

# GEOMETRY FOR WOMEN IN TEACHER TRAINING SCHOOLS IN THE LATE 19TH CENTURY IN SPAIN

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# Geometry for women in teacher training schools in the late 19th century in Spain<sup>1</sup>

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## Abstract

*At the beginning of the second half of the 19th century the teaching of mathematics for boys and girls was different in Spain. In the same way, teacher education for men and for women was different. In particular, in a new law adopted in 1857, geometry was excluded both for girls in primary education and in teacher training schools for women. Instead, the law established that tasks appropriate for women had to be taught.*

*In this text I present how geometry is reintroduced in teacher education for women throughout the second half of the 19th century precisely linked to those tasks appropriate for women, and I briefly analyse two textbooks in which geometry is presented in this way, one written by a man and one by a woman and both published in Valencia, Spain.*

Keywords: geometry teaching; teacher training; 19th century; gender difference

## Introduction

The need to organise teacher training schools for women began to be considered in Spain in the second half of the nineteenth century in the *Ley de Instrucción Pública* (Law of Public Instruction), adopted in 1857<sup>2</sup>, and known as ‘Ley Moyano’ [Moyano’s Law], by the name of its promoter.

However, in spite of the progressive character of this law in its intention to improve women’s education, the law established important differences in the syllabus of mathematics, both for boys and girls in primary education and for men and women in the teacher training schools.

Before Moyano’s Law, teacher training schools for primary teachers had begun to be established in Spain in the 1830s with the name of “Escuelas Normales” (Normal Schools). The first one was created in 1839 in the capital of Spain, Madrid,

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1 This paper is a slightly different version of parts of a chapter written in Spanish for the catalogue of the exhibition *Escoles i Mestres. Dos siglos de historia y memoria*, held at the Cultural Centre of the University of Valencia from November 28, 2017 to March 18, 2018 (Puig, 2017). All quoted texts written in Spanish have been translated by the author.

2 The law was signed by Her Majesty the Queen on September 9, 1857, and was published in *Gaceta de Madrid*, September 10, 1857, num. 1710, pp. 1-3.

with the name of ‘Escuela Normal Central’ [Central Normal School]. The character of ‘central’ was defined in the main aim of the school and was twofold: first, to serve as a model for the other Normal Schools, and second to train not only prospective teachers of primary education, but also prospective teachers of Normal Schools. After the creation of this Central Normal School in Madrid, there followed other Normal Schools in provinces, the one in my hometown, Valencia, in 1845. All these teacher training schools were exclusively for men.

The first teacher training school for women was created in 1847 in Pamplona with the name of ‘Escuela Normal de Maestras’<sup>3</sup>, and by the time of Moyano’s Law only three others had been created. The teacher training school for women in Valencia was created in 1867, ten years after Moyano’s Law.

Thirty years later, in 1897, two books were published in Valencia, one by Carmen Cervera, a book of 110 pages on fractions entitled *Lijero* (sic) *estudio de las fracciones comunes* [Slight study of common fractions], and one by Francisca Ferrer, *Elementos de Geometría plana y descriptiva y nociones de dibujo, con aplicación a las labores de la maestra* [Elements of plane and descriptive geometry and notions of drawing, with application to the tasks befitting the woman teacher].

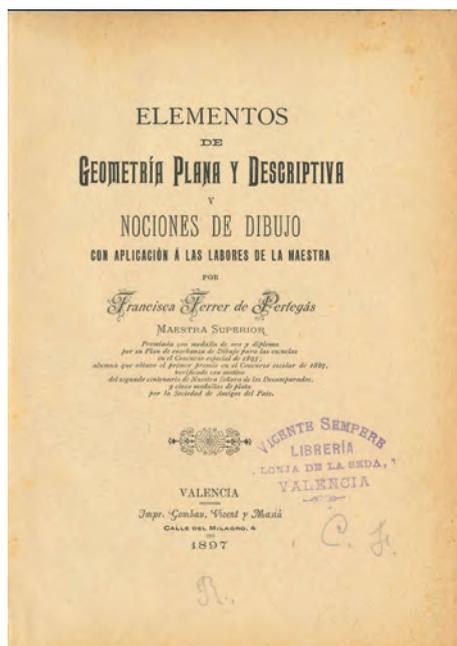


Fig. 1. Title page of Francisca Ferrer’s book

<sup>3</sup> In Spanish, nouns are usually marked according to gender: “maestra” is feminine for teacher, the masculine being “maestro”.

