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Scientific didactic materials and the history of the Natural Science teaching in São Paulo (1880-1901)

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Abstract

This article aims at discussing, through a historical perspective, the Natural Science teaching in São Paulo, between 1880 and 1901. The study is developed through the analysis of that period of time cataloguing of the scientific objects and didactic materials of the Escola Normal de São Paulo. So, the processes of international circulation of the school materials designated to the Natural Science teaching, such as the pedagogical possibilities and the indications of appropriation of the objects of that graduation teachers' institution, are shown. There were investigated, as sources, the trades and the solicitations' correspondences of buying of those school objects, the budgets, the receipts, the school inventory of goods and the teaching manuals. The methodological procedure consists on confronting the different kinds of sources, highlighting which objects were acquired, the trade and administrative processes which led them to school. It is also interesting to see the indications of usage of these materials (especially of those designated to the Chemistry teaching), considering the discussions about the teaching methodologies and the teaching manuals' proposals. As a result, the work propitiates a better understanding of the circulation of objects to the Natural Science teaching processes and of the possibilities of their usage, associated to the speeches and pedagogical practices spread at that period of time.

Keywords

School material culture – Science teaching – Scientific objects.

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Introduction

The Science teacher graduation for the elementary level is still a challenge in Brazil. In such a field, it is more evident the subject related to the courses' curriculum in Science. So, a dilemma to deal with is the understanding of a Science teaching graduation that is not distant from the Science teaching itself in that country. That is the reason why many Science teaching proposals are elaborated, until nowadays, without considering the historical processes of the field.

Teaching Science to the elementary level students demands much more than the specific knowledge of the subjects Physics, Chemistry and Biology. It demands more than the domain of some experiments, methods and didactic resources. For a political and social understanding of his/her function, the Science teacher needs to reflect about when and how Science have started to be part of the elementary and high school curriculums and realizes that some interests took part in the area in that period of time, as well as the material conditions of feasibility of the Science teaching in different historical contexts. Finally, the choices were made on the processes of the curricular construction, in relation to the contents' and method's options and to the structuring of the school institution and the teachers' appropriation.

The process of the Science education objects' acquisition by the paulista schools started at the 19th century and was developed until the 1960's (MELONI; GRANATO, 2014) and the quantity and the quality of those materials – many of them imported from other countries –, used by the teachers and the students, show the investment in schools during some periods.

This initial time is justified for the reopening of the Escola Normal de São Paulo, when the institution started to acquire a set of objects to the development of the intuitive method. In 1901, the regulation of the Ginásio Nacional was approved, which was considered a model to the other institutions along the country and brought news to the Natural Science teaching.

The text is developed in two strands: a) relations inside school, i.e., the practices and the pedagogical models, the usage and the indications of appropriation of the objects to the Natural Science teaching; and b) extra school relations, economic and administrative issues that circumscribed the paulista government investment into the acquisition of the materials to the Natural Science teaching, between 1880 and 1901. Taking into account the usage, the production, the acquisition, the distribution and the circulation of these objects, it is very important to understand the construction of a school culture related to the Science teaching in the state.

During the development of this investigation, some challenges have appeared. The first one is about the trans-disciplinal approach. Studying the history of the Natural Science teaching through the school materiality is very limited in just a disciplinal field. This research has an approach, necessarily, trans-disciplinal, because there is only a problem, whose better understanding links elements and situations of different subjects.

It is necessary to pay attention to the references and procedures of work, which help to examine the social and school objects, inside the material culture. It

is indispensable the knowledge about the pedagogy and history of education in São Paulo, and the organization and expansion of the public system of teaching during the considered period of time. No less important is the knowledge of the contributions of the economic history to examine the relations between industry, State and investment in materials to the Natural Science teaching. The concern about how these materials were led to school requires attention to the organization of the public administration. They are not pedagogical issues that justify the insertion of the Natural Science in the school curriculums. During the 19th century, the scientific knowledge had also been focused, the world understanding idea through the observation of things and through the concrete experience. Articulating the concepts of the different subjects with the object understanding is a fertile procedure, but still complex.

The second challenge deals with the object, the history of the Science teaching in São Paulo. It is about an incipient theme and not so much studied. In Brazil, there is a very important set of articles and research groups about the Science history and, still, about the Science teaching. However, there is little study about the Natural Science history.

The third dilemma is related to the periodization. Between the last decades of the 19th century and the middle of the 20th, it is observed the coexistence of different proposals and pedagogical models to the Science teaching, and different ways of the school material provision by the public administration. That is the reason why the analysis of the pedagogical practices and of the scientific objects' production and acquisition ways must be seen through the contextual features.

The fourth has to be with the sources. This is a research that uses the school materiality in order to understand that the objects reveal information and indications about the practices that were developed inside the teaching institutions that, by other ways, would possibly not be seen. However, the objects described in the inventory, the manuals and other written sources can rarely be found. One of the main difficulties of the work is to follow the clues of the school furniture and objects, since they have been deleted along the time. Vidal and Gaspar (2011, p. 31, Our translation) state that "the difficulty in locating the elements of this school material culture has led researchers to look for guidelines of the school materiality and of the school processes in a huge set of sources". This is what it is intended in this research.

