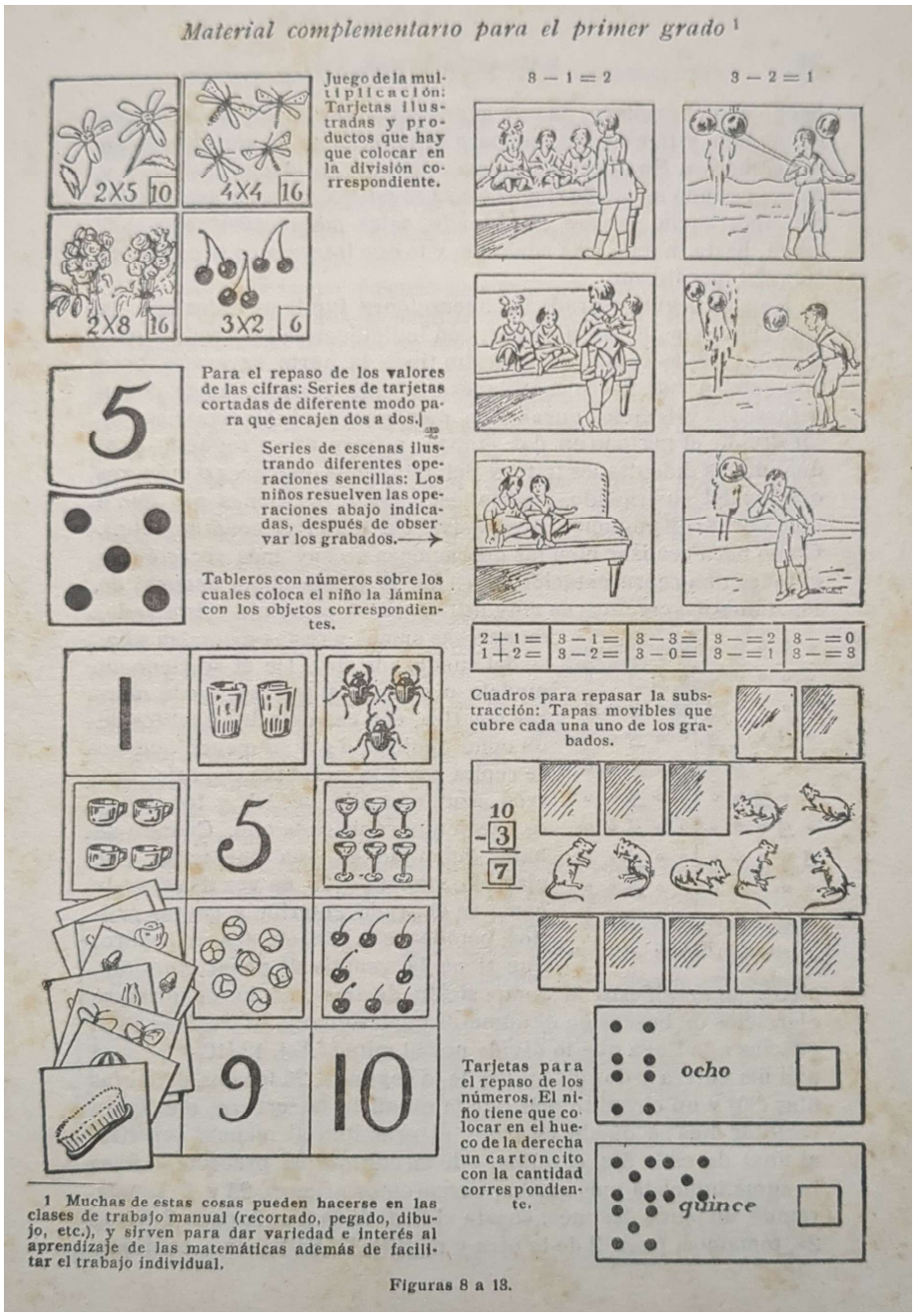

Fig. 1. Comas Camps' suggestions of cards and pictures to work on counting numbers in early grades of primary school.

Source: M. Comas Camps, *Metodología de la aritmética y de la geometría*, Publicaciones de la Revista de Pedagogía, Madrid 1932, p. 25.

