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Knowledge Objectification Processes: The Role of the *Expert* and the *Expertise* and the Teachings of Geometry and Drawing

Maria Célia Leme da Silva[a]

[a] Universidade Federal de São Paulo/UNIFESP, Campus Diadema, Departamento de Física, Diadema, SP, Brasil.

ABSTRACT

The present article aims to discuss the complexity of the process of objectification of school knowledge, especially the knowledge proposed for the teaching of geometry and drawing in the first years of schooling. In order to do so, we take up studies developed since 2010 within the scope of GHEMAT in order to produce a historical narrative about the relations between the teaching of geometry and drawing, from the Brazilian Empire until the 1920s. Finally, the role of subjects is discussed in the transformation of the geometric knowledge, in particular, the figure of Heitor Lyra da Silva and his modernizing proposal for the teaching of geometry, which dissociates the articulation between geometry and drawing, inserting the simultaneous study between plane and space.

Keywords: History of school geometry. Elementary school. Heitor Lyra da Silva. Experts. Expertise.

Processos de Objetivação de Saberes: o Papel do *Expert* e da *Expertise* e os Ensinos de Geometria e Desenho

RESUMO

O presente artigo tem como objetivo discutir a complexidade do processo de objetivação de saberes escolares, em especial, os saberes propostos para o ensino de geometria e desenho nos primeiros anos de escolarização. Para tanto, retomam-se estudos desenvolvidos desde 2010 no âmbito do GHEMAT no intuito de produzir uma narrativa histórica sobre as relações entre o ensino de geometria e de desenho, desde o Império brasileiro até a década de 1920. Discute-se finalmente, o papel dos sujeitos na transformação dos saberes geométricos, em particular, a figura de Heitor Lyra da Silva e a sua proposta modernizadora para o ensino de geometria, que desvincula a articulação entre geometria e desenho, inserindo o estudo simultâneo entre plano e espaço.

Palavras-chave: História da geometria escolar. Escola primária. Heitor Lyra da Silva. Experts. Expertise.

Corresponding author: Maria Célia Leme da Silva. E-mail: mcelialeme@gmail.com

THE PLACE OF DEPARTURE – PREVIOUS STUDIES

In 2010, we have the approval of the first research project[1] that focused on the teaching of geometry and drawing in primary education in São Paulo between 1890 and 1930. Without limiting itself to the regulations, the project prioritized the study of the teaching programs of the two subjects in question, in the state of São Paulo: geometry and drawing. Many results were obtained, however, the article entitled "Drawing and Geometry in primary school: a long-lasting marriage ending with litigious separation" was highlighted, which revealed from the title the existence of conflicting relations between the two scholar types of knowledge and concluded that:

> Drawing, in times of the Empire and in the first republican legislation, in the State of São Paulo, is assumed to support the teaching of Geometry. Freehand tracing of geometric figures, studied in the field of Drawing play a reinforcement to the Geometry of the initial years.
>
> With the crisis pointed out in the method of teaching drawing through geometric traces, the relation of dependence between Drawing and Geometry breaks. A new conception is installed, however, Geometry is already established, with own proposals. It can be said that Geometry gains its independence to follow its own trajectory of recognition in primary education. (Leme da Silva, 2014, p.72, emphasis added)

Roughly, the study pointed out that the nineteenth century can be characterized as the drawing aiding geometry in the so-called first letter school. Geometry was designated as "practical geometry," and the practice represented as that of freehand drawing geometric figures. At the end of the nineteenth century, with the arrival of the Republic and the creation of a republican school, in particular the new structure of public education in São Paulo – school groups –; new pedagogical models circulate in the country and begin to produce changes in the harmonious relationship existing between the teaching of drawing and geometry.

The tension between drawing and geometry is identified in the articles of pedagogical journals, which in the period in question play the role of disseminating the debates about teaching proposals based on intuitive methods. Two studies investigate the teaching of drawing in the period in question, with different sources, the book chapter called "The National and International Circulation of Pedagogical Ideas on Drawing in the Primary Course" and the article "What drawing to teach? Analysis of discourses of the pedagogical magazines of São Paulo in the early twentieth century "and reveal two contradictory points of view:

> On the one hand, the vision of the artistic community, propagated by the strength of international events, in particular the International Drawing Congresses, which

[1] Project entitled "Geometry and drawing in primary education in São Paulo, 1890-1930" by Edict 02/201 of Humanities, Social and Applied Social Sciences.