So, the text is divided in two parts. The first one develops an approach that crosses different areas of knowledge, i.e., the material culture, the administrative and the economic history of the paulista public school. It is made an analysis of the provenance of the scientific-didactic materials sent to the Escola Normal de São Paulo. It is interesting to think who were the individuals involved in the acquisition of such objects and what economic and administrative procedures were used. In the second part, under a more pedagogical perspective, the possibilities of usage of these scientific objects are analyzed, more specifically, of the objects to the Chemistry teaching, showing the types, and the indications of the pedagogical practices, from the examination of the inventory of goods and the prescriptions of the teaching manuals.

The educative modernity ways: the acquisition of objects to the Natural Science teaching in São Paulo (1880-1901)

At the end of the 19th century, schools experience a material profusion whose provenance shows the different ways in order to reach educative modernity. The modernity of the educative invention was seen in the international circulation of pedagogical models, subjects and objects (VIDAL, 2009). This educative modernity carried an idea of progress that associated, according to the author, scientific and educative development to the school material spread. As a result, the State emerges as a buyer of the school material and the school as a consumer market of furniture and objects produced by a school industry (VIDAL, 2009). This leads to inquire not only about the buyer (State) and the consumer (the school), but also about the sellers, producers and distributors of the scientific-didactic materials.

The analysis of the documentation of the Escola Normal de São Paulo indicates that, under the period of study, the importation was the possible way to equip the paulista schools with modern teaching materials. However, the difficulties related to the importation demanded different ways of acquisition of didactic materials and scientific objects.

If the government did not have its own industries in order to produce school material and furniture, if the little national commerce did not offer the new objects that became so necessary to the Grupos Escolares and Escolas Modelo, it was necessary to add a set of actors – travelers, mediators and culture translators – and internal and external commercial relations to create the physical conditions of this new school.

A traveler who brings the educative modernity

Here, are called travelers the Brazilian people, inserted in the school context, that accept orders of the Public Instruction administrators to buy Natural History museums and objects to the Physics and Chemistry teaching. As an example, Paulo Bourroul, French, Physics and Chemistry teacher, and the principal of the Escola Normal de São Paulo between 1882 and 1884, had been responsible for making a budget and buying teaching materials to the institution during his vacation travel to Paris.

Frame 1 – Mailing between the school principal and the Province president

ESCOLA NORMAL DE SÃO PAULO
on October 24th, 1882

I affirm that I have received the official government document, dated yesterday, through which I am responsible for buying, during my trip to Paris, the necessary equipments to the Physics and Chemistry teaching in the Escola Normal, the pedagogical items for the library of the same school, and the study and organization of a pedagogical museum that the Governor wants to be attended in the school I am the Principal. As an answer, I state to the Governor that I really appreciate this request and will make it, so I will receive the right financial amount, signing it according to the law.

So, I would really like to thank the Governor, representing the Escola Normal, for the service destined to the Public Instruction.

Sir Francisco de Carvalho Soares Brandão
President of the Province
The Escola Normal Main Director
Paulo Bourrou

Source: APESP – Serial Manuscrito – Escola Normal de São Paulo; 1849-1855; 1886-1899. Order – 5131/ Group – Gestão Financeira; Serial – Propostas orçamentárias. (Our translation)

The Province president himself asks the Escola Normal principal to buy school material during his travel to Paris. From Paris, Paulo Bourroul sends a correspondence to the Providence president, the counselor Francisco do Carvalho Soares Brandão, showing his knowledge about the content of thirteen boxes for the Physics and Chemistry teaching.

Taking into account this information, the Treasury Department should order the Santos Customs Service dispatch and send the goods to the Capital. As a result, it is known that the ways to the educative modernity, of the materials and the furniture, arrived and immediately needed to pass through the Santos Customs. On February 21, 1883, the information that "three big boxes designated to the Escola Normal, shipped on the French Sully steamboat to Santos", gives us a dimension of such a movement. When traveling to Paris, the principal Paulo Bourroul acquired the material that he himself ordered to the São Paulo Province President. As it was allowed, he bought it and sent it through steamboats to the Santos Customs Service, where all the orders would be sent to São Paulo, after the instructions of the Treasury Department.

As a result of the Paulo Bourroul trips, the Escola Normal acquired furniture, books for its library and thirteen (13) boxes containing material for the Natural Science (Physics and Chemistry) teaching. Pestana (2011) numbers six books that were brought for usage in the subjects of the 5th Cathedra, French Grammar and Linguistics, Physics and Chemistry notions:

1– *Physique*, by Edmond-Jean Langlebert,
2– *Chimie*, by Edmond-Jean Langlebert,
3– *Leçons élémentaires de chimie moderne*, by Charles Adolphe Wurtz,
4– *Physique*, by Adolphe Ganot,
5– *Histoire de la littérature française*, by Jacques Demongeot,
6– *Grammaire de la langue française*, by Pierre Auguste Lemaire.

As it shall be seen at the second part of the text, some of these manuals brought instructions about how the teacher should use the appliances and substances to work with the students in the Physics and Chemistry subjects.

The news brought by the travelers could be materialized in objects or reports. According to Carvalho (apud SOUSA; CATANI, 1998, p. 40), it cannot be underestimated the participation of these "regular travelers" in the educational renovation. The "famous intellectuals: public men, reformers, lawyers, school owners, principals and teachers" (SCHELBAUER, 2005, p. 136 - Our translation) are "important actors in highlighting the production, circulation and appropriation of the pedagogical knowledge material processes in Brazil" (CARAVALHO apud SOUZA; CATANI, 1998, p. 40 - Our translation).