To my knowledge, these are the only two books of mathematics, intended for the teaching of mathematics to the pupils of teacher training schools for women and written by women who taught at the teacher training school for women of Valencia<sup>4</sup>, from its opening in 1897 until its integration in the Normal School of Teachers of Valencia in 1967, when teacher training schools in Spain were no longer segregated by sex.

I present in this text a brief account of the differences in the teaching of mathematics in teacher training schools for men and for women in the second part of the nineteenth century in Spain, and I will use Francisca Ferrer's book to illustrate how these differences evolved in the case of geometry.

### *Teacher education and mathematics in Moyano's Law*

First of all let me say that there was a difference in the way that Moyano's Law considered teacher education for men and teacher education for women. Moyano's Law established that there would be a teacher training school for men in each of the fifty provinces of Spain, but, as far as teacher training schools for women were concerned, the law only stated that the Government would try to promote them "where convenient", without establishing their sources of funding.

With regard to the differences between what had to be taught, the content established in Moyano's Law for teacher education in the schools for men and the schools for women was not only different, but also established in a different way.

Indeed, Articles 68, 69 and 70 of the law listed what had to be studied to obtain the degrees of primary school teacher (in the case of men), in two levels (elementary and higher). In the case of mathematics, the articles specified that "Arithmetic" and "Notions of geometry, technical drawing and surveying" would be studied for the elementary degree, and, for the higher degree, in addition to the above, "Notions of algebra". However, for the degree of primary school teacher in the case of women what the law established in its article 71 is that

[...] it is required:

First. To have studied with the extension due in a Teacher Training School the subjects that the primary education of girls embraces, elementary or higher, according to the title to which they aspire.

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4 Actually, Francisca Ferrer was not a teacher of the teacher training school for women of Valencia when she wrote her book. And when she was hired at that school as a specialist teacher, she did not teach geometry, but drawing and calligraphy. Carmen Cervera was an assistant teacher when she wrote her book. She got a permanent position some years later, but she did not then teach arithmetic.

Second. To have been instructed in the principles of Education and Teaching Methods<sup>5</sup>.

It is therefore necessary to examine the syllabus for the primary education of girls established by Moyano's Law, in order to know what had to be studied by women aspiring to become teachers. However, what the law established for the primary education of girls is not explicitly stated, rather the law referred to what was established for boys with the indication that some parts had to be omitted and replaced by others. Indeed, Article 5 reads as follows:

In the levels elementary and higher of the primary education of girls, the studies dealt with in the sixth paragraph of article 2 and the first and third paragraphs of article 4 will be omitted and they will be replaced with:

First. Tasks befitting their sex<sup>6</sup>.

Second. Elements of Drawing applied to the same tasks.

Third. Slight notions of domestic hygiene.

And, in the paragraphs indicated, the subjects that appear for the boys, but that must be omitted for the girls are:

Sixth. Brief notions of Agriculture, Industry and Commerce, according to localities.

[...]

First. Principles of Geometry, Technical Drawing and Surveying.

[...]

Third. General notions of physics and natural history adapted to the most common needs of life.

So, as far as mathematics is concerned, girls will not study geometry to give room to the "tasks befitting their sex", "elements of Drawing applied to the same tasks ("labores")" and "slight notions of domestic hygiene".

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5 The instruction "in the principles of Education and Teaching Methods" was also included in the syllabus of the teacher training schools for men with the same wording.

6 I translate literally the expression in Spanish "Labores propias del sexo", that refers to tasks such as sewing, embroidering, weaving and housework, which were seen as the ones befitting women. The expression "Labores propias del sexo", meaning this kind of tasks, was shortened to "labores" (tasks) in the school context to refer to the subject taught in women's schools having this content. A similar shortened version was used to indicate in any kind of official forms or identification documents the profession of a housewife: "sus labores", her tasks. In what follows, when I translate a Spanish text with this use of "labores", I will add between brackets the Spanish word "labores" to the English translation "tasks".

Of the paragraphs contained in the syllabus for boys that are not be omitted in the case of girls, the only thing left of mathematics is the fifth paragraph of Article 2, which says:

Fifth. Principles of Arithmetic, with the legal system of measures, weights and currencies.

Since Moyano's Law established that in the teacher training schools for women they have to study "the subjects that the primary education of girls embraces", the only subject they have to study are those "Principles of Arithmetic, with the legal system of measures, weights and currencies". They don't have to study geometry, nor algebra.

