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School practices in the office of the Natural History/Biology teaching laboratory at Colégio Pedro II (1960-1970)

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Prácticas escolares en el laboratorio de la oficina de docencia de biología en el Colegio Pedro II (1960-1970)

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Abstract: This article aims to scrutinize the school and curricular practices experienced within the laboratory of the Natural History office at Pedro II's high school between 1960 and 1970 in order to understand how the school discipline Biology conformed within the walls of that institution. To understand the praxis in the office, we used as empirical material: record book of practical lab classes and former teachers' testimonies. The everyday doing characterized the school discipline Natural History/Biology as an experimental one linked to the scientific method and practical teaching, predominantly academic and associated with biological sciences; and it also allowed for its consolidation and legitimation in the context of the movement to renew science education.

Keywords: history of school subjects; school objects; teaching of natural history/biology; curriculum.

Resumo: O presente artigo visa escrutinar as práticas escolares e curriculares vivenciadas no âmbito do laboratório do gabinete de História Natural do Colégio Pedro II entre 1960 e 1970 a fim de compreender como a disciplina escolar Biologia se conformou nos muros da referida instituição. Para entender a práxis no gabinete, utilizamos como material empírico o livro de registro das aulas práticas laboratoriais e depoimentos de ex-professores. O fazer cotidiano caracterizou a disciplina escolar História Natural/Biologia como de caráter experimental ligada ao método científico e ao ensino prático, predominantemente acadêmica e associada às Ciências Biológicas; e permitiu a consolidação e legitimação dela no contexto do movimento de renovação do ensino de Ciências.

Palavras-chave: história das disciplinas escolares; objetos escolares; ensino de história natural/biologia; currículo.

Resumen: Este artículo tiene como objetivo analizar las prácticas escolares y curriculares experimentadas en el laboratorio de la oficina de Historia Natural en el Colegio Pedro II entre 1960 y 1970 con el fin de comprender cómo la disciplina escolar de Historia Natural/Biología se ajustó dentro de los muros de esa institución. Para comprender la praxis en la oficina, utilizamos como material empírico: el libro de registro de clases prácticas y testimonios de antiguos maestros. Las actividades cotidianas caracterizaron la disciplina escolar de la biología como experimental vinculada al método científico y la enseñanza práctica, predominantemente académica y asociada con las Ciencias Biológicas; y también permitió su consolidación y legitimación en el contexto del movimiento para renovar la educación científica.

Palabras clave: historia de las materias escolares; útiles escolares; enseñanza de historia natural/biología; plan de estudios.

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Introduction

This work seeks to understand the school practices at the office of the Natural History laboratory of Colégio Pedro II between 1960 and 1970[1]. Taking the log book of practical classes taught at the laboratory as an object of analysis, we sought to understand how the teaching was scrutinized with the help of ergological materials (Escolano Benito, 2017), merging practices that constitute a school grammar. The ethnographic construction of habits, behaviors and school praxis is made possible through the statements of teachers, which complement the research conducted for the purpose of this study and also provide a rich source for a socio-historical investigation of the curricular design for the teaching of Natural History/Biology[2]. The didactic materials and related actions of teachers depict the teaching practices that were in vogue at the time, guaranteeing a smooth transition from Natural History to Biology, all the while legitimizing the latter at the school in question[3].

The common thread of this academic production is the narrative of experiences at the Natural History office that lend substance to what we could call the laboratory culture of Natural History/Biology at school in the context of educational actions at Colégio Pedro II. When we reference Certeau (1996), we realize that the invention of a way of practicing the teaching under study, in addition to being an action defined by culture, actually generates a specific culture, that is, a culture that encompasses both the subject, as related to the contents of Natural History/Biology, and the laboratory. Such experiences are codifiable in curricular and cultural practices that allow us to characterize teaching in a certain way. The adoption of an ethnological approach allows us to understand the universe of school practices that combine a professional identity of teaching associated with the movement for the renewal of science teaching and the modernization of secondary education, proposed by the reforms taking place during the years that are the focus of this study.