> bring together artists with the aim of increasing the taste for art and beauty, from the artistic point of view, without any requirement of perfection. They also make use of the vocational training strategy of a craft, not restricted to artists, but of the future citizen in modern society. This trend advocates natural drawing.
>
> On the other hand, the vision of science, linked to the model of geometric drawing, to future studies of geometry, in which perfection is necessary because it represents abstract concepts, is aimed at instruction rather than student formation. This approach aims at preparing for the preparatory study, with a view to secondary education, in which the geometric concepts will be defined and their properties deduced, in the logical order. Such a tendency to consider the drawing aligns it to the mathematical knowledge, formalized, ordered by Euclidean geometry. (Leme da Silva, Camara, Frizzarini, Trindade, Guimarães, 2016, p.80)

The debate is strongly discussed in the pedagogical journals and in the end, it is concluded that:

> In summary, everything indicates that the organization of the artistic class is determinant in the introduction of natural drawing in the Brazilian primary school, in tune with the international debate. Demands external to the school, such as the professionalization and organization of International Drawing Congresses, interfere with and modify an established school culture of a long time. (Frizzarini, Trindade, Leme da Silva, 2015, p.17)

The natural drawing, whose focus is the reproduction of everyday objects of the child, free form and without instruments, is now recommended in the programs of several Brazilian states, such as the 1905 program in São Paulo, the 1912 program in Sergipe , the program of 1914 of Santa Catarina, program of 1914 of Paraná (Leme da Silva, Camara, Frizzarini, Trindade, Guimarães, 2016).

The drawing of geometric figures, in turn, does not disappear from primary school; it remains, but no longer as freehand drawing. The geometric drawing, characterized by the use of instruments, particularly the ruler and compass, is spread by different subjects, especially in programs in which there is the subject geometry and in some others coexists with natural drawing in the heading drawing. The book *Primeiras noções de Geometria Prática* (First notions of Practical Geometry), by Olavo Freire da Silva, published in 1894, translates as a compendium of geometric constructions with ruler and compass. The manual was analysed and it was found that:

> […] the geometry proposed in Freire's book can be interpreted as a practical geometry, insofar as the concepts studied are related to objects of daily life, but the presence of geometric constructions in a continuous and increasing manner represents a new approach to the practicality of the geometry, that is, the practicality

> in the action of constructing geometric objects with ruler and compass. (Leme da Silva & Valente, 2014, p.56)

Freire's book had a long life, numerous editions and came to the mid-twentieth century. The presence of geometric drawing in primary schools was also investigated in the article "Ruler and Compass in primary education? Circulation and appropriation of normative practices for the subjects of Drawing and Geometry" that took as a source the teaching programs of five Brazilian states: São Paulo, Minas Gerais, Sergipe, Goiás and Rio Grande do Sul. The study identified in the regulations of all states cited, the prescription of the use of ruler and compass for the construction of geometric figures in the primary school in the first half of the XX century. In São Paulo, the recommendation for the use of ruler and compass was identified from the 1918 program; in Minas Gerais, from the 1906 program; in Sergipe, there is no mention of the use of the instruments, however, Geometrical Drawing was used in the 1917 program; in Goiás, the prescription of exercises with rulers and compass occurred in 1893; and finally, in Rio Grande do Sul, the orientation of geometric drawing with the use of ruler and compass was present in 1899. In the end, it was argued that:

> Constructions using ruler and compass participate in normative practices in primary education, in matters of *drawing, linear drawing, geometry, practical geometry* in the geographic cut of the chosen states. It is also inferred that constructions with geometrical instruments can represent pedagogical practices for the teaching of geometry and drawing in the primary education of the First Republic period, beyond the state of São Paulo, and modelled on it. It is evident the circulation and appropriation of the recommendations for the use of ruler and compass and, in this way, more in-depth studies need to be developed in order to understand the purposes of the geometric construction as a constitutive element in the national representation on the past of the teaching of geometry in the school primary education. (Leme da Silva, 2014b, p.94)