### *What geometry for primary education*

Geometry was excluded from teacher education of women, but in the case of men it appears linked with Technical Drawing and Surveying: "Principles of Geometry, Technical Drawing and Surveying". This is a consequence of a conception of the kind of geometry suitable to primary education and to the education of primary teachers that is clearly stated in the book that was the official textbook of Pedagogy for teacher training schools from 1850 to 1905. This book of 390 pages dedicates less than a page to the teaching of geometry, containing this assertion:

Geometry must, in our opinion, remain rigorously enclosed in the study of its usual applications. In schools, the difficult theories of this science must be left aside, for they are at least useless when they cannot be well understood. The most useful application of geometry, especially in Spain and generally in all rural schools, is surveying, which should be reduced frequently to practical exercises. The teaching of Geometry in schools should be limited to establishing easy principles and to demonstrating its application immediately. (Avendaño & Cerderera, 1850, pp. 254-255)

This option to limit the study of geometry to its applications defined the subject of geometry in the general syllabuses, and the content of textbooks for teacher education. Geometry was presented in the teacher training schools for men applied to surveying. When geometry found its way to the syllabuses for women, the general idea of its study in application to a field was imported, but the field of application was changed. There was no way to present the use of geometry in surveying, since surveying was a subject that also had to be omitted for girls in Moyano's Law, and furthermore it was not seen as a field usual in women's lives. Instead, the tasks befitting their sex was the field chosen for the application of geometry.

## Mathematics in teacher education from Moyano's Law till the end of the 19th century

Following Moyano's Law, a general regulation with a more detailed syllabus for teacher training schools for men was published in 1858<sup>7</sup>, but this was not the case for teacher training schools for women. Table 1 shows the parts on mathematics in this syllabus.

Table 1. Mathematics for teacher education from 1857 till 1881

Men	Women
Elementary level: <ul style="list-style-type: none"> <li>• Arithmetic</li> <li>• Notions of geometry, technical drawing and surveying</li> </ul>	Lack of a general regulation. Regulations for each newly created teacher training school for women.
Higher level: <ul style="list-style-type: none"> <li>• Complements of Arithmetic and notions of algebra</li> <li>• Elements of geometry, technical drawing and surveying</li> </ul>	

In the case of teacher training school for women, due to the absence of a general regulation, regulations appeared independently for each teacher training school as they were created, or new regulations were adopted for teacher training schools already established. These regulations were proposed by the faculty of the school or the promoters of the new schools, and were approved by the Ministry of Development, which was in charge of the educational system. The situation regarding the inclusion of geometry was very varied: a good number of schools did not include it, a few included it as an independent subject, and other schools linked it to the tasks ("labores").

It was not until 1881 that a Royal Decree<sup>8</sup> established the syllabuses and regulations both for teacher training schools for men and for teacher training schools for women. In this Royal Decree, the subject "Drawing applied to tasks ("labores")<sup>9</sup> with slight notions of geometry" is included, generalizing the initiative of several teacher training schools for women that had included in their syllabuses geometry

7 Royal Decree September 20, *Gaceta de Madrid*, September 23, 1858, num. 266, pp. 1-2.

8 *Gaceta de Madrid*, August 31, 1881, num. 243, p. 614.

9 "Tasks", "labores" in Spanish, means in this Royal Decree "the tasks befitting her sex", shortened to "tasks", "labores". See footnote 6.

applied to tasks (“labores”)<sup>10</sup>. This had been the case of the teacher training school for women of Valencia, where it was included in its general regulations of 1867<sup>11</sup> for the syllabus of teachers of the higher level of primary education with the title of “Notions of geometry and further drawing applied to the tasks (“labores”).

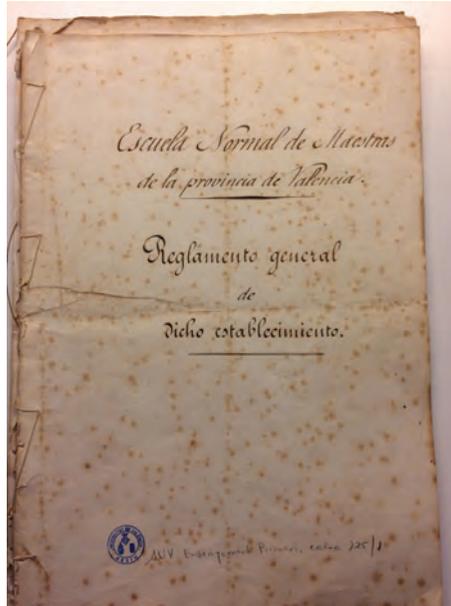


Fig. 2. Cover of the manuscript of the General regulations of the Teacher training school for women of Valencia, 1867

Table 2 shows the part on mathematics of this syllabus. In the case of the teacher training schools for men, there is no change with respect to the program established by the Royal Decree of 1858.