The theoretical-methodological arsenal that substantiates the work is rooted in the curricular perspectives of Ivor Goodson (1997, 2001, 2013) regarding school subjects as socio-historical productions in which traditions are invented in a dynamic process of stability and change. It is also supported by the perception of school

1 The study covered practical classes at the Central unit of Colégio Pedro II.

2 We adopted the term Natural History/Biology for the teaching of a school subject that was in a context of transformation. According to Cassab (2011), it is not possible to determine when the name of the subject was officially changed from Natural History to Biology. It is only in the 1973 curricular plan that the subject of Biology in schools is mentioned. On the other hand, official texts published in the official journal of the Brazilian Federal Government, *Diário Oficial da União* (DOU), refer both to Biology, in a bulletin listing the names of the teaching staff of Colégio Pedro II in April 1970, and to Natural History, in a summons for Natural History teachers to attend a meeting published in August 1972 (Cassab, 2011).

3 We view this change as a continuous process rather than a break from the teaching of an 'old' subject (Natural History) to the 'new' subject of Biology.

subjects as unique and creative products (Chervel, 1990), and by theorists who debate and characterize school culture as comprising a set of norms and practices that make school actions intelligible (Escolano Benito, 2010; Julia, 2001; Vidal, 2005, 2006, 2009, 2017; Viñao Frago, 1995). The work is also aided by the contributions of these authors to the characterization of school materialities, as constituents of school material culture, as the substrate for the mobilization of practices and rituals. In this sphere, they are also understood as "archaeological remains" and/or sociocultural traces that allow us to understand part of the school's "black box", that is, its internal activities.

The work is structured into four sections. The first addresses the theoretical-methodological arsenal that is used, while the second exemplifies the historical elements that influenced the formation of Natural History/Biology teaching at the institution. The third explains the curricular and cultural practices put into action by teachers within the scope of the Natural History office of Colégio Pedro II from the 1960s to the 1970s, dialoguing with the socio-historical movements for the renewal of science teaching and the structuring of secondary teaching. The work is concluded with the final considerations.

THEORETICAL-METHODOLOGICAL ARSENAL

The universe of school practices "[...] plays an essential role in the construction of knowledge of the school and in the foundation of the effective culture in which the actions and speeches carried out and interpreted by educational institutions materialize" (Escolano Benito, 2017, p. 29). The adoption of an ethnological approach allows us to understand the discourses that are attributed to certain practices and how they are intertwined in the conformation of what we call the laboratory culture of Natural History/Biology teaching. The perception of school culture allows us to understand that, within the limits of their field of action, the social actors of education translate the changes that are brought about outside the institutions into cultural hybrids that materialize in the culture of a subject, more specifically the laboratory at Colégio Pedro II. According to Julia (2001, p. 10-11), school culture is an aggregate of norms and practices that dictate both the knowledge taught and the behavior learned.

> In brief, school culture could be described as a set of norms that define the knowledge to be taught and the behaviors to be inculcated, and a set of practices that allow the transfer of this knowledge and the incorporation of these behaviors, coordinated norms and practices for purposes that may vary over time (religious, sociopolitical purposes or simply purposes of socialization).

To complement this viewpoint, we also ally ourselves with Viñao Frago (1995, p. 68-69, our translation)[4], as this author broadens the notion of school culture, highlighting other "layers" that constitute it:

> practices and behavior, ways of life, habits and rites – the daily history of schooling –, material objects – function, use, distribution in space, physical materiality, symbology, introduction, transformation, disappearance... –, and ways of thinking, as well as shared meanings and ideas. Someone will say: everything. And yes, it is true, school culture is all school life: deeds and ideas, minds and bodies, objects and behavior, ways of thinking, saying and doing.

Although his concept is very broad, this author chooses school time and space as the most important aspects in the process of conformation and definition of school culture. For research purposes, we focused on the spatial dimension of culture, as we believe that the Natural History office is important in the sense that it enables laboratory practices to materialize. The school space educates and confers a series of educational values. When analyzing the statements of the teachers who worked in the laboratory of the Natural History office, we noticed signs of how it was organized, demonstrating that teaching values and visions were put into practice. The spatial dimension, therefore, is a non-neutral element, a cultural and social construct that mobilizes meanings regarding purposes and teaching methods. In other words, "[...] space speaks and communicates, therefore, it educates" (Viñao Frago, 1995, p. 69, our translation)[5]. The office space is a locus of education and disciplinary culture. It is, thus, "[...] a kind of discourse that institutes a system of values in its materiality [...] [it consists of] frameworks for sensory and motor learning and a complete semiology that encompasses different aesthetic, cultural and even ideological symbols" (Escolano Benito, 1993, p. 97-120, our translation)[6].