The easibility of the transcontinental trips, through the steamboats, enabled the international circulation of people, ideas and objects, what contributed significantly to the modernization of the paulista school. This circulation can be noticed in the following picture. It is a manifest of the Ville de Ceará steamboat, in which were boarded three boxes of Physics appliances, acquired during Paulo Bourroul's trip. The manifest informs about the acquired material type, the background (Havre/France), the price of the goods, the freight, along other pieces of information.

Picture 1 – Physics appliances box

Source: APESP – Serial Manuscrito – Escola Normal de São Paulo; 1849-1855; 1886-1899/ Order – 5131. Group – Gestão Financeira; Serial– Propostas orçamentárias (Our translation).

Although not being the focus of this paper, it is important to mention the teachers' trajectory and graduation in scientific subjects (Physics, Chemistry and Natural History). These people were graduated in Medicine or Pharmacy and were members of families that also were dedicated to these fields, being owners of clinics or drugstores. This is not only about the Escola Normal de São Paulo teachers. Meloni's thesis (2010) mentions a considerable number of pharmacists among the first Science teachers in Gymnasio de Campinas.

Meloni (2010, p. 72) explains that it occurred "the absence of Chemistry or Physics graduates while there were many pharmacists available". This availability can be understood "according to the reforming process that took place in the Medicine Department in Rio de Janeiro during the 1870s by the Minister Carlos Leôncio de Carvalho" (MELONI, 2010, p. 72), what fomented the implementation of three courses besides Surgery and Medical Science, including the Pharmacy one.

In 1891, the Medicine schools in Rio de Janeiro and Bahia started to be called Institutes of Medicine and Pharmacy. The author still highlights that the Pharmacy Schools had the following cathedra: Physics, Mineral Chemistry, Mineralogy, Organic Chemistry, Botanic, Zoology, Medical and Therapeutic Materiality, Toxicology, Pharmacology and Practical Pharmacology. This, possibly, made the school principals understand that those

teachers were able and ready to teach the scientific subjects. These elements can help understanding why Macedo Soares had a private collection of Physics and Chemistry materials that was partially donated to the Escola Normal de São Paulo, in 1894.

Paulo Bourroul's family, from French origins, arrived in São Paulo in 1839, where they opened a pharmacy. In 1869, the Pharmacy Paulistana was relied on 20, Imperatriz Street (PESTANA, 2011). Paulo Bourroul was son of Camilo Bourroul and was born in 1855. He was in elementary school in Brazil and graduated in Medicine in Belgium.

Pestana (2011) still mentions that, when Bourroul came back to São Paulo in 1879, he occupied the 5th Cathedra (French, Physics and Chemistry) in the new-brand Escola Normal de São Paulo. In 1882, he became this institution principal. His European background (French) and his familiar and professional formation help understanding his mission of acquiring a set of didactic materials to the Natural Science teaching.

Anyway, his case evidences one of the administrative procedures used by the paulista government to equip some schools in its territory. However, the analysis of formal elements of the crafts and correspondences also clarifies how the trips' regularity, as well as the temporal gap between the travelers' departure and the arrival of the objects in São Paulo, showed a little efficient and practical way of attending the school constant necessities for new materials. No accidentally, other subjects were called as cultural mediators.

Educative modernity culture mediators

The culture mediators, or passeurs culturels, are, according to Gruzinski (2005), people between "two worlds". This is a fertile category to think the meeting and the contact between different types of culture. In the case studied, these individuals' acts promotes more than the circulation of pedagogical ideas and school objects. They are more than agents that carry "ideias e projetos de um mundo a outro" (GRUZINSKI, 2005, p. 16). Peering the relations they established, the places they visited, the choices they made, the procedures they used, help understanding the changes and the permanencies that occurred in the education and cultural areas; the changes and crossings in order to understand the contours that education took in a determined period of time and space. This study of case shows how the mediators make the local and the global synthesis, the social and cultural dynamics that accomplished, making changes not only in their origin and destiny places, but also local changes (CANCLINI, 2003).

The culture mediators are the foreigners who lived in São Paulo who, being involved with the instruction in their home country and in Brazil, were intermediates between the providers and the government, or, when they came back to their home country, acquired the materials to the paulista public school. The chosen example is of the American Miss Marcia Browne, school principal of the Escola Modelo, part of the Escola Normal de São Paulo.

After three years of "constant work" in the Escola Modelo, Miss Browne asks the Country Business Secretary, Cesário Motta, a permission to travel to her home country. Her pretension was:

> [...] study the exhibition of furniture, equipments, books and activities of the schools in France, Belgium, Switzerland, Germany and the United States. If there is any extra time, in my return, I wish to visit the schools in Portugal and Germany. I need to spend two months on the sea, so I cannot be back before January, 1894. Since December and January are holiday months, I will be absent of school for five months. This visit to my home country is motivated by health and school interests, and this is the reason why I ask you a license period until the February 1st, 1894. (APESP. Serial Manuscritos. Countryside Secretary. Escola Normal. Year 1892. Order 7135, Our translation).