Continuing the analysis on the presence of ruler and compass in teaching programs, the text presented at the GHEMAT Thematic Seminar in 2014, entitled "Ruler and compass: in search of a national representation in the programs of the school groups in the 1920-1930" adds three states and the Distrito Federal, Rio de Janeiro. In Santa Catarina, the program of 1928 indicated constructions with instruments, which leads to believe to be with ruler and compass; in Espírito Santo, the 1936 program made explicit the use of transferor and compass; and in Alagoas, the 1937 program recommended instruments used in the drawing, without specifying what they would be. The last program analysed was from the year 1934 of the Federal District, Rio de Janeiro and, to our surprise, the extensive and detailed program of mathematics, published in a book, did not mention the use of instruments, nor of ruler and compass. The work did not respond to the singularity of the Federal District, did not confirm the hypothesis that the geometric constructions and

the use of ruler and compass were configured as a national representation of pedagogical practices for the teaching of geometry, and raised possibilities of interpretation:

> Clearly, the proposal of the *Mathematics Program* bears the mark of reality, of the necessity of concretization and of great concern with measures of length, area and volume in problems. However, no approach is made about geometric constructions. Is this a practice that is not in line with the 'New School' proposals? [...] the absence of geometric constructions in the program of the Federal District of 1934 reveals a rupture of national references, which may be tied to the arrival of the pedagogical wave of the New School. (Leme da Silva, 2014c, p.10-12)

Time passes and the open question went numb. New studies and projects continued to be developed, in order to approach Rio de Janeiro. The thesis of Claudia Frizzarini,[2] defended in 2018, investigated the relations between mathematical knowledge in the field of Handicrafts in São Paulo and Rio de Janeiro and the contact with the programs of Rio de Janeiro.[3] In parallel, the thesis under construction by Gabriel Conceição,[4] analyses the geometric knowledge present in the reports and articles published by three primary teachers from Rio de Janeiro who carried out a study mission in Europe at the end of the century XIX. In addition, recently, contact is made with the book *Geometry (Observation and Experience)* by Heitor Lyra da Silva, published in 1923 in Rio de Janeiro, which was the object of analysis in some studies,[5] always inserted and in dialogue with the network of productions already made. New sources, new questions and reflections about hypotheses already made…

PROFESSIONAL *EXPERTISE* AND THE *EXPERTS*

All studies reviewed focused on changes in school knowledge, both geometry and drawing, and it is clear that the processes of changes, reorganizations, inclusion and exclusion of content and methodologies in schools are operated by men, at a certain time and place. Marc Bloch told us in the 1940s that history is the "sciences of men, in time" (Bloch, 2001, p.55). However, although such subjects are present in the various productions, a more in-depth and particular analysis about men and their professional

[2] Frizzarini, Claudia Regina Boen. *Mathematical knowledge in the field Manual Works: processes of schooling of doing, São Paulo and Rio de Janeiro (1890-1960).* Thesis (PhD) – Federal University of São Paulo, School of Philosophy, Letters and Human Sciences. Guarulhos, 2018.

[3] It should be noted that the digital content repository (https://repositorio.ufsc.br/handle/123456789/1769) is beginning in 2012 and the process of insertion of sources (identification, transformation into pdf, filling of metadata, availability) is a continuous process since then, in each state as well as in the enlargement of participating states.

[4] Thesis in development with provisional title "Circulation of international pedagogical models on the teaching of geometric knowledge (Brazil, end of century XIX)".

[5] The text "The expertise in the production of geometry manuals in Brazil" presented in 3 JECICNaMa in Argentina in September 2018 and "Cartonage and the teaching of geometry: an analysis of Rio manuals" presented in a table submitted in the IV ENAPHEM, in November 2018.

performances can corroborate in the complex understanding of the fabric of school knowledge transformations over time.

In this sense, the studies developed by the Research Team on History of Educational Sciences (ERHISE) of the University of Geneva (Switzerland) on the professional knowledge of teachers – understood as the articulation between knowledge to teach and knowledge for teaching – present in in teacher education throughout history, highlights the relevance of the studies of experts and professional *expertise* in the process of objectification[6] of knowledge.

Hofstetter, Schneuwly, Freymond, and Bos (2017) highlight that the experts have their origins in the teaching itself in the broad sense: inspectors, primary and secondary teachers and school principals. They are considered "*experts*" because they know perfectly the teaching profession and in it stand out: "*The expertise is, therefore, carried out by people from the school environment, that is, by the teaching profession. Under clearly defined institutional conditions, the work of expertise is perfected and develops the knowledge that concerns it*" (Hofstetter, Schneuwly, Freymond, & Bos, 2017, p.67-68, our emphasis).