10 Four years before, the Royal Decree for creation of the teacher training school for women of Toledo, which also included geometry linked to the tasks (“labores”) in the syllabus, established that this syllabus would apply to any other school that was created thereafter. However, this Royal Decree did not require schools that had already been created to adopt this syllabus. (Royal Decree March 14, *Gaceta de Madrid*, March 28, 1877, num. 87, pp. 853-854.)

11 A manuscript of this 1867 regulation is kept in the Historical Archive of the University of Valencia (Escuela Normal de Maestras de la provincia de Valencia, *Reglamento General de dicho establecimiento*, AHUV, Primary Education, box 125/1).

Table 2. Mathematics for teacher education in the 1881 Royal Decree's regulations

Men	Women <sup>1</sup>
Elementary level: <ul style="list-style-type: none"> <li>• Arithmetic</li> <li>• Notions of geometry, technical drawing and surveying</li> </ul>	1 <sup>st</sup> Elements of arithmetic applied to the natural numbers, fractions, decimals and the legal system of measures, weights and currencies Drawing applied to tasks (“labores”) with slight notions of geometry
Higher level: <ul style="list-style-type: none"> <li>• Complements of Arithmetic and notions of algebra</li> <li>• Elements of geometry, technical drawing and surveying</li> </ul>	2 <sup>d</sup> Further arithmetic until proportions, and exercises on problem solving 3 <sup>d</sup> Further arithmetic, including proportions and the applications of this theory

*Geometry in textbooks for the training of male primary teachers and female primary teachers*

By the end of the nineteenth century, after the introduction of geometry through its link with the tasks befitting the woman teacher was generalised, some other books, intended to cover the syllabus of “Drawing applied to tasks (“labores”) with slight notions of geometry” like the one by Francisca Ferrer, were written. I have been able to find four of them, three written by men, and one written by a man and a woman. The only one I know written by a woman is the one by Francisca Ferrer published in Valencia.

That is not unusual, Ballarín et al. (2000) found in a general survey of textbooks for women education in Spain in the second part of the nineteenth century that fifty six per cent of them were written by men. But it is at least a surprise to find men writing not only on mathematics, geography, history or language, but also on the so-called “tasks befitting the sex”, meaning sewing, embroidering, weaving, cutting, and so on. In the books that I have found, the male authors used different strategies to cope with writing on these themes.

Juan Barceló wrote the book *Nociones de geometría con aplicación a las labores y corte de prendas* [Notions of geometry with application to the tasks (“labores”) and garments cutting]<sup>12</sup> with a woman, Vicenta de Luis, a primary teacher, for a popular series of books called *Biblioteca de las Escuelas Normales* [Teacher training schools library], published by Saturnino Calleja. These books covered all subjects, and were not intended

12 This book has been analysed in Meavilla & Oller (2016).

as textbooks for the teacher training schools, but as texts to prepare the exam for a teaching position<sup>13</sup> in the Spanish public school system (Barceló & de Luis, 1895).

Crescencio Moles, who was a professor at the teacher training school for women of Barcelona, explains in the introduction of his *Curso de geometría y dibujo lineal aplicado a las labores* [Course on geometry and technical drawing applied to the tasks (“labores”)] his feelings by saying<sup>14</sup>:

From the moment that I was entrusted with the teaching of geometry and drawing applied to women’s tasks at the teacher training school for women of Barcelona, I naively confess that I was perplexed at the thought of the special application of geometry I had to do; a work truly somewhat prickly, when there is no deep knowledge of the art to which all my efforts should be directed.

And he adds:

However, the need, and even more, the desire to fulfil my role worthily, made me study all the major tasks (“labores”) in detail; and by this means I was able to overcome certain difficulties [...] (Moles, 1869, p. 5).

Prudencio Solís, who was a professor at the teacher training school for men in Valencia and its director till his death in 1897, does not seem however to have studied the tasks much in order to write and publish his book *Nociones de geometría y dibujo aplicado a las labores para las aspirantes al magisterio* [Notions of geometry and drawing applied to the tasks (“labores”) for the women aspirants to the teaching profession] (Solís, 1889). He had already published a book for the correspondent subject in the syllabus of the teacher training school for men *Nociones prácticas de geometría, agrimensura y dibujo lineal gráfico y a pulso para los aspirantes al magisterio* [Practical notions of geometry, surveying and technical and freehand drawing for the men aspirants to the teaching profession] (Solís, 1881<sup>15</sup>), and he just copied literally from this book the first part that contained geometry, omitting some lessons and some items from other lessons, and adding just five pages with some slight indications on ornamental drawings and garment cutting, and the reference to other books where these matters were treated.