Another aspect highlighted by Viñao Frago (1995) that is fundamental to the theoretical construction of the research is the "look" concerning the specific singularities of a given school. Alongside the broad conception of culture, this author also preferred the conception of school cultures, expanding this notion to school establishments, making it possible "[...] to attribute a singularity to each school,

[4] "Prácticas y conductas, modos de vida, hábitos y ritos – la historia cotidiana del hacer escolar –, objetos materiales – función, uso, distribución en el espacio, materialidad física, simbología, introducción, transformación, desaparición... –, y modos de pensar, así como significados e ideas compartidas. Alguien dirá: todo. Y sí, es cierto, la cultura escolar es toda la vida escolar: hechos e ideas, mentes y cuerpos, objetos y conductas, modos de pensar, decir y hacer".

[5] "El espacio dice y comunica; por tanto educa".

[6] "Una especie de discurso que instituye en su materialidad un sistema de valores [...]. unos marcos para el aprendizaje sensorial y motórico y toda una semiología que cubre diferentes símbolos estéticos, culturales y aún ideológicos".

college and university, which helped to broaden the possibilities for studies in the field of the history of institutions" (Faria Filho, Gonçalves, Vidal, & Paulilo, 2004, p. 148). Indeed, Colégio Pedro II had specific characteristics, such as fully qualified teachers, the appreciation of humanities teaching and the characteristic of having opened during the days of the Empire (Ferreira, 2005).

The Imperial Collegio de Pedro II, founded in 1837, as part of the drive for unity and national construction, "[...] was one of the instruments of the civilizing project of the monarchy, with the teaching of the humanities being the paradigm for the formation of the Brazilian nation, with a white profile and of European origin" (Andrade, 1999, p. 1). Its main purpose was not only to teach the humanities to Brazilian students, allowing them to enter higher education courses. The institution was considered a model school, an educational parameter that should serve as a "mirror" for the other educational institutions in the country (Andrade, 1999).

However, this status as a model school was undermined by the various republican reforms enacted subsequently, the Francisco Campos Reform, of 1931, being the last to refer to the institution as a model school. As Ferreira (2005, p. 86) pointed out, based on Andrade (1999), "[...] although the various reforms experienced by the former imperial college in the First Republic point to this progressive loss of status, Colégio Pedro II sought to resist and reinvent new ways of maintaining the prominent position it had enjoyed in the past". In the period under study here, "[...] the institution lost its patronage for good and faced a new moment of crisis, with a reduced number of students and new threats of transfer to the state level" (Ferreira, 2005, p. 123).

In this context, the institution proved to be vulnerable to the initiatives of the science teaching renewal movement, allowing the practice of markedly experimental and active teaching. At this time, there was also considerable praise in the Brazilian context "[...] for the use of laboratories and laboratory practices in science teaching, both by teachers working in basic education and by teachers of pedagogical disciplines working in higher education institutions" (Fracalanza, 2006, p. 34-35). What is worth mentioning, particularly in the period under study, is the influence of the science teaching renewal movement both in science as a school subject (Ferreira, 2005) and in biology in schools (Cassab, 2011). Thus:

> threatened by the loss of the prerogative of being recognized as a model school, it was necessary to work with government spheres to create a discourse to sustain its distinction and prestige, favoring initiatives aimed at "enabling more active and less encyclopedic scientific teaching". This urgent need was assumed by those engaged in the science teaching renewal movement and in the struggle for the modernization of secondary education (Cassab, 2011, p. 183).

Another research axis addresses "[...] school practices, materiality and the formality of school culture" (Faria Filho et al., 2004, p. 151). In this respect, there is a renewal in studies on school and teaching methods. In general, these studies have analyzed how subjects, based on their "standpoint", act and how these actions "[...] do not only aim to operationalize one prescription or another, but to produce places of power/knowledge, intelligibility and meanings for school teaching for generations" (Faria Filho et al., 2004, p. 151). Furthermore, the "[...] practices [...] produced by subjects in their daily school lives also in turn produce them" (p. 151). Thus, at the intersection between different theoretical arsenals (history of school subjects, history of education and anthropology) the study is structured so as to understand the set of school practices in teaching Natural History/Biology at Colégio Pedro II.