> As a consequence, probably due to the theory of evolution, there is currently a trend that we could call dynamic, which has led Biology to study, with preference to finished forms, the process of becoming such. [...] it was natural for this principle to influence mathematics, and it has done so much that Borel was able to call modern Geometry, the Geometry of movements. Lines, surfaces, and angles are treated in their generation, and arithmetic also offers a wide field for analogous examples.[15]

She can be associated with an optimistic, Pestalozzian outlook regarding the elective affinity of children for mathematics:

> It is not a matter, as some uninformed people believe, of masking the difficulties, to inadvertently make the children swallow them like a pill wrapped in sugar, but of presenting them in such a way that it is the pupil himself who wants to solve them, making the necessary effort pleasant, not because it is disguised as a game, but because it is in accordance with the child's inclinations and wishes.[16]

The evolution of the final bibliographical notes of the two books[17] in their various editions is very striking, as they correspond to the eclecticism expressed in them: Comas's aim was not to construct a method of introduction to calculation to be adopted with conviction in order to obtain expected results, but to show the tension and articulation between various aspects of mathematics as a field of knowledge and the didactic methods that intervene in teaching.

Her intellectual eclecticism and judicious ability to synthesize pedagogical ideas from a broad cultural foundation are particularly noteworthy. Unlike contemporaries such as Maria Montessori (1870–1952) and Ovide Decroly (1871–

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[15] M. Comas Camps, *La enseñanza de las matemáticas* [The teaching of mathematics], "Revista de pedagogía" 1922, vol. 6, p. 217–218. In her references, she included Émile Borel's arithmetic and geometry textbooks for various school grades, published in the first years of the new century.

[16] M. Comas Camps, *Metodología*, p. 14.

[17] She did not publish any review of books published in Spain, but both her books included references to Spanish scholars. She referenced several arithmetic schoolbooks, as well as some contributions on mathematics education: a paper by José Augusto Sánchez Pérez (1882–1958) and three papers in the journal of a Spanish educational institution central in the modern school movement, the Institución Libre de Enseñanza [Free Institution of Education] (see J.M. Núñez Espallargás, J. Servat Susagne, *La matemática en la Institución Libre de Enseñanza* [Mathematics in Free Institution of Education], "Llull" 1988, vol. 11, p. 75–96). In 1934 he included three books on elementary arithmetic and geometry and a 1933 book on methodology and didactics of mathematics for normal schools published by the influential University of Madrid professor Julio Rey Pastor (1888–1962), with his former student and collaborator in the field of education Pedro Puig Adam (1900–1960) (see A. Millán Gasca, *Julio Rey Pastor (1888–1962)*, Colegio Universitario de la Rioja – Instituto de Estudios Riojanos, Logroño 1988). She reviewed a single Spanish-language essay, *Metodología de la aritmética elemental* [Methodology of Elementary Arithmetic] (1930; 2nd ed. 1948) by the Cuban scholar Elpidio Pérez Somossa (1892–1973) (see C. González Duro, *José Elpidio Pérez Somossa: un pedagogo renovador* [José Elpidio Pérez Somossa: a reformist pedagogue], Editorial Universitaria, La Habana 2008.

1932)[18], she did not seek to develop a prescriptive methodological framework; rather, her aim was to provide educators with guiding principles that would enable them to develop their own pedagogical approaches.

Her bibliographic references evolved from an initial focus on contributions in England to a broader scope, reflecting Comas's experiences abroad, as a graduate student and then as a scholar. She kept up to date on current research and proposals, also on behalf of the RP, publishing lively contributions where she could show in more detail competing ideas and approaches: book reviews as well as essay reviews. In the following sections, we will trace the origins of these references appearing in her works.

Benchara Brandford and beyond: a testimony to primary mathematics education scholarship and modern schools in England

In her first paper related to mathematics, *La enseñanza de las matemáticas*, published in RP in 1922, following her first grant from the JAE in England[19] (November 1920 – July 1921), her references focus on the UK: she wrote about the British Board of Education reports and suggestions for teachers and discussed the contributions by John Perry (1850–1920), Thomas Percy Nunn (1870–1944) – whose lectures at the London Day Training College[20] she had attended – and Benchara Bradford (1868–1944). One year later, the references in her book CEAG included a reference to *Essays on Mathematical Education* (1913), with an introduction by David Eugen Smith (1860–1944), by Georges St Lawrence Carson (1873–1934)[21], and listed three publications by the Board of Education[22]. She continued to follow the English schol-

[18] Comas admired and took up ideas from both scholars, and historical records confirm their interaction at the New Education Fellowship conference in Dublin (R. Silva Rabelo, *Transnational perspectives in the history of mathematics education: entanglements with the new education fellowship* (in Portuguese), "Educação Matemática Pesquisa Revista do Programa de Estudos Pós-Graduados em Educação Matemática" 2021, vol. 23, no 1, p. 112–139).