The authors still consider the complex evolution of the practices of *expertises* in the pedagogical field, especially in the late nineteenth century, the time of the first "*expertises*":

> Research of the "men of goods" then professionals: numerous and rich, the first "expertises" appear in fact to the occasional researches, the babbling methods, initiated or entrusted to the individuals who invest in the mission to organize a public education worthy of this name; the forms and approaches of these researches become professionalized progressively as the State responsible for public education develops; the premises of a disciplinary field are outlined on this basis. (Hofstetter, Schneuwly, Freymond, & Bos, 2017, p.104)

The *expertise* in the teaching profession is linked to the objectification of knowledge, the "authority" in inserting, altering, building knowledge for the school, or for teacher training. Valente (mimeo) discusses the different possibilities of establishing new objective knowledge, which may be in official norms, in teaching programs, in books or pedagogical manuals.

And so, one turns to Rio de Janeiro and the analysis of the book *Geometry (Observation and Experience)* if Heitor Lyra da Silva, to examine the work, having as a magnifying glass the production of new knowledge for the teaching of geometry, as well as the analysis of the author's political and social relations, considered as a possible

[6] Valente (mimeo) emphasizes that the study of the articulation between knowledge to teach and knowledge to teach, in view of the production of the complex processes of objectification, highlights the historical role of the emergence of pedagogical expertise and the creation and action of experts in the field pedagogy and its role in objectifying knowledge.

expert of Education in the period of book production (the 1920s) in the Distrito Federal, Rio de Janeiro.

THE BOOK *GEOMETRY (OBSERVATION AND EXPERIENCE)*

The book *Geometry (Observation and Experience)* of Heitor Lyra da Silva, was published in 1923, within the series Bibliotheca of General Education, by Livraria Editora Leite Ribeiro, in Rio de Janeiro, Federal District, and had the intention to present a modernizing proposal for the teaching of Geometry, appropriated of the circulation international model of pedagogical models,[7] as the author explains in the introduction.

One of the innovations evidenced in the work is the exposition of the contents, which breaks with the conventional division, of first realizing the study of flat Geometry to only later address the one of Geometry in space. Lyra designates the new orientation as a modern trend:

> The exposition of matter is made according to the criterion which has already been termed concentric circles, and which consists in following, instead of an open linear order, another one in which a superficial knowledge of all matter is at first provided and then it is returned to each part, a second and even a third time, to study it more closely.
>
> By obeying this orientation, the study of flat geometry is not done first, to address the geometry in space only later. At least in elementary school, such order does not seem rational: it is evident that there are many more complex questions in plane Geometry than others in spatial Geometry, and the modern tendency must be to abolish this conventional division. (Silva, 1923, p.7, author's italics)

Changing the geometrical teaching gait that departs from the plane towards space implies a review of the relationship between the teaching of geometry and the geometric drawing, which necessarily follows the plane-to-space direction. It means being free to get rid of the geometric drawing, of the structure imposed by the constructions. A teaching of geometry, according to Lyra's proposal – which returns to the same concept two or three times, interspersing space and plane – departs from the sequence of geometric constructions that starts from the straight lines, angles, parallel lines, perpendicular lines, flat figures and at the end spatial figures, ordering adopted by Olavo Freire[8] in the book *First notions of Practical Geometry*, and who did school until the middle of the XX century.

[7] Article titled Observation and experience as the guiding thread of Geometry by Heitor Lyra da Silva de Silva and Leme da Silva (mimeo) analyzes in detail the work of Lyra and its appropriation of French references.
[8] The thesis of Márcio D'Esquivel, in development, investigates Olavo Freire.

Heitor Lyra's book begins with general notions of body, lines and surfaces similar to those announced in the first chapter of Freire's work. The difference is in the sequence of the concepts that starts from angles, positions of straight lines, planes between them and in relation to the earth and when studying the geometrical figures, proposes: cube, parallelepiped, quadrilaterals, triangular prism, triangles, cylinder, circle, sphere, and bodies of revolution. As also announced, after this first approach, it returns to the angles, perpendicular and parallel, strings, tangents, area, triangles, quadrats etc.