The recognition of this daily practice was made possible by analyzing a log book in which practical classes were registered[7], written by Luiza Dyer Barones, who, according to official papers (Colégio Pedro II Yearbook, 1963), was a caretaker at the school. However, as stated by Teacher A and in the log book, the said employee helped with the teaching work in practical classes taught in the Natural History office. This was understood here in two ways: (i) as a source that allowed us to access the school's "black box"; and (ii) as ergological material, which made it possible to construct a narrative of the actions undertaken in the context of the school space under study. Thus, we perceive, in keeping with Escolano Benito (2017, p. 120), that

> material objects, integrated into the empirical strategies of students' and teachers' school work, are a functional and symbolic reflection of ways of understanding and governing practice. This culture is not a mere "empiricism", devoid of meaning, but a manifestation of the complex reasons that inspire good practices [...].

The ritualization of practices in the laboratory of the Natural History office is in keeping with both the historical contingencies that characterized the period in question and the culture, allowing the school to select "[...] from the environment in which it exists [...] the knowledge or disciplines that make up the curriculum and the inherent values of this knowledge" (Escolano Benito, 2017, p. 118). Therefore, the school subject of Natural History/Biology, as a unique production of the school, is manufactured in a context in which there are combinations of school imperatives and knowledge arising from the reference sciences, as claimed by Chervel (1990) with regard to the formation of school subjects. In this respect, "[...] school culture takes on the role of a translation device, that is, a function of appropriation or adaptation of knowledge to the grammar that governs the functioning of the educational

[7] In historical terms, the log book covers the period between 11/09/1972 and 11/18/1975. It is a kind of minute book with a hard black cover and lined paper. Every page is numbered, and the book contains a total of 358 pages of records.

institution, as well as to the psychosocial characteristics of the subjects" (Escolano Benito, 2017, p. 119). Such a culture "[...] hosts practices and discourses that are objectified in traditions, generates behavioral habits in the intervening subjects, is structured in stereotyped rituals with a prescribed course and is symbolized in material objects and images with semantics that give it an identity" (p. 42).

In addition to studying the log book, we interviewed three former teachers[8] at the school to gain a better understanding of past school practices, seeking to answer questions that emerged during the analysis of written sources. We chose to combine different sources to broaden our empirical scope and understand the management of practices, as these "[...] are produced as an act, as an operation, and this does not always allow them to be bequeathed as a historical record" (Vidal, 2006, p. 158). The use of interviews helped to broaden the scope of knowledge of the school practices developed in the Natural History laboratory, allowing "[...] a better understanding of these doings with school routines and the constitution of corporeities of subjects at school" (Vidal, 2006, p. 161).

When selecting content, teaching materials and knowledge in their daily practices, teachers follow a "bricolage" process (Escolano Benito, 2017), aiding a creative and unique feature of school subjects (Chervel, 1990). According to this author, the formation of school subjects is one of the processes that make schools unique places for the manifestation of knowledge and, therefore, schools cannot be considered as mere passive receptacles of society. The Natural History/Biology school subject, as an original production, is created in a context in which school imperatives and knowledge arising from the reference sciences are combined. Thus, the engendering of curricular practices is a creative and singular process.

With regard to traditions, Goodson (2001) hints that they identify a certain disciplinary culture, initiating the teacher in widely differing visions regarding hierarchies of knowledge and content, the role of teachers and global pedagogical orientations. According to the author, it is these traditions that serve as the main agency for introducing teachers into disciplinary communities, which is why they are the most visible face of the broader phenomenon of disciplinary subculture (Goodson, 2001). The author identifies three traditions that configure a given school subject, namely: academic tradition, related to the reference sciences, imbued with abstract values that justify school knowledge; pedagogical tradition, which is related to

[8] There was a criterion for the choice of professionals: they had to have taught practical classes at the laboratory of the Natural History office in the 1960s or 1970s at the Central unit of Colégio Pedro II. The interviews were conducted in accordance with Brazilian ethical resolutions, especially National Health Council Resolution 510/2016. The study was submitted to the National Research Ethics Committee through Plataforma Brasil, and approved in Report 2.263.336 and CAEE 74002417.5.0000.5582. In accordance with the ethical parameters of the aforementioned committee, the identity of the teachers was protected by professional standards of discretion, and any information obtained was used only for the academic purposes of this research project. The interviewed teachers are identified herein by the letters A, B and C.