[19] This nine-month scholarship, obtained before starting her doctoral studies in science, was aimed at getting to know the methodological and pedagogical advances in England.

[20] See R. Aldrich, *The New Education and the Institute of Education, University of London 1919–1945*, "Paedagogica Historica" 2009, vol. 45, no. 4–5, p. 485–502. Nunn argued that the New Education basic principles were 'to be found in a synthesis of some of the fundamental ideas of biology and the philosophical or religious notion that man is essentially a creative spirit' (in: T.P. Nuun, *The Principles of new education*, "The New Era" 1929, vol. 10, no. 4, p. 205–208). On the English scene, see G. Howson, L. Rogers, *Mathematics Education in the United Kingdom*, [in:] *Handbook on the history of mathematics education*, ed. by A. Karp, G. Schubring, Springer, New York 2014, p. 257–282; G. Howson, *A history of mathematics education in England*, Cambridge University Press, Cambridge 1982.

[21] G.L. Carson, *Essays on Mathematical Education*, Ginn and Company, London–Boston 1913.

[22] Great Britain, Board of Education, *Suggestions for the consideration of teachers and others*

arly production and school innovations in the following years, thus marking a difference to the usual references to French authors; her familiarity with the language and culture could possibly favor her contacts with the USA contributions later on.

Branford, the English educator and social theorist, was perhaps the most significant influence on Comas's early work[23]. In his essay *A study of mathematical education* (1908, 2nd ed. 1921)[24], he advanced several innovative and thought-provoking propositions, such as the integration of arithmetic and geometry and the crucial role of effective teachers. Yet his work also espoused the now-discredited theory of recapitulation, which drew problematic parallels between child development and human evolutionary history, carrying racist connotations; thus, as John Scott has pointed out, this theoretical foundation, combined with his dense and allusive prose style, has significantly diminished his subsequent scholarly influence[25]. The attention to dichotomies or tensions in mathematical education typical of Comas appears to be deeply linked to Branford's thesis: both advocated a standardized curriculum and developed well-founded pedagogical proposals, yet at the same time strongly defended teachers' autonomy in developing their own passionate approach to instruction. Branford cautioned against the risk that an essential yet potentially excessive emphasis on mathematics' experimental aspects (as in Perry) might compromise the discipline's formal and systematic virtues. Similarly, Comas emphasized that 'mathematical concepts do not allow for vagueness'[26], emphasizing the interplay between theoretical and practical aspects, between experimental and demonstrative geometry, and between logic and intuition.

In 1927, she discussed in the RP the report *The teaching of geometry in school. A report for the Mathematical Association* (1923)[27], and she continued to pay at-

concerned in the work of public elementary schools, HMSO, London 1918; Idem, *Memoranda on the teaching of geometry*, HMSO, London 1919; and Idem, *The place of graphs in the teaching of mathematics*, HMSO, London 1909.

[23] In her essay *Cómo se enseña la aritmética y la geometría*, she even included the translation of a geometry lesson (on surfaces) by Branford, presented as a logbook page describing contents and activities, transcribing dialogues, and reflecting on educational practice. Comas strongly embraced the notion of integrating mathematics history into teaching as a means of recapturing the 'primitive freshness' of mathematical concepts. Yet, in *Metodología de la aritmética y de la geometría*, she nuanced Branford's biological postulates regarding the parallelism between child development and species evolution by identifying the successive human needs that mathematics has addressed throughout history: initially, practical necessities, followed by the drive for systematization, and ultimately aesthetic pleasure and the pursuit of knowledge.

[24] B. Branford, *A study of mathematical education, including the teaching of arithmetic*, Clarendon Press, Oxford 1908.

[25] J. Scott, *Life, the universe and everything: an undiscovered work of Benchara Branford*, "Journal of the History of Behavioral Sciences" 2009, vol. 45, no. 2, p. 181–187.