In the study of geometric forms, the author introduces cardboard construction as a tool, support for the teaching of geometry. As an example, the first solid treated is the cube. Without presenting the definition, start by comparing it with a dice and other objects. Denominates the faces of the cube of squares, and proposes:

> You can construct a cube in carton by drawing the 6 squares representing the faces, as shown in the figure. The layout will be simpler using squared paper. The small strips that exceed squares are necessary for bonding.
>
> Cut out then figure with a pair of scissors, or rather, with a penknife and ruler, fold over the dotted lines and glue the faces that are should meet. (Silva, 1923, p.34-35)

With the cube built, the author brings a list of exercises for the student to explore the solid, such as: "Multiplying the number of faces by the sides of each face, what needs to be done to find the number of edges? Are faces of a cube equals or not? Are all edges equal? How could you verify this? How many edges can be placed horizontally at the same time? And vertically?" (Silva, 1923, p.35). The same procedure is adopted for the study of the triangular prism and quadrangular pyramid.

It is clear a rupture of geometric teaching proposal in the book of Heitor Lyra, presenting an integrated and simultaneous movement between plane and space. In addition, the definition of the figures is not given at the beginning, nor emphasized; instead, the observation and analysis of the parts of the solids are prioritized and valued. The book suggests and guides the construction of solids by students so that they can manipulate, observe, conjecture, and validate properties to respond to exercises.

In addition, the geometric drawing is not mentioned by Lyra? The answer is yes, it is present in a punctual way in the book, in a single chapter, number XIX, called Problems. It features five geometric constructions with ruler and compass: (1) lift a perpendicular to the middle of the AB line, (2) find a point that is at given distances of m and n, of two other points A and B; (3) lift a perpendicular by a point M of a line AB; (4) lowering from a point C a perpendicular on the line AB; (5) to draw the bisector from an angle, whose presentation, detailed with all the steps of the construction is very similar to the approach of Olavo Freire's book. It is worth considering that Freire's book is part of the bibliography presented by the author at the end of the book. The chapter is proposed after the study of angles, which does not approach bisectors and perpendicular, oblique

and parallel lines, so it can be interpreted that the constructions with ruler and compass complement and exemplify the studies of the previous chapters. Another peculiarity of the chapter is the absence of exercises at the end, since in almost all of the forty-two chapters, only the Problem and the last chapter of the book do not bring to the end an exercise session. One hypothesis is that the geometric tracings of the Problems chapter serve only the purpose of the students to know the process of some constructions, without, however, having to perform them in exercises.

That is, the geometric drawing is a detail in the work, an illustration, a punctual addition in the middle of a proposal in which the emphasis is on observation and experience, as highlighted in the title of the work. This is a really differentiated proposal, compared to the book by Olavo Freire, with numerous editions and great circulation in Brazil, as well as the prescription of the geometric drawing in programs of several states. Lyra warns about innovation in introduction:

> The little book that is presented here is an additional compendium, but a compendium that pretends to insinuate, in the teaching of elementary geometry, the adoption of new methods, advised today in all the modern books of pedagogy, but not yet followed in Brazil. (Silva, 1923, p.7, our emphasis)

The analysis of how and in what form Lyra's innovative proposal for the teaching of geometry of the primary course is incorporated in the school culture[9] requires more in-depth studies; however, it is known that the geometric drawing is losing force until its prescription becomes restricted and practically disappears from the programs.

However, it is still necessary to know the *expertise* of an author, in the case in question, Heitor Lyra da Silva, how it is constructed, how he elaborates and circulates the proposal, particularly in its interlocution with the foreigner (modern books of pedagogy). Could the hypothesis of Lyra be raised as an *expert* in the production of new objectified knowledge?

HEITOR LYRA DA SILVA: AN *EXPERT*?

The study on the professional formation of Heitor Lyra da Silva indicates that he has different training from other authors[10] who signed books destined to the teaching of primary geometry of great circulation, since it had a formation linked to Mathematics.

[9] It adopts the concept of school culture from Julia (2001), as "a set of norms that define the knowledge to teach and behaviors to instill, and a set of practices that allow the transmission of this knowledge and the incorporation of these behaviors" (p.10).
[10] As an example, two authors, Olavo Freire da Silva, who was Conservator of Pedagogium and professor of the discipline Manual Work in Normal Schools of Rio de Janeiro (D'Esquivel, 2018) and Abílio César Borges graduated from the School of Medicine of Rio de Janeiro, he was director general of the studies of the province of Bahia, he founded the Baiano Gymnasium in Salvador and the Abílio College in Rio de Janeiro, he served as the Council of Public Instruction of the Court and received the title of Baron de Macahubas (Saviani, 2010).