Her trip resulted in a material investment for the paulista public school, because some shipping were made by Miss Browne during this period. On 9th May, 1894, three boxes with anatomic pieces, furniture and the school material were boarded on the steamboat Corrientes, to Santos. This order was from the store Emile Deyrolle, in Paris. Besides the human anatomic pieces, the boxes contained fruit and flowers models for the study of the Natural History, as it is read in the following craft.

Frame 2 - Acquisition at the Emile Deyrolle

Main City Escola Normal Secretary
May 9th, 1894

2ª secção
Oficio n.38

Citizen.

A copy of the human and compared anatomy pieces list is attached, as well of the fruit and flowers models, requested for this school to the Paris Emile Deyrolle office, and shipped to Santos on the CORRIENTES steamboat inside three boxes, according to the document n.31 of the first day of this month in order to ease the respective checklist.

Health and Fraternity
To the citizen Dr. Cesario Motta Junior
Countryside Business Government Secretary
Gabriel Prestes
The Main Director
Gabriel prestes

Source: APESP. Série Manuscritos. Secretaria do Interior. Escola Normal. Ano 1892. Ordem = 7135. (Our translation)

In order to justify the absence of five months, the Escola Modelo principal associates her personal necessities to the school interests. It would be usable for her and for the institution the study about the furniture and school objects of many countries, societies of reference whose modern educational systems were globally accepted (SCHRIEWER, 2000). This purchase does not constitute "mere international goods' and economic interdependence interchange relations" (SCHRIEWER, 2000, p. 107 – Our translation).They signalize the efforts of the States to be constituted by the centrality of an educative modernity (VIDAL, 2009).

Through Miss Browne correspondence to Cesário Motta it is possible to see that the whole process of going and coming from Brazil to Europe or to the United States would last two months by sea, i.e., it lasted a month to go and another one to come back. Besides the financial support, the imported houses, the agents and the commercial representatives would take another place as a way to equip schools.

Educative modernity culture translators

The culture translation is an important concept to think about processes of de-contextualization and re-contextualization promoted by people as an effort to turn a misunderstanding culture to another one (BURKE, 2009). For Burke (2008, p. 56, Our translation):

> [...] what makes people of a culture be attracted for people of another one is, many times, the idea of a practice analogue to their own, so, familiar and strange at the same time. Following this attraction, the ideas or practices of both culture get more similar.

In the last decades of the 19th century, there was an attraction, a local fascination for North-American and European models, theories and educational practices. The circulation of these models, with the objects themselves, turned this in a workable situation. This was possible due to people and institutions, like the culture translators.

The translators are the imported stores, agents and commercial represents whose relations with the school in the different countries are limited to the economic field. They act in different commercial areas, being school just one more profitable consumer market.

Taking into account the correspondences of the Escola Normal de São Paulo, it is observed that there is a great amount of material provided by agents and commercial represents. Among them, two people are important: Etienne Collet and Charles Vautelet, both resident in Rio de Janeiro and represents of French companies, the Maison Emile Deyrolle and the Maison Paul Rousseau & Cie. In this article, the analysis relies on Charles Vautelet, because he stood out in the companies' representation that supplied scientific-didactic materials to the Physics and Chemistry teaching.

The commercial representation and the agency integrate "a categoria dos chamados contratos de colaboração empresarial" (FRANCO, 2013, p. 253). They are contracts among businessmen, a represent, and another, represented. One, producer, the other, distributor. So, Charles Vautelet was an intermediate between the European producers and the paulista school administrators. In the following ad, from 1896, it is observed that the Casa Paul Rousseau & Cie introduces itself as a "supplier of privilege for the Brazilian government" to many establishments, between them, the Escola Normal de São Paulo.

It is observed, as well, a list of the main supplied things: Physics appliances, chemical, scientific and industrial products, Chemistry appliances, photographic signs and cameras and school material. Besides the company specialty, it keeps the attention to the mention and participation on the universal expositions. This can be visualized not only in the ads and propaganda, but also in the receipts that confirm the acquisition of products from Paul Rousseau by the Escola Normal de São Paulo.

Picture 2 - Casa Paul Rousseau & Cie

1724 Notabilidades Commerciaes e

Casa PAUL ROUSSEAU & Cie

Sociedade em commandita por Accões. — Capital, Fr. 400,000.

16, Rue des Fossés-Saint-Jacques, Paris

OUTR'ORA : 17, Rue Soufflot

Agentes: E. Charles VAUTELET & Cia

Rua do Hospicio, 107, Rio de Janeiro

Instrumentos de Physica
Productos chimicos, scientificos e industriaes
Utensilios de Chimica
Placas e apparelhos photographicos — Material escolar.

PAUL ROUSSEAU

Commissario delegado do Estado de Minas Geraes na Exposição Universal de Paris, em 1889
Membro do Jury do Brazil (Clase 45) na mesma exposição.

HORS CONCOURS

*Fornecedor privilegiado do **Governo Brazileiro** para os diversos estabelecimentos seguintes :*

Rio de Janeiro. — Hospitaes da Guerra e da Marinha, Escola Polytechnica, Pedagogium, Faculdade de Medicina, Laboratorio de Bromatologia.

Ouro Preto. — Escola de Minas, Escola Normal, Escola de Pharmacia.

São Paulo. — Escola Polytechnica, Escola Normal, Instituto Bacteriologico.

Bahia. — Faculdade de Medicina, etc.