[26] M. Comas Camps, *Metodología*, p. 6 (translation by the authors).

[27] M. Comas Camps, *The teaching of geometry in school. A report for the Mathematical Association (1923): a review*, "Revista de Pedagogía" 1927, vol 71, p. 583–585.

tention to contributions in the area of the London Day Training College/Institute of Education, such as those by Margaret Punnett (1867–1946), the author of *The groundwork of arithmetic. A handbook for teachers*[28] (1914), as well as those by other British authors.

Comas was also a pragmatic innovator, strongly committed to Spanish teachers who had to carry out their work in isolation, without nearby colleagues or professional development networks. Therefore, her vision of the paths that an effective change in mathematics teaching could take was thoroughly rooted in the practices she observed at schools during her nine-month fellowship in England. In her book *Las escuelas nuevas inglesas* [The English new schools] (1930)[29], she described the curriculum of many schools inspired by the ideals of the New Education (Abbotsholme, Bedales School, St Cristopher School, Perse Grammar School, Caldecott Community, Bembridge School, Kearsley Council School). In her review (1929) of Jessie Mackinder (1864–1938), *Individual work in infant schools* (1923)[30], and in her booklet *El método Mackinder* [The Mackinder method] (1930)[31], she analyzed the methodology developed by Jessie Mackinder for infant schools, who adapted Maria Montessori's ideas. The method offered a detailed and individualized system of worksheets, which Comas considered highly valuable for Spanish schools where children of different ages learned together in the same classroom. This connection she established with the English scholars and schools during this stay in London played a crucial role in her intellectual trajectory, and, from 1939, became the context for the second part of her life in exile[32].

School textbooks and scholarship: exploring the international scene

The literature considered in the bibliographies of her two books, including the several editions of them, was in continuous evolution until the 2nd edition (1934) of her second book, with separate sections devoted to mathematics textbooks and the growing production of scholarly essays on mathematics education.

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[28] M. Punnett, *The groundwork of arithmetic: a handbook for teachers*, Longmans Greens and Co., London 1914.

[29] M. Comas Camps, *Las escuelas nuevas inglesas*, Publicaciones de la Revista de Pedagogía, Madrid 1930.

[30] J. Mackinder, *Individual Work in Infants' Schools*, Educational Publishing Company, London 1923.

[31] M. Comas Camps, *El método Mackinder*, Publicaciones de la Revista de Pedagogía, Madrid 1930.

[32] See C. Ryan, *Margarita Comas Camps: the English connection*, [in:] *Margalida Comas Camps (1892–1972): científica i pedagoga*, ed. by M.A. Delgado Martínez, Govern de les Illes Balears, Palma de Mallorca 2019, p. 11–22.

Altogether, in her publications in 1922–1934, she considered authors from nine foreign countries, in the Americas (Argentina, Cuba, and the USA) and Europe (Belgium, France, Germany, Italy, Switzerland, and the UK), published since the late 19th c., even if she preferred current publications from contemporaries. Thus, an international panorama of research is offered to us through her testimony (see Table 2, which also includes authors mentioned in the books but not in the bibliography).

In her first book, her sources, together with the already mentioned English scholars and Spanish authors, were mainly French mathematicians (reflecting the traditional impact of French culture in Spain): Charles-Ange Laisant (1841–1920), Émile Borel (1871–1956), and a 'classical' textbook author, Pierre Leyssenne (1827–1916)[33]. Yet some further authors in the pedagogical area were considered by her: Maria Montessori, who was already internationally well known, and the Argentinian Víctor Mercante (1870–1934), and in further editions, a USA author, Paul Klapper (1885–1952). She further included additions to the bibliography in subsequent editions, published reviews of single books, and reached a peak of completeness of her sources in the second edition of her second book: Decroly and Amélie Hamaïde (1888–1972) from Belgium were included, as well as the Cuban author Elpidio Pérez Somossa (1892–1973)[34] and a variety of contributions from the USA[35], as if she wanted to catch up, albeit belatedly, with those sources, but also reflecting the growing production in the country. Furthermore, the addition of three references to German authors gave some space to the history of primary school arithmetic education: *Geschichte der Methodik des Rechenuterrichts* [History of the methodology of Arithmetic Instruction] (1888)[36] by Edouard Jänicke and *Die Methodik der praktischen Arithmetik in historischer Entwicklung vom Ausgange des Mittelalters bis auf die Gegenwart*[37] [The Methodology of Practical Arithmetic in Historical Development from the End of the Middle Ages to the Present] (1888) by Friedrich Unger.