This strategy used by Solís to write the book for women repeats somehow the way in which the syllabus for women in Moyano’s Law is presented: it takes what is

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13 The degree awarded by the teacher training schools qualifies graduates to work as teachers in any public or private school. To get a permanent position in the Spanish public education system, in which teachers are civil servants, one must pass an exam.

14 I quote from the second edition of 1869. I have not been able to find the first edition.

15 I quote from the second edition of Solís’ book for men and the third edition of Solís’ book for women. I have not been able to find the previous editions.

established for men and removes a part, but not exactly to make room for what is considered appropriate for women. Solís' book for men has 160 pages and his book for women only 85. The book for women is then half the length of the one for men, but it is not only a question of size, what Solís removes from his book for men to compose his book for women is a clear indication of the conception held by the author, and the society of his time, of what parts of mathematics were not suitable or were too difficult for women. The following are a sample of different aspects of mathematics omitted in the book for women.

In one lesson on angles, the Spanish word "bisectriz", meaning "angle bisector", and its definition are removed, and the section only states how to divide an angle in two equal parts.

In one lesson on triangles, the section on Pythagoras' theorem is removed, even though in the book for men Pythagoras theorem appears as a property of rectangular triangles without mention of Pythagoras nor the word "theorem". And, by removing the section on Pythagoras' theorem, the words "hypotenuse" and "cathetus" and their definitions are also removed. Figure 3 shows how section 71 from the book for men has been cut out in the book for women and sections 70 and 72 from the book for men have been cut and pasted literally in the book for women, becoming the consecutive sections 64 and 65.

70. Puesto que los tres ángulos de todo triángulo valen dos ángulos rectos, infiérese que de los tres ángulos del triángulo, dos no pueden ser rectos ni obtusos, y por tanto, el triángulo tendrá siempre, bien un ángulo recto y dos agudos, bien un ángulo obtuso y dos agudos, bien los tres ángulos agudos. En el primer caso se denomina *triángulo rectángulo*, como D E F (fig. 43); en el segundo *triángulo obtusángulo*, como C H I (fig. 44), y en el tercero, *triángulo acutángulo*, como A B D (fig. 40).

71. Los lados D F y D E, que forman el ángulo recto D del triángulo rectángulo F D E (fig. 43), toman el nombre de *catetos*, y el lado E F opuesto á dicho ángulo se llama *hipotenusa*.

Entre estos tres lados hay constantemente una relacion dada que constituye una importante propiedad del triángulo rectángulo, á saber:

El cuadrado de la hipotenusa es igual á la suma de los cuadrados de los catetos, esto es:  $E F^2 = F D^2 + D E^2$ . De aqui resulta que la hipotenusa es igual á la raíz cuadrada de la suma de los cuadrados de los catetos, y un cateto es igual á la raíz cuadrada de la diferencia entre el cuadrado de la hipotenusa y el cuadrado del otro cateto, esto es:

$$F E = \sqrt{F D^2 + D E^2}, \text{ y } F D = \sqrt{F E^2 - D E^2}$$

Si, pues, los catetos de un triángulo rectángulo tuvieran, por ejemplo, 8 metros de longitud uno y 6 metros el otro, la longitud de la hipotenusa seria igual á  $\sqrt{8^2 + 6^2} = \sqrt{100} = 10$ .

Si la hipotenusa tuviera 20 metros y un cateto 12, el otro cateto tendria  $\sqrt{20^2 - 12^2} = \sqrt{256} = 16$ .

72. La construcción de triángulos en general ofrece una gran variedad de casos; pero solo trataremos de los más comunes, á saber:

64. Puesto que los tres ángulos de todo triángulo valen dos ángulos rectos, infiérese que de los tres ángulos del triángulo, dos no pueden ser rectos ni obtusos, y por tanto el triángulo tendrá siempre, bien un ángulo recto y dos agudos, bien un ángulo obtuso y dos agudos, bien los tres ángulos agudos. En el primer caso se denomina *triángulo rectángulo*, como D E F (figura 39); en el segundo *triángulo obtusángulo*, como C H I (figura 40), y en el tercero *triángulo acutángulo*, como A B D (figura 37.)

65. La construcción de triángulos en general ofrece una gran variedad de casos; pero solo trataremos de los más comunes y que el dibujo lineal resuelve con suma sencillez:

Fig. 3. Comparison between Solís' book for men (left) and Solís' book for women (right)

Another significant difference appears in the lesson on areas: in the item on the area of a circle, symbolic formulas are removed, and the letter  $\pi$  does not appear, being replaced by the number 3,14159. Furthermore, in the same lesson, the inverse problem of finding the radius knowing the area is removed as well, in order to avoid a formula that includes a square root. On top of this, almost all three-dimensional geometry is removed.