personal knowledge, social knowledge and common sense; and utilitarian tradition, which is linked to utilitarian aspects of knowledge and work (Goodson, 2001). In this study, we found that the *modus operandi* of forming the school subject of Natural History/Biology is therefore affected by a diversity of traditions that are sometimes related to its reference discipline, that is, Biological Sciences, and sometimes to pedagogical processes or utilitarian aspects.

It should be highlighted that Natural History/Biology as a school subject is an integral part of a school curriculum, perceived here as a socio-historical construction through which traditions are created (Goodson, 2013). From this perspective, we consider that the emergence of innovations does not erase existing traditions. On the contrary, the "new" dialogues with the "old". In view of this, we conceived of the dynamics of disciplinary structuring as a kind of feedback in which traditions and innovations are correlated, generating specific teaching rituals and practices, according to the socio-historical circumstances of the period in question. Thus, materiality, together with teaching practices, allowed the circumscription of rituals that configured a laboratory practice and, consequently, a laboratory culture that occurred within the confines of the laboratory of the Natural History office. Such a culture is not averse to the imperatives of the institution itself or to social and historical conjunctures. It is related to both, generating a hybrid that delimits the teaching of Natural History/Biology both in terms of the so-called modernities – as with the addition of microscopes, considered by the social actors of the time as a milestone in terms of modernizing the subject (Oliveira & Gomes, 2020) – and the traditions already incorporated into the Natural History/Biology discipline – such as animal dissection, which was a common practice in this discipline.

In summary, the actions mobilized by the social actors that gave rise to a certain laboratory culture of Natural History/Biology teaching must be understood both in terms of the external aspects of this culture and its internal aspects. Therefore, we agree with the following statement:

> Both the extrasomatic elements of this culture (expressed in the material objects that are objectified) and the intersomatic elements (reflected in the intersubjective relationships of bodies) shape patterns of institutional behavior. They are not merely instrumental pragmatic variables, since both the ergological equipment used by teachers and the ceremonial devices used in school life configure, in anthropological and socio-historical terms, a culture with particular signs of identity (Terrón & Núñez, 2002 apud Escolano Benito, 2017, p. 87).

HISTORICAL CONTINGENCIES

Several government initiatives, in the context of the Cold War, between 1950 and 1980, were intended to innovate the teaching of science through an experimental methodology that influenced the teaching of Biology (Selles, 2008). The Soviet Union, by launching its first Sputnik satellite in 1957, paved the way for pedagogical interventions. The capitalist countries entered the space race in order to win the battle for technical and scientific development. As a result, the quality of that teaching was questioned, at meetings sponsored by international organizations, in order to curb the scientific expansion of the socialist country in technological terms (Barra & Lorenz, 1986; Chassot, 2004). Countries in the capitalist bloc, such as the United States and the United Kingdom, in an attempt to halt the advance of the Soviet Union, organized committees and science centers for the development of didactic materials and curricular projects. These were appropriated and reformulated by several countries, including Brazil (Barra & Lorenz, 1986; Marandino, Selles, & Ferreira, 2009). This set of actions was recognized as a "[...] movement for the renewal of Science teaching [...]", based on teaching of an experimental nature, which is considered an adequate way to "[...] break with practices that linked this discipline to traditions of memorization, students' passivity and an excess of outdated content" (Selles, 2008, p. 604).

The movement for renewal in the teaching of Biology took place "[...] through the curriculum reformulation project known as the Biological Science Curriculum Study (BSCS)" (Selles, 2008, p. 604). This project generated a series of didactic materials that were translated for use in a number of countries, including Brazil. Through these materials, the idea of experimentation was manifested as the appropriate way to teach Biology, seeking to break away from traditional teaching, which relied heavily on learning by rote and was encyclopedic in nature. The BSCS books valued experimental practices, differentiating themselves from other textbooks of the day. These materials also helped to shape the school subject of Biology along the lines of academic production, strengthening biology in the school context and in the university context, placing it in a prominent position from the 1960s onwards (Ferreira & Selles, 2008).