[33] M. Moyon, V. Legros, *Instruction arithmétique et éducation morale: un double projet chez Pierre Leyssenne* [Arithmetic instruction and Moral Education : a dual project in Pierre Leyssenne], [in:] *Les mathématiques à l'école élémentaire (1880–1970): études France-Brésil* [Mathematics in Elementary School (1880–1970): France-Brazil studies], ed. by R. D'Enfert, M. Moyon, W. Valente, PULIM, Limoges 2017, p. 59–82.

[34] Ibidem, footnote 18.

[35] She had included in the second edition a reference to the scholar educator Paul Klapper (1885–1952). She published in 1929 a review in RP on Klapper's essay *The teaching of arithmetic* (1916).

[36] E. Jänicke, *Geschichte der methodik des Rechenuterritchts*, 1888.

[37] F. Unger, *Die Methodik der praktischen Arithmetik in historischer Entwickelung vom Ausgange des Mittelalters bis auf die Gegenwart*, B.G. Teubner, Leipzig 1888.

Table 2. A transnational chorus of voices on children's mathematics education in Margarita Comas's books (1923, 1932, and subsequent editions). She further considered foreign essays on mathematics education in her book reviews and essay reviews.

Country	***Como se enseña la aritmética y la geometría*, 1923**	**Added in 1929, 3rd ed.**	**Added in *Metodología de la aritmética y de la Geometría*, 1934, 2nd ed.**
Spain	José de Caro Blas Lázaro Angel Llorca José Mur Aínsa José Augusto Sánchez y Pérez Juan Palau Vera	Luis Gutiérrez del Arroyo	Felix Martí Alpera Julio Rey Pastor & Pedro Puig Adam Juan Comas Clota Casasnovas Ramón Torroja Maria Esteve-Llach & Concepció Vandellós
Argentina	Víctor Mercante		
Cuba			Elpidio Pérez Somossa
Italy	Maria Montessori		
France	Charles Laisant Émile Borel Pierre Leyssenne	Maurice Royer & Planel Court Émile Lemoine	Henri Bouchet
USA		Paul Klapper	Joseph C. Brown & Lotus D. Coffman Guy Thomas Buswell Frank Clapp Franklin Hoyt & Harriet Peet Charles Judd Alexander Mac Lellan & John Dewey David E. Smith Edward Thorndike Guy M. Wilson Stuart Appleton Courtis Clifford Woody
England	Benchara Bradford Georges St Lawrence Carson Thomas Percy Nunn John Perry	Margaret Punnet Trevor Dennis Clement V. Durrell & Reginald C. Fawdry Clifford Granville & Charles Emmanuel Rice	Margaret Drummond F. B. Selking William McDougall
Germany			Eduard Jänicke Friedrich Unger Gustav Holzmüller
Belgium			Ovide Decroly &Amélie Hamaïde

Schoolbooks, mainly on arithmetic, include those written by Trevor Dennis[38] and by Ángel Llorca García (1866–1942)[39], as well as a series of books in Catalan: *Lliçons d'Aritmètica*[40], adapted from a book[41] by Philip B. Ballard (1865–1950), and works by Gustav Holzmüller (1844–1914) in Spanish translation.

Combining these sources, Comas developed a view on children's mathematics education that integrated arithmetic and geometry, while also considering the specificities of young children's feelings and understanding. Key educational aspects included the shift of emphasis from literacy to orality, the use and design of gadgets intended as rational games, and the openness to playfulness and beauty, in language and classroom dialogue, in activities, and in the rhythm of school lessons[42].

In her reflection, educational essays focused increasingly on the issue of learning rather than on that of teaching, and this aspect became central in Comas' contributions in the 1930s, especially regarding work in child psychology. Nevertheless, the key tension between different aims of elementary mathematics education, which she had addressed early in the 1922 essay mentioned above, was re-examined through insights from experimental pedagogy research in the USA.