In summary, technical vocabulary, symbolic formulas, special mathematical signs, complex properties and almost all three-dimensional geometry are removed by Prudencio Solís from his book for men to construct his book for women.

### *Francisca Ferrer and her book on geometry*

Francisca Ferrer, was born in Valencia, Spain, in 1853, and died in 1931 also in Valencia. She studied in the teacher training school for women of Valencia from 1871 to 1873<sup>16</sup>. She wrote two books on the teaching of drawing, one for the drawing syllabus of the teacher training school for women of Valencia and another one for the primary education of girls, which was honoured with an award from the University of Valencia and the Department of Public Instruction in 1895. When she wrote her book on geometry for the syllabus of the teacher training school for women of Valencia she was not working as a teacher at this institution, but at a private one called *Institución para la enseñanza de la mujer* [Institution for women's education], founded in 1888 in Valencia<sup>17</sup>, an institution in which courses of general culture for women were taught, including courses in arithmetic and geometry. This institution was created by people of krausist ideology<sup>18</sup> with the aim to improve the general education of women.

After publishing her book, Francisca Ferrer worked at the teacher training school for women between October 1899 and January 1902, as a special teacher of drawing and calligraphy. She was not in charge of the subject she treated in her book, but her

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16 Courses to get the degree of teacher lasted two years at that time in the teacher training school for women of Valencia.

17 The Institution for women's education was the follow-up of the *Escuela de Comercio para Señoras* (School of Commerce for Ladies) founded in 1883, following a call to expand the pioneering schools for women organized since 1870 in Madrid by the *Asociación para la Enseñanza de la Mujer* (Association for the education of women) (cf. Reig, 2012).

18 Krausism was an ideology, named after the ideas of the German philosopher Karl Christian Friedrich Krause (1781-1832), which was the philosophical foundation of a cultural movement developed in Spain by a group of progressive thinkers, university professors and politicians. Their ideas were put into practice in education through the creation of the *Institución Libre de Enseñanza* (Free Institution of Education) in 1876, when some of their main members got expelled from the university by a conservative government. This Free Institution of Education lasted until the civil war of 1936-1939 and the victory of the dictator Francisco Franco.

book was adopted as an official textbook not only in the teacher training school for women of Valencia, but also in the one of Tarragona.

She was married with a well-known physician, Enrique Pertegás Malvech. She added the name of her husband to her name, Francisca Ferrer de Pertegás<sup>19</sup>, and signed her book with her name as a married woman (see the title page of her book in figure 1), instead of Francisca Ferrer Lecha, her maiden name.



Fig. 4. Francisca Ferrer Lecha (1853-1931)

Her book is presented explicitly in the introduction as an answer to the official syllabus of the teacher training school for women of Valencia. However, she adds that

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19 In Spain we receive two family names, one from each of our parents. Until recently, the order of the family names had to be the father's in first place and the mother's in second place. Women don't lose their family names when they get married. However, it was common until recent times that they dropped out their second family name, the one from their mother, adopting the first family name of their husband preceded by the preposition "of", "de" in Spanish, meaning "dependent of" or "property of".

in anticipation of the contingencies that might arise from the change of [the syllabus], I have added what, in my opinion, they lack in order to complete the study of this subject; but attending to the published ones, I exclude in the part corresponding to Geometry all mathematical demonstration, allowing only the indication of some simple general formulas of essential necessity. (Ferrer, 1897, pp. III-IV)

Francisca Ferrer separates clearly the parts that answer the official syllabus and the added ones, by two devices. First, the lessons that answer the official syllabus are numbered with roman numerals and the added lessons are unnumbered. Second, the text that corresponds with added parts is printed in a smaller font both in the numbered lessons and in the unnumbered ones (these last ones are then completely printed in the smaller font).

The added lessons are the following:

- Curves composed by arcs of circumference
- Graphic problems of these curves
- Curves described by points or by a continuous movement
- Graphic problems of these curves
- Equal figures
- Equivalent figures
- Similar figures
- Symmetrical figures
- Areas of plane surfaces
- Areas of surfaces of solids
- Volumes of solids
- Solid nets

But this is only a part of what Francisca Ferrer added to the official syllabus. In the lessons that answer the official syllabus there is a considerable amount of added issues. A sample of the most significant is the following:

- Proportional segments
- Division of a segment in extreme and mean ratio
- Number of diagonals of a polygon, number of diagonals from a vertex
- Division of a polygon in triangles
- Measure of the interior angle of a polygon
- Drawing of polygons
- Star polygons

In the added paragraph on “proportional segments”, Francisca Ferrer explains the idea of proportional segments and relates the graphical methods to construct proportional segments to four statements. She explicitly calls these statements “theorems”, although she states them without proof.