Heitor Lyra da Silva received a bachelor's degree in Sciences and Letters at Colégio Pedro II and in 1896 joined the Polytechnic School of Rio de Janeiro, where he graduated as a civil engineer in 1901. He travelled to Europe in 1919 with the aim of researching and studying railway networks, but according to Tobias Moscoso the trip would have been essential for the engineer from then on to devote himself effectively to educational and social issues. He was a teacher at the Central School, Jacobina Course, Merity Regional School, National School of Fine Arts and in 1925 he was invited by Tobias Moscoso, at the time director of the Polytechnic School of Rio de Janeiro, to take a seat at this institution, but did not accept. Throughout his career, Heitor directed the Journal of Education, was an effective collaborator to *Brazilian Journal of Engineering* from 1920 to 1924, collaborated as a member of the editorial committee of the journal *Architectura* in Brazil from 1921 until his death. Hector died as a result of chronic illness on December 18, 1925. (Gomes, 2015).

The formation of engineer of Heitor Lyra at the beginning of the century XX corresponds to what Valente (2008) designates by our professional grandfather, since the graduates of the engineering courses constitute the cradle of the future teachers of Mathematics, that is, their formation is distinguished from those realized in the Normal Schools, their familiarity and recognition is linked to the disciplinary field of Mathematics.

However, Heitor Lyra joins a group of engineers, doctors and educators with a common project of a social reorganization of the country, having as main stem the progress and the scientism. In this environment, it was created in 1924, the Brazilian Association of Education (ABE), in the Federal Capital of the Republic, in which Lyra plays a prominent role (Gomes, 2015).

TEACHING PROGRAM – RIO DE JANEIRO

In 2014, the teaching program of the City Hall of the Federal District of Rio de Janeiro, signed on February 28, 1923, by the director general of the Instruction, Carneiro Leão, was not yet included in the UFSC digital content repository. The 1923 program predates that of 1934, and even without so much detail as that of 1934, it lays out the contents envisaged in the different disciplines that make up the four years of the Fundamental Course, including Geometry, proposed for each year and the Drawing, prescribed from the second school year.

Basically, the organization of the contents did not reveal the integration – plane and space – proposed by Lyra in his book, but also did not follow the classic ordering of the plan for the space. In the 1st year, it proposes the study of the sphere and the cube, notions of faces, angles, edges and corners and, from the cube on, the study of lines and positions; in the 2nd year, cylinder and prism, along with tracing of lines; in the 3rd year, pyramid and cone, shape of the faces and perimeter and finally, in the 4th year, circle and

circumference, plus the general idea of the polygons. That is, without making a connection between flat and spatial geometry, the program reverses the classical order, prioritizing solids in the first three years and only in the fourth year, explain the study of polygons. In addition, one can point out relations between solids and their parts (position of lines, faces, etc.). The program emphasizes the "practical knowledge and in view of the solid" (Rio de Janeiro, 1923) as a recommendation for every year.

Regarding the Drawing program, no mention is made of the use of instruments nor the requirement to draw flat geometric figures as a starting point. It is proposed the drawing of imagination and memory, with wide freedom in the representation of objects and suggested ideas, as the beginning of the study of drawing that is done in the 2nd year; for the 3rd year, reproduction of objects that represent sphere, cone, cylinder and prism and exercises on regular polygons; in the 4th year, straight and sloping pyramid contour, contour exercises and decorative composition.

In this way, a differentiated approach has been identified since 1923 in the proposal of teaching geometry and drawing of the Federal District, compared to the other states investigated in previous studies, in which the presence of the geometric drawing with the use of instruments is a brand, whether in geometry or in drawing. Everything indicates that Rio de Janeiro follows a different orientation, not only due to the lack of prescription of geometric constructions with instruments in the 1923 program, but also to an ordering in contents unrelated to the precepts of geometric drawing, to start with the flat figures and then to present the figures space. It is also necessary to point out that the 1890 program of the Federal District prescribes for the third year of the primary course the indication "first exercise with ruler, compass, square and transferor" in the discipline of Drawing.

The 1923 program is not in accordance with the modernizing proposal of Lyra's book, published in the same year as the program, which indicates that despite the author's political and social engagement in the period, his proposal for teaching geometry does not gain an accent in public bodies, at the time of writing. In this sense, the answer to the open question would be that Heitor Lyra was not recognized as an *expert* in the production of new objectified knowledge.