Between psychological foundations and pedagogical aims in mathematical education

As we have seen, the second edition of *Metodología de la Aritmética y de la Geometría*, published in 1934, presents a great variety of references, and in its introduction she added a new section on studies of arithmetic tests in the USA, such as those by William McDougall (1871–1938), Stuart A. Courtis (1874–1969)[43], Clifford Woody (1884–1948) and the *Progress tests in arithmetic for the primary schools* marketed by the Houghton Mifflin Company.

In November of the same year, Comas Camps, now a professor of infant biology at the University of Barcelona, published a paper (in Catalan) in the "Revista de psicología i pedagogia" [Journal of Psychology and Pedagogy][44] investigating

[38] T. Denis, *An arithmetic for preparatory schools*, Bell and Sons, London 1919.

[39] A. Llorca *Aritmética*, Casa editorial Calleja, Madrid 1918.

[40] M. Esteve-Llach, C. Vandellós, *Lliçons d'Aritmètica*, Editorial Pedagogica, Barcelona (several editions in the late 1920s and 1930s).

[41] P. Ballard, *Fundamental arithmetic*, University of London Press, London 1927.

[42] All these are interwoven threads that emerge in ongoing research on the 'golden age' of reflection on mathematics and children, see A. Millán Gasca, *A hidden thread*.

[43] See: P.A. Boyer, *The Courtis tests in arithmetic*, "The Mathematics Teacher" 1919, vol. 11, no. 3, p. 121–132.

[44] M. Comas Camps, *Alguns fonaments psicològics per a la metodologia de les matemàtiques* [Some pshicological Foundations for the methodology of mathematics], "Revista de psicología i pedagogia" 1934, vol. 2, no. 8, p. 419–429.

recent contributions to the psychology of mathematics instruction, focusing on research in Geneva by Alice Descśdres (1877–1963) and by Jean Piaget (1896–1980)[45]. However, she added references to many other authors, such as Victoria Hazlitt (1887–1932)[46], a professor at Bedford College in London – where Comas could possibly have met her years before – who was critical of Piaget's views and carried out several investigations suggesting that children could grasp logical relationships at an early age. Further authors included: in England, William Thierry Preyer (1841–1879); in Germany, Karl Bühler (1879–1963) and William Stern (1871–1938); and in the USA, Walter Dearborn (1878–1955), James Mark Baldwin (1861–1934), and Arnold Gesell (1880–1961). Of course, Binet was mentioned, and in fact, she was discussing researchers closely linked with his pioneering investigations with collaborators in Paris at the beginning of the century. She emphasized the need to apply a scientific methodology to understand how children learn, and particularly how they learn mathematics:

> Almost all educators know numerous and important psychological principles; but among these, there are very few that can currently be applied in detail to the teaching of a specific subject, such as arithmetic, for example, because the necessary connection with its content is lacking.[47]

Further contributions in experimental pedagogy in the USA concerned investigations into the actual aim of numeracy. Comas Camps had put forward this dilemma in her first paper in 1922 in the RP:

> There are two aspects to the teaching of mathematics in primary school: one, the main one, is educational and formative; the other, essentially practical. […] The mathematical baggage of the pupil leaving school must therefore comprise: a) Knowledge of the fundamental truths [...] intimately linked [...] forming part of the mind. b) Ease of calculation and handling of all those aspects that can simplify the work.[48]

However, she did not see these two aspects as opposite, but rather as complementary. She points out that an undesirable consequence of an overemphasis on utilitarian aspects is the neglect of geometry, although 'it is the mathematical branch that interests children most'[49]. Moreover, early in 1923, she had criticized the confusion between the real and the useful, and the exclusion of the imagination due to a focus on commercial arithmetic, as if children were all 'little depend-

[45] See J. Piaget, *Le language et la pensée chez l´enfant*, Delachaux et Niestlé, Paris 1923; Idem, *Le jugement et le raisonnement chez l´enfant*, Delachaux et Niestlé, Paris 1924.

[46] See V. Hazlitt, *Children's thinking*, "British Journal of Psychology" 1930, vol. 20, no. 4, p.354–361.

[47] M. Comas Camps, *Algunas contribuciones modernas a la metodología de las matemáticas* [Some modern contributions to the methodology of mathematics], "Revista de Pedagogía" 1934, vol. 150, p. 245.

[48] M. Comas Camps, *La enseñanza de las matemáticas*, p. 218.