With all these added to the syllabus, Francisca Ferrer’s book looks more like Solís’ for men than Solís’ for women. A close comparison of Francisca Ferrer’s book with Solís’ book for men (made in Cucala, 2017) shows that Francisca Ferrer’s book covers, in its first part on geometry, even more than Solís’ book for men<sup>20</sup>.

On top of this, Francisca Ferrer’s book articulates the content of the first part on geometry with the second part on tasks (“labores”) of the women teacher by mutual references between the content of the lessons in the part on geometry with the content of the second part, something that is lacking in Solís’ book for women, which simply adds some a few pages on the tasks (“labores”). A sample of these references is shown in Table 3.

Table 3. References between the lessons on geometry and the tasks in the second part

<b>Lesson in the part on Geometry</b>	<b>Task in the second part</b>
General issues on the straight line	Main tasks of folding in straight line
Operations with straight lines	To draw simple laces or pointelles (fig. 5)
Angles	Drawing of angles for a frieze (fig. 6)
Scales	Application to the cutting of garments (fig. 7)
Circumference	Drawing of simple festoons
Arcs of circumference	Drawing of all kind of festoons (fig. 5)
Measure of angles	Main crochet tasks
Triangles	Procedure to square a piece of cloth: its foundation
Polygons	Geometric figures in the cutting of garments

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<sup>20</sup> One may wonder where Francisca Ferrer got her knowledge of mathematics. As far as I know she was an autodidact.