Unica Casa ROUSSEAU

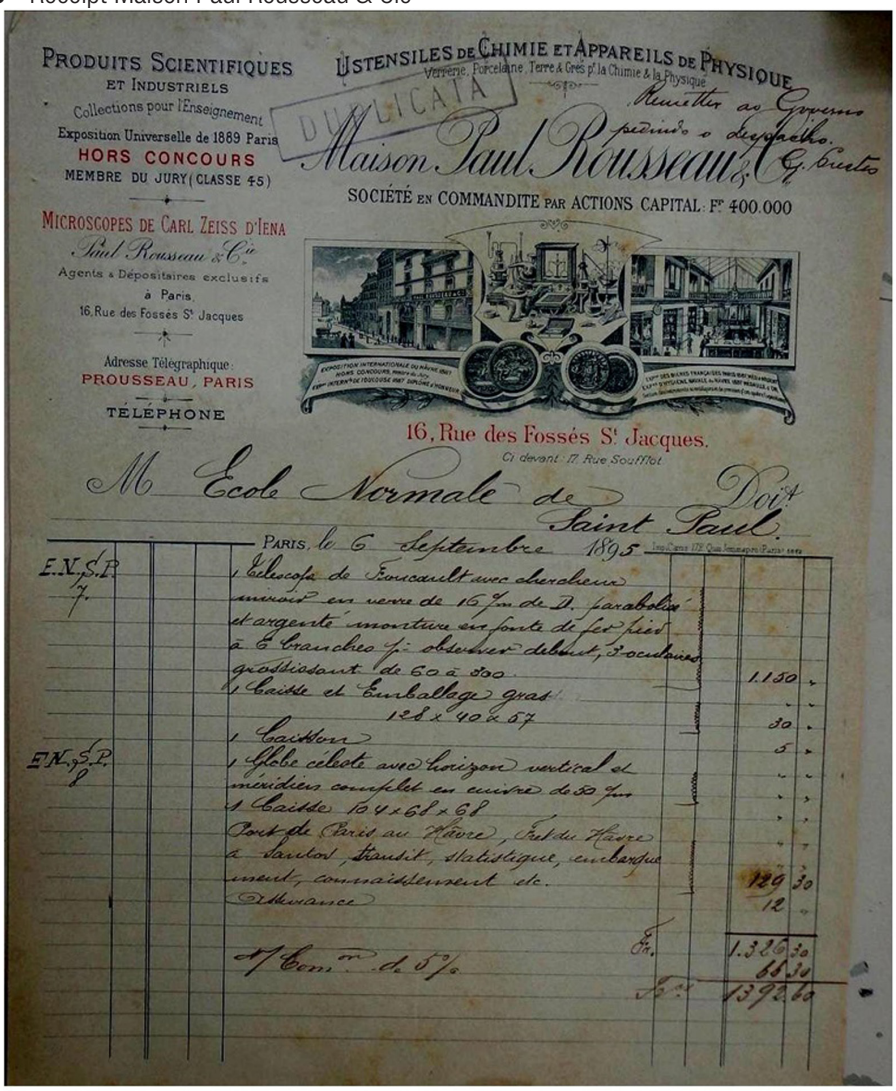
Agente e depositario exclusivo dos MICROSCOPIOS da CASA CARL ZEISS de IENA

à PARIS

16, Rue des Fossés-St-Jacques, 16

Source: RIO DE JANEIRO. Almanak administrativo, mercantil e industrial do Rio de Janeiro, 1896, p. 1724 – Notabilidades Commerciais e Industriais da França.

Picture 3 - Receipt Maison Paul Rousseau & Cie



Source: APESP. Serial Manuscritos. Countryside Secretary. Escola Normal. Year 1892. – Order 713, Our translation.

This is just one, among other receipts which were found, that informs about the acquisition of Chemistry and Physics appliances. They are boxes 7 and 8, acquired in 1895. In this year, the school principal of the Escola Normal, Gabriel Prestes, informs to the National Business State Secretary about the existence of a "account of Charles Vautelet e Cie containing teaching material provided by the Paris Paul Rousseau e Cie office, with the amount of fry 1.392,60" (APESP. Serial Manuscritos. Countryside Secretary. Escola Normal. Year 1892 - Order 7135, Our translation).

Of this amount, 5% corresponded to the payment of the agent Charles Vautelet, as it is seen at the end of the picture. Considering the sum of the importations at the end of the 19th century, being an agent or a represent of foreign commercial stores was a great business. School becomes a profitable market for companies and a set of professionals get structured to supply the demands to and for school. At the center of the receipt (picture 3), scenes of the universal expositions and of the participation of Paul Bourroul in these events can be seen. The company was hors concours and member of the jury in the Universal Exposition in 1889, in Paris.

The universal expositions spread objects of desire and necessity, creators of certificates of quality of products inside the school educational field. According to Bandeira Junior (1901, p. xiv) "[...] the industrial man clearly shows the diplomas of the Industrial Rallies and Expositions" (Our translation).

The modernity was represented in the objects acquired by school and offered by the companies, as well as in the ways how the materials were commercialized and sent to schools. In the three analyzed cases - of travelers, mediators and translators - these are the main ways of acquisition of scientific-didactic materials, via importation, from the 19th to the 20th century.

The possibility of using these scientific objects, in the flowering of Natural Science in school, is the topic of the second part of the paper.