According to Ferreira (2005), the renovating ideals promulgated by the "science teaching renewal movement" found "fertile soil" in Brazil, since here there was already a movement for the renewal of secondary education that was in line with its propositions. Secondary education modernization initiatives emerged in the nineteenth century, intensifying between the 1930s and 1970s with regard to the issue of teaching based on disinterested classical humanism, historically intended for the elite, and teaching of a scientific and technical nature (Souza, 2008, 2009). The predominance of the humanist curriculum during the Empire can be seen at Colégio Pedro II based on its programs in which these studies were emphasized to the detriment of school subjects such as Physics and Chemistry (Massunaga, 1989 apud Ferreira, 2005).

Following years of debates over the educational purposes of secondary education, the 1961 Law of Guidelines and Bases initiated a "[...] break from the standards of composition and curricular ordering prevailing in Brazilian secondary education" (Souza, 2008, p. 154). For some authors (Barra & Lorenz, 1986; Chassot, 2004), this reform brought to Brazil a movement that appreciated the value of scientific studies, allowing the perspectives of the movement for the renewal of science teaching to penetrate the school walls. This legislation even allowed the adoption of didactic materials that permitted the manifestation of the ideals of this movement with experimental methodologies, bringing school and academic purposes closer together.

Laboratory practices in the Natural History office of Colégio Pedro II: laboratory culture in action

The possibility of structuring and systematizing practical classes depended on school objects[9] as a whole, including the materiality represented by the specific space of the laboratory that enabled the production of a laboratory culture. When asked about how the office space was organized spatially and structurally, the interviewees told us that practical activities were done in a classroom that was integrated with the Natural History office. Teacher A recalled that a teacher named Carlos Potsch was in charge of this office. There was a space to carry out activities and "[...] a little office over there in the corner, the door sometimes open, sometimes closed [...]", as recalled by Teacher A, referring to the office of the teacher in charge; a "[...] more administrative" room, according to Teacher C.

We did not find any architectural plans of the office, but rather we relied on recollections that allowed us to access some elements of its spatial dimension. According to the former teachers, the laboratory was furnished with Formica benches, around eight, in a row, with tall glass stirring rods, and on each of bench was the material to be used by the students. There were also cabinets in which microscopes were kept (they were made available individually to each student), test tubes, in short, "[...] all the glassware" (Teacher A). In addition, there were shelves on which both taxidermized animals and some representatives of the animal kingdom were located,

[9] The objects that make up the laboratory classes of the aforementioned school space are understood here, in accordance with Fiscarelli (2009, p. 11), "[...] as each and every object that the teacher can use in the classroom in a way that affects the teaching and learning process". In the field of educational research, "object" can be used to refer to a wide array of other terms, such as teaching materials, teaching resources, didactic materials, didactic resources, and material means, It is important to point out that, in the present study, the terms "school objects", "teaching objects", "didactic objects", "artifacts", and "didactic materials" are used as synonyms for the material objects used by teachers and students in the context of learning and teaching (Fiscarelli, 2009).

arranged in glass containers "[...] in formaldehyde or alcohol" (Teacher B). As Teacher A pointed out:

> This was a practical classroom. There were benches. Here there was a board to write on, and the teacher had a larger bench because he had to put things on it to give explanations. So, we would go in through the back door, and we went through the room of... through the office door and there were about eight long rows, end to end, with tall glass stirring rods, the Formica benches and on each bench a microscope for each student, and at the front the bigger bench for the teacher. Behind that, a blackboard for you to write explanations on and also your microscope, a slide projector, you know?

We have indicated that, in the 1960s and 1970s, there was space to appreciate practical teaching alongside the theoretical classes of the teaching of Natural History/Biology[10]. The recollections of Teacher A and the analysis of the log book showed that practical classes were not merely incidental and sporadic. Furthermore, technicians helped to arrange and organize the laboratory for practical activities. In addition to the possibility of linking the school objects in the Natural History office with the movement to renew science teaching, the mobilization of material objects can also be seen as a correlation with the process of educational reforms in Brazilian secondary education. In view of this, the ideas of Brazilian intellectuals, who believed that a new secondary education should combine the sciences with humanism in a perspective of forming the human spirit, can be seen in the following statement.