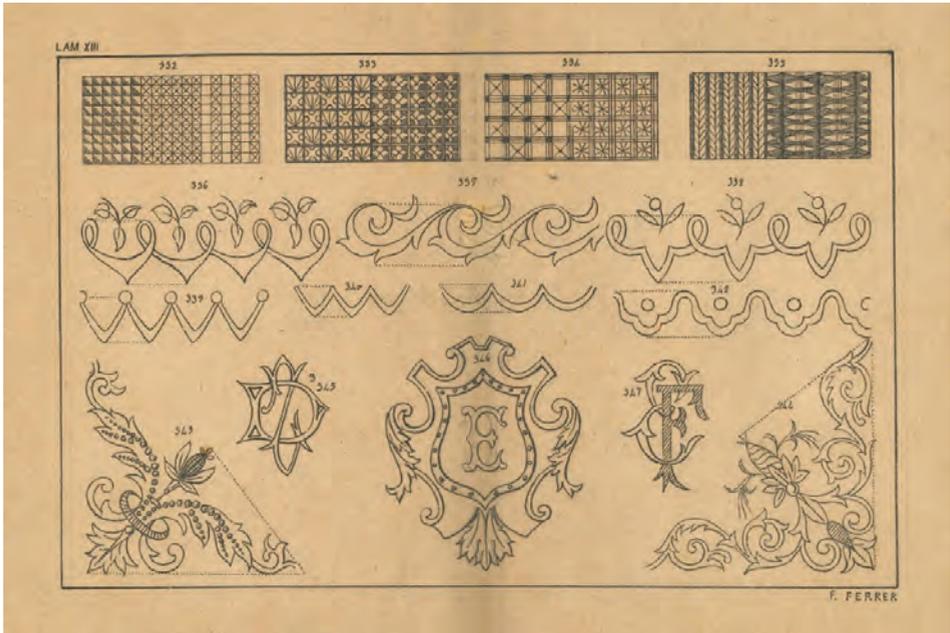


Fig. 5. Pointelles and festoons

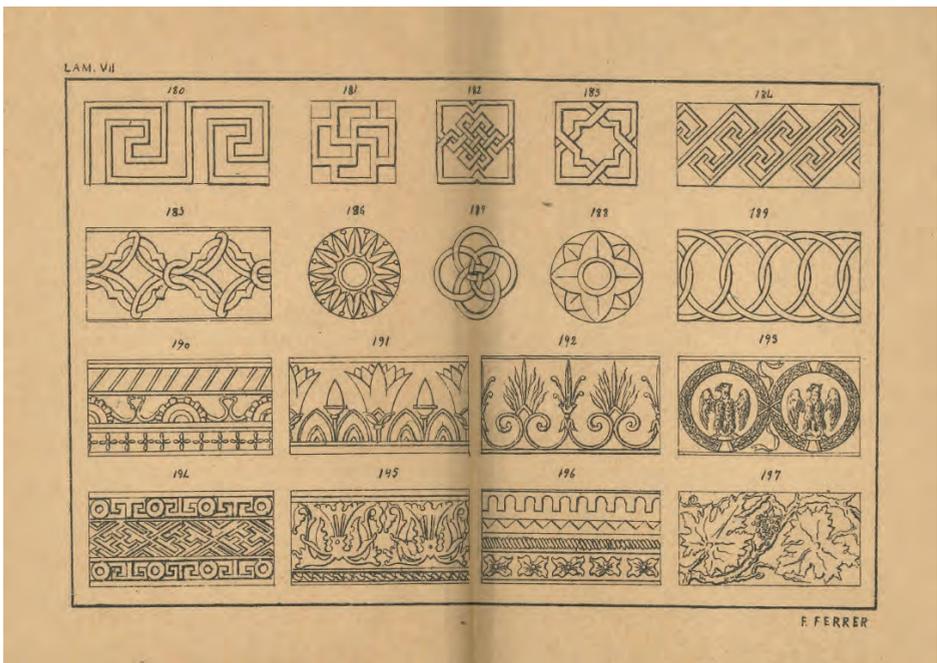


Fig. 6. Friezes

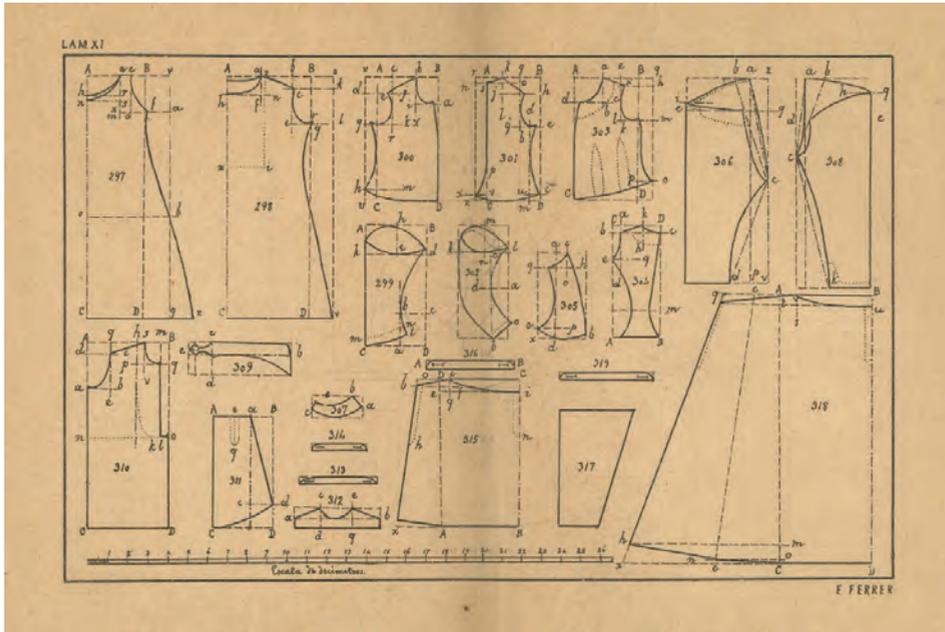


Fig. 7. Cutting of garments

Ferrer's book is an example of how the exclusion of geometry from the teaching of mathematics to girls to give room to the tasks befitting their sex could be restored paradoxically through the use of what had been the cause of its exclusion.

We do not know to what extent the parts of her book that go beyond the official program were used in teaching, but their mere presence in her book had the effect of being a statement of what women are able to study, and of what should be in the syllabus for women. And the fact that her book was adopted as an official textbook in the schools of Valencia and Tarragona guarantees that her book was in the hands of women students who might have had the curiosity to learn the added parts even if they were not taught.

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## Legislation

- Ley de Instrucción Pública. *Gaceta de Madrid*, September 10, 1857, num. 1710, pp. 1-3
- Royal Decree September, 20. *Gaceta de Madrid*, September 23, 1858, num. 266, pp. 1-2.
- Royal Decree March, 14. *Gaceta de Madrid*, March 28, 1877, num. 87, pp. 853-854.
- Royal Decree August, 17. *Gaceta de Madrid*, August 31, 1881, num. 243, p. 614.
- Escuela Normal de Maestras de la provincia de Valencia, *Reglamento General de dicho establecimiento*, AHUV, Primary Education, box 125/1.

(Footnotes)

- 1 In the case of the teacher training schools for women the syllabus was presented in the Royal Decree organised by years instead of by levels.