Possibility of using the scientific objects: a pedagogical approach

Among the many materials acquired by the Escola Normal de São Paulo, the objects to the Chemistry teaching will be analyzed in this study. This option is justified, first, because in this period of time there was a great investment in the acquisition of the objects to the Natural Science teaching, indicating a valorizing of this area of knowledge inside the curriculums; second, due to, when limiting the analysis of the objects to the Chemistry teaching, within all the materials that were acquired for the Science teaching, it will be possible to make a more detailed examination of this material and its possibilities of use.

The organization of Science subjects at Caetano de Campos school followed a general wave, stimulated by the educative modernity that promoted the Science teaching in a practical way. In the high school level, the *Regulamento do Ginásio Nacional de 1901* predicted, besides the subjects of Letters and Humanities, the Science subjects: "Basic Maths, Mechanics and Astronomy Elements, Physics and Chemistry, Natural History, Geography, especially from Brazil, History, especially from Brazil, Logics" (BRASIL, 1901a, Our translation).

To the Chemica, Physica and Natural History teaching, the educational institutions organized labs, cabinets and school museums and acquired teaching materials, specific to each area, like the instruments, the models, the reagents, the glasses, among others, most imported from Europe. Two important examples of this movement, besides the Cateano de Campos school, are the Ginásio de Campinas (MELONI, 2017) and the Colégio Marista

Arquidiocesano de São Paulo (BRAGHINI, 2017). In these institutions, Science teaching spaces were organized, using specific objects.

This organization occurred because of the valorization of the practical teaching and also because there was a determined imposition by the Código dos Institutos Officiaes do Ensino Superior e Secundário, which stated that all the equated schools should "take into account the teaching rules and the programs adopted in the federal field" (BRASIL, 1901b, Artigo 361, III – Our translation).

On the *Regulamento do Ginásio Nacional* (BRASIL, 1901a) there was no instruction in relation to the labs' organization, but when it was about the preparatory attributions, it offered a structural and functioning indication of this space:

> The lab preparers ought to have, through an official institute or another one similar to it, the respective lab belonged to the cathedra exam. §1st. Responsibility: 1st: All the cabinet objects must be catalogued and showed according to the best sequence and care; 2nd: All the collections must be prepared according to the teacher instructions; 3rd: Follow the teacher's pieces of advice in relation to the practical classes. (BRASIL, 1901a, article 66, Our translation).

In 1883, in the case of the Escola Normal de São Paulo, as it had been already said, the teacher Paulo Bourroul, that taught Chemistry in such an institution, bought a set of appliances to that school, and for the Chemistry teaching about 120 items were acquired, within glasses, ovens, instruments, accessories for assembly and Chemistry products (Escola Normal de São Paulo. *Livro Geral de Inventário*. 1895-1896).

Kinds of objects and indications of use

The variety of types of objects keeps our attention, since the material was destined to a school lab of a regular school, i.e., it did not aim at forming for the Science area, but for the elementary schools. Analyzing the list prepared by the teacher Bourroul, there were defined two categories of objects: utilities, those used in many regular lab procedures, and specific, those used to build apparatuses with more focused goals. The objects' quantities in each category are mentioned in Table 1.

Table 1 –Types, quantities and examples of Chemistry objects

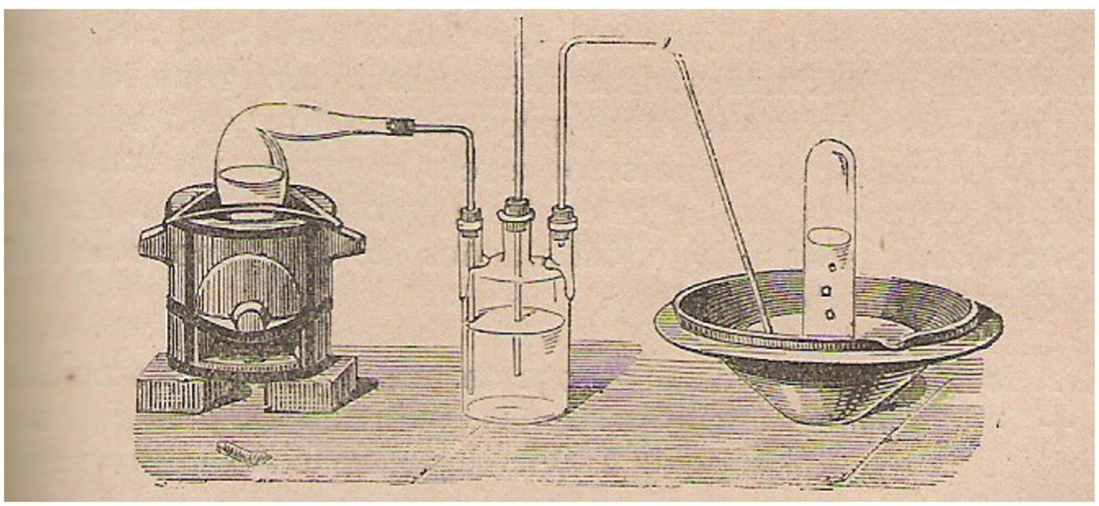
Typology	Quantity of items	Examples
Utilities	116	Straight and curve lengthens; circle bottom balloons; bi-tubular and tubular balloons; funnels; retorts; ovens etc.
Specific	4	Appareil à deplacement de Robiquet; ozonômetro; hypsomètre de Régnault; epprouvettes à gaz.