[49] M. Comas Camps, *Metodología*, p. 6.

ents'[50]. In a further 1934 paper for the RP, she again defends the idea of taking these two goals into account in order to build a sensible program for children[51]. On the one hand, she discussed three contemporary studies destined to analyze the real role of arithmetic which could guide the choice of content: 1) its uses in professional life, in a contribution by Guy M. Wilson (1876–1965), professor at the Iowa State College of Agriculture and Mechanic Arts, *A survey of the social and business usage of arithmetic*[52] (1919); 2) its presence in newspapers and magazines, explored in a PhD Thesis at the University of Chicago Department of Education[53], and 3) its part in the out-of-school life of students, in an early research contribution by Nita Banton Smith (1889–1976), working at the time in the Detroit public schools[54]. On the other hand, given that whether a subject is more or less formative also depends on the approach taken, she again advocates going deeper into the very incipient at the time psychology of arithmetic, as initiated by Thorndike (1874–1949).

Final remarks

The interest in mathematical pedagogy between the end of the 19th c. and the beginning of the 20th c. was expressed at the national level in many countries around the world, and at the same time was strengthened by international mechanisms of imitation, communication, and competition. It is a complex cultural phenomenon, where reflections from the mathematical world and others from pedagogical environments came together and mutually reinforced one another, interacting with political-cultural agendas.

In turn, the phenomenon can be analyzed at the various levels corresponding to the different stages of mathematical education: from nursery school to higher technical and university education. Mathematical environments were particularly interested in the higher and secondary level, while pedagogical environments instead focused on mathematics for all, that is, the basic education that today we generically call numeracy as part of literacy.

The level of mathematics education for all is undoubtedly the one most deeply rooted in the context of national culture. Examples of this include the configura-

[50] M. Comas Camps, *Cómo se enseña*, p. 17.

[51] M. Comas Camps, *Algunas contribuciones.*

[52] G.M. Wilson, *A survey of the social and business usage of arithmetic*, Teachers College, Columbia University, New York City 1919 (Teachers College, Columbia University. Contributions to Education, vol. 100).

[53] H.W. Adams, *The mathematics encountered in the general reading of newspapers and periodicals*, unpublished Master's thesis, The University of Chicago ProQuest Dissertations & Theses, Chicago 1924.

[54] N.B. Smith, *An investigation of the uses of arithmetic in the out-of-school life of first grade children*, "The Elementary School Journal" 1924, vol. 24, no. 8, p. 621–626.

tion and diffusion of Maria Montessori's 'method' in Italy; the movement catalyzed by John Dewey's proposals in the USA; Charles-Ange Laisant's vision of a 'mathematical initiation alien to any program' in France; and Wilhelm Lay's program of experimental numeracy pedagogy in Germany. Interest in primary mathematics education emerged in pedagogical circles both through the movement of new schools and through new scientific-experimental trends in pedagogy and educational psychology.

Margarita Comas paid attention to various approaches and aspects of the diffusion of numeracy in school, including the idea of mixing arithmetic and geometry, offering a genuine introduction to mathematics and mathematical thought. Her education in the pedagogical field took place in a cultural context inspired by the New Education or modern schools, also thanks to the influence of her family, and then to her contact with the circle around the "Revista de Pedagogía" to which she contributed regularly, thus keeping her attention on the international literature. In the *Escuela Superior de Magisterio* she became familiar with experimental methods in educational research, and her subsequent education in the field of biology would help consolidate a scientific, anthropological vision of mathematical pedagogy. In her writings, some interesting dualities emerge: 1) between the formative and utilitarian values of mathematics, that she doesn't consider opposed, 2) between the need to begin with concrete, intuitive – even experimental – aspects of mathematics, but only to open the path to the indispensable abstraction inherent to mathematics, and 3) the contrast and relationship between reality and utility.

We can conclude that Comas offers us testimony to the vibrancy of the early years of the twentieth century regarding mathematical instruction for children: a plurality of proposals from diverse national cultural contexts. This account is grounded in extensive international experience and systematic documentation, and can be explained by the Spanish context of openness toward Europe described throughout the article.

Simultaneously, this testimony raises significant questions about the causes of a subsequent shift toward a more pessimistic perspective on children's relationship with mathematics that emerged in the 1940s and dominated the international academic landscape until at least the 1970s.

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