However, it is possible to punctuate the low relevance of geometric drawing with instruments for the teaching of geometry and drawing as a similarity recognized between the program of the Federal District of 1923, 1934 and the book of Lyra, and which differs from the other states previously examined. Perhaps the production of Heitor Lyra is an important element in the process of renewing the proposal for the teaching of geometry, in the sense of unlinking the geometric drawing as a driver for the teaching of geometry, in order to allow the integration between the study of the plane and the space, a change that will be identified some time later.

BY WAY OF CONCLUSIONS

The present study had the pretension to discuss how complex is the process of objectifications of scholastic knowledge, in particular, the proposed knowledge for the teaching of geometry and drawing in the first years of schooling. The active role of the school is clear, in the understanding that the school knowledge is not static, it changes over time and space as response to the demands of society and the different purposes that the school assumes. It is also evidenced the relevance of the subjects, actors involved in political and social movements and in contact with international pedagogical discussions as engines of the process of transformation of school knowledge. However, I think it is necessary to be careful not to characterize the study of "*experts*" as monuments[11] (Le Goff, 2003). In my opinion, the focus of the research should not be on referring or not subject as *experts*, but rather on understanding the participation of subjects in the complex process of objectifying mathematical knowledge.

It is also necessary to call to the debate the struggles of representation (Chartier, 1990) between the disciplinary fields in the elaboration of proposals for the primary education. Education and Pedagogy are gaining recognition as scientific fields at the turn of the XIX to the XX century, while Mathematic science has its *status* legitimized. The *experts* and the *expertise* produced in the course of time maintain ties with their peers and their respective disciplinary fields, which are fundamental in the process of objectifying knowledge.

In the example in question, the proposal of the book *First Lessons of Things. Manual of elementary education for parents and teachers* authored by Norman Allison Calkins, translated by Rui Barbosa and published in 1886, inaugurates a proposal of simultaneous teaching of geometric forms flat and space in the lessons of form, as well as does not use instruments of construction in the lessons of drawing, however Calkins makes clear, in his work, that his lessons do not concern geometry (Frizzarini & Leme da Silva, 2016). Norman Calkins was a primary teacher and school principal in the interior of the State of New York. He devoted himself to renewing teaching, for having verified the difficulty teachers felt in adapting Pestalozzi's ideas to teaching practice. Calkins was recognized by his peers in the pedagogical field at the end of the 19th century, time of the first *expertises* (Hofstetter, Schneuwly, Freymond, Bos, 2017).

Heitor Lyra da Silva, in the book *Geometry (Observation and Experience)*, inaugurates a joint study of plan and space and minimizes the role of geometric drawing in a specific work for the teaching of Geometry in the primary course. Lyra was engineer formed at the beginning of the XX century, considered "professor of Mathematics" in Brazil at the time, its recognition is built with the engineers of Rio de Janeiro, its peers are linked to the Mathematical science. His *expertise* dialogues with education; however, he produces a specific work of Geometry legitimated by the disciplinary field. Perhaps,

[11] The Monument has as its characteristic the link to the power of perpetuation, voluntary or involuntary, of the historical societies (it is a legacy to the collective memory) and the resubmit to testimonies that only in a single parcel are written testimonies (Le Goff, 2003, p.526).

Lyra may be considered the first Brazilian "mathematician" to produce a proposal for the teaching of geometry of the initial years. It can also be conjectured that its authority in the face of mathematics may have been an important element to remove the geometric drawing or even the practice of drawing as a driver of the organization of the concepts to be studied in elementary school. The change of an order established centuries ago in Geometry – from the study that part of the plan to space – for an integrated study between plan and space, demand time and involves ruptures with other knowledge incorporated into the school culture, such as the geometric drawing. In other words, a seemingly simple process, from a school standpoint, involves a process of objectification of new school knowledge.

In summary, the brief historical narrative of movements of transformation of geometric knowledge in the primary school here presented – geometry linked to freehand drawing; Geometry articulated to geometric drawing and geometry free from the drawing – allows us to reflect on the complexity of studying such processes, in particular in our country, with a wide cultural diversity, of many subjects, in constant circulation by the Europe and the USA, producing differentiated appropriations for a proposal for teaching geometry of the initial years.

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