Source: Made by the authors.

This list shows that the objects that are used to handle many lab procedures (the so-called utilities) prevail. In this set of materials there are some items with more than 10 units. Among others are registered: 15 straight and curve lengthens, 51 circle bi-tubular and tubular bottom balloons, 25 jugs, 25 right collars, 24 Wolf bottles of 1 and 2 tubular, 10 spatulas, 30 vases for precipitates, 22 glasses for experiments, 55 bottles of large opening, 60 regular and tubular retorts, 23 glass regular and tubular retorts.

Some of these materials, like the vases, the jugs, the beakers, the glasses for experiments and the crucibles, are in big quantity and are easily handled. These materials are usually used to mix substances, to make reactions or the storage, i.e., they are used for simple procedures and could be manipulated with no difficulty by the students. However, there are also objects registered in a great quantity, but that are used for very specific goals in apparatuses that require some ability for their handle, like the ovens, the retorts and the Wolf bottles. An example of the use of these materials can be seen in picture 4.

Picture 4 – Preparing Carbon Oxide



Source: Langlebert, 1900, p. 226.

The picture 4 represents an assembly of an apparatus used for the production of a substance and is very common in the teaching manuals. In the picture, in the left side, an oven and a retort containing liquid are represented. Taking into account the class lesson and its description, it is understood that inside the retort a gas that passes through the Wolf Tube is being produced, as shown in the center of the picture, and gets the collector pipe. The gas is shown by the little bubbles that can be seen inside the collector pipe. The gas production pushes the liquid inside the collector glass to the cube, creating a space that is also represented in the picture. It is noticed that the objects are connected by pipes and stoppers, making an apparatus that requires some ability to be assembled.

Comparing the quantities and typologies of objects indicated in Table 1, it is noticed that the school Caetano de Campos had material for the students to make labs' activities and also to be used for solutions, mixes, simple reactions etc. It also had objects for the assembly of more sophisticated apparatuses that would serve for observation, like showed in Picture 4.

In the inventories of the Escola Normal there are only 2 ovens like that one described in picture 4, but there are 83 retorts and 51 balloons (that can also be used in this kind of experiment, replacing the retorts) in the school collection. Apparently, there is no justification for the occurrence of a big number of retorts and balloons, since it would only be possible assembling two similar apparatuses like the ones described in picture 4.

On the one hand, the quantity of some materials indicates a big investment in the labs' structuring. On the other hand, there is an apparent inadequacy between the acquired objects and their ways of usage indicated in this manual. Anyway, the inventories indicate that the school was equipped with many objects and that it would be possible the realization of practices by the students and the assembly of some apparatuses by the preparers or by the student.

The teaching manuals and the indications of usage

In the teaching manuals that are some indications about how the objects should be used. In the inventories, the books *Wurtz – Chimie modern and Langlebert - Chimie* are listed. They have already been mentioned according to Pestana's studies (2011), and, although the references are not explicit, because of the similarity of some titles' terms and for the productions of the two authors in that period of time, everything indicates the following books:

- WURTZ, C. A. **Leçons élémentaire de chimie moderne**. 4. Ed. Paris: G. Masson.
- LANGLEBERT, J. **Chimie**. Paris: Delalain Frères.

Generally speaking, from the pedagogical perspective, both books are similar. The lessons are descriptive and the illustrations aim at showing procedures of preparation or the explanation of the substances' properties. Analyzing the 1900 Langlebert's book edition, it is verified that there are drawings of practices using objects, similar to those described in the inventories of the Escola Normal de São Paulo.

There are many demonstrative drawings of experiments that were made to produce a substance for a chemical reaction promoted by oven warming, as seen in picture 4. Besides them, there is also, at the end of the book, a table containing the colors of the precipitates of the main types of mineral salt and the indications of the reactions for these products' formation (LANGLEBERT, 1900). In this case, it is also a very simple operation. The preparation of the precipitates through the mix of the salty solutions is made by the students at the high school level and could be made in school with some orientation.

In this topic presentation, Langlebert (1900, p. 615) defends that "nothing is more important to memory than the teaching through vision" (rien ne vaut, pour la mémoire, l'enseignement par la vue). Though the topic's focus was established according to the observation's practices, a feature of the pedagogical methodologies at that period of time (BRAGHINI, 2017), the descriptions of this item suggest the realization of the lab practices by the students.

Although the *Regulamento do Ginásio Nacional attributes* to the lab preparers "follow the teacher's pieces of advice in relation to the practical classes" (BRASIL, 1901a, Article 66), according to the kinds and quantities of objects acquired by school and the indications of the Langlebert's manual (1900), there were very favorable conditions to the realization of practical procedures by the students.

The Langlebert's manual (1900) and the collection of the objects described in the inventories are coherent to two possible perspectives about Science teaching at that period of time, i.e., the proposals which aimed at promoting the "demonstration as a pedagogical practice" (BRAGHINI, 2017, p. 229) and the possible conditions of students handling the objects, passing through their mere observation.

If in other Science areas, like the Natural History or the Physics, it would be more favorable valorizing the observation due to the features of the studied objects, like the animals, the plants, the rocks or due to the difficulty of handling instruments for the sound and light study etc., in Chemistry it was possible that, besides observation, it also would be allowed to the student to mix, crush, separate substances etc.

The inventories and the pedagogical practices

The collection movement throughout the time offers some issues of this process. In the 1893 inventories, there were listed a hundred types of different objects in the topic "Apparelhos e utensílios". Comparing them to the 1883 inventories, it is noticed that there was a decrease of about twenty items during this period of time. Analyzing more specifically the items, it is verified that:

Table 2 - The movement of the inventories from 1883 to 1893

	Inventories (1183)	Inventories (1893)
Retorts	83	45
Lengthens	15	14
Wolf bottles	24	14
Balloons	51	4
Vases for precipitates	30	13
Crucibles		13
Containers	22 (glass for experiments)	17 (little cups with a basis support)

Source: Made by the authors.

This compilation indicates that the objects used in assembling apparatuses to the reactions' procedures (retorts, balloons and Wolf's bottles) and in other experiments (crucibles, balloons, vases for precipitates etc.) decreased quantitatively in the collection. The great difference existent on the quantity of retorts and balloons can indicate that the use of these materials had been made by inexperienced people, and, therefore, that many of these objects had been broken during this period of time.

The vases for precipitates, crucibles and the recipients for reactions decreased their quantities and, since these materials are easily handled, it is possible that they were directly handled by students. It is surprising that the lengthens have their quantity kept, since they are made of glass and are more fragile. Another object that decreased in quantity is the oven: since in the 1883 list there are 2 ovens (similar to what it is described in picture 4, called *fourneau à bassine*), in the 1893 inventories there are listed "1 little oven" and "5 Bunsen burners". It is noticed that an oven was lost, but other heating instruments were acquired.

Whether there was a decreasing of quantity in some items, there was the acquisition of new ones in this period of time. In the 1893 inventories, 18 glass canes, that had not been listed in 1883, were registered (objects used for mixing substances), what suggests an increasing in procedures of simpler mixtures.

In sum, the inventories indicate that there were changes in the collection. On the one hand, it is noticed the decreasing of the quantity of some items, what can indicate the loss for using them, because many of them are glass materials and under failure, or can indicate not good conservation or theft. However, it was also observed that there was an increasing of other objects' quantity, what indicates a constant investment in the labs' improvement.

Final considerations

This paper aimed at showing the provenance and the possibilities of usage of the scientific-didactic materials, in São Paulo, from the end of the 19tth and beginning of the 20th century, a period of time when the Natural Sciences are highlighted in the curriculums of the Escola Normal and high schools.

It was possible to show that the acquisition of these materials occurred by their importation, through different subjects, here called travelers, mediators and culture translators. Their actions constituted the main means of material provision of the Escola Normal de São Paulo and, consequently, they had a great responsibility to equip the Escola Normal de São Paulo with scientific materials, according to the movement for the valorization of the Natural Science teaching that took place in the European school institutions, specially, in France and Germany.

In relation to the extra-school issues, from the administrative perspective, it is noticed a set of practices permeated by informality and unsystematic acquisition procedures to equip the paulista schools. From the economic perspective, it is noticed that this mandatory and mass school makes the market and the economy more dynamic, in a two way movement. On the one hand, the school movements the market and its necessities make it more adaptable to attend its demands. On the other hand, the market makes desire objects to school.

In the multiple ways of acquisition, it is not difficult to verify an imbrication between the public and the private spheres, in the legality and in the extra-official issues. In the legality topic, it can be affirmed that the public school spread, mandatory and massive, throughout São Paulo, would not be possible without the private support, i.e., the importance of the school industry must be highlighted, since it supplied the furniture and all the modern equipment and necessary objects in order to provide a modern pedagogy. In the case of the extra-official procedures, Paulo Bourroul and Miss Browne travelled by themselves to France and to the United States, respectively, and are allowed and/or responsible, by the government, to acquire teaching materials to the Escola Normal. These promiscuous relations between the public and the private, as a means to get easily the public service offer, would have been stated for a long period of time in the educational field, as in other public departments as well.

In relation to the intra-school issues, the collection analysis about the acquisition processes and inventories indicates that, during the period of time under investigation, there was a great investment in the material structuring of the Escola Normal de São Paulo, specially in reference to the Natural Science/Chemistry teaching. This is a result of a natural knowledge valorizing movement and of a promotion of the active pedagogies, influenced by the intuitive method proposition. The production and commercialization of pedagogical material processes also contributed to such a movement.

In the case of the pedagogical practices, the types and the quantities of materials, the practices contained in the Langlebert's manual (1900) and the inventories indicate a valorization of the practical education, in opposition to the teaching methods based only upon books. So, it is not safely affirmed whether these practices were limited to the observation valorization or whether they were close to the intuitive method prescriptions and to the intent of a formation based upon practical meaning. The fact is that, at the end of the 19th century, the school labs became organized, structured and active spaces inside schools and this would influence the teaching graduation at that period of time.

Lastly, whether in Science teacher graduation more studies and researches that problematize the historical constitution of this area of knowledge are needed, this paper contributes to the question when it shows, through the analysis of a concrete case, the Escola Normal de São Paulo, when and how the Natural Science has acquired the status of relevant knowledge in the elementary and high school teacher's graduation, being, therefore, an issue for the public investment.

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