> Researcher: All right, what orders and procedures did the students have to follow in their laboratory activities?
>
> Teacher C: [...]. So, you had to wear a lab coat, behave in the laboratory, be careful with the material, tidy up, and not leave the room in a mess. It's not because we had an employee who helped that you were allowed to leave things any way you liked. So, this was all part of training the student in this respect. He had to take care of the laboratory, he had to take care of the material, he had to behave as you should in a laboratory, right? So, we worked on these things with the student in the practical class because this was part of him becoming a citizen. You had to show him that this was public property, not his own private properly [...].... he could use those things, but they were not private property [...].

[10] This does not mean that, within the confines of the office, theoretical contents were not taught. There are indications in the log book that theoretical classes were taught using only theoretical content.

In this regard, students had to show respect for public property and act as responsible citizens. Therefore, we perceived in the practical laboratory classes remnants of a humanist form of teaching, a tradition that continues to survive, at least apparently, at Colégio Pedro II. In addition to these behaviors of respecting public property, students had to wear lab coats, just like professional scientists, another reference to how knowledge is constructed in an academic environment.

As pointed out by Selles (2008), experimental activities, in addition to retaining unique aspects typical of the school environment, have characteristics that relate them to scientific work. In this regard, it is worth mentioning that "[...] if the processes of didactic experimentation cannot wholly erase the elements that identify scientific action, it is necessary to recognize that they are not reduced to mere attractions for learning, but represent constitutive elements of didactic explanations" (Selles, 2008, p. 611-612). In this respect, the teacher, in order to teach certain abstract concepts, such as the structure of the different types of cells, "[...] needs to make use of devices and artifacts built and used in a context other than that of the school, and for teaching and learning, the presence of these materials becomes indispensable" (Selles, 2008, p. 612).

We noted that didactic materials, correlated with "laboratory" activities, introduce students to a laboratory culture, taught on the "premises" of the Natural History office, predominantly associated with academic tradition. These activities we referred to as "order and procedure in the laboratory" and "arrangement and order of the material required for each experiment", and students had to label their materials and be careful when heating substances in test tubes. They also had to know how to define and schematically design the tools used in these practices. When we refer to the words of Ferreira (2014, p. 193) to reflect on practical teaching in the laboratory of the Natural History office, we realize that:

> Experimental teaching gained time and space in the school subject of Biology, in an even more scientized (and less integrated) format than the one that was being forged in the school subject of Science. After all, the position occupied by this school subject in the secondary school curriculum placed it closer to university studies, even though the social purposes of schooling brought other elements to the debate.

The following excerpt demonstrates the scientific nature of some rituals that introduced students to activities that were recognized as scientific. Under the auspices of "order and procedure in the laboratory", this class outlines a series of practices that involve being careful with the materials used. In this way, the materiality used in these activities helped to spur the development of rituals, notably with academic characteristics that introduced students to markedly scientific activities. In these activities, students had to follow a series of rituals, such as "cleaning the material",

"reading labels correctly before using substances", and "washing their skin in case of any contact with a substance". Below, we have transcribed the subjects addressed on 03/20/1974, the first class of the school year.

> Order and procedure in the laboratory
>
> Graduated and common laboratory glassware
>
> Labeling material
>
> Precautions when heating substances in a test tube
>
> Flammable substances that must be heated in a water bath or on a hot plate.
>
> Read the vial labels before using the substances contained therein.
>
> Be careful to wash with plenty of water if any substance comes into contact with your skin.
>
> Be careful to avoid breaking laboratory glassware
>
> Test tubes (various sizes); beakers (various sizes) (Log Book, undated, p. 187).

School objects, such as test tubes, beakers, glassware, scales, pipettes, test tubes, Erlenmeyer flasks, petri dishes, and funnels, as mentioned in the practical laboratory classes log book, enabled the production of rituals that initiated students in the laboratory culture of the Natural History office. By correlating these practices with the movement towards the renewal of science teaching, we can see the influence of scientific culture on school culture, subordinating the aims of these practices to scientific imperatives. As pointed out by Selles (2008, p. 602), in the historical context of this movement, "[...] the academic purposes are intended not only to overshadow those of the school, but also to impose a scientized ritual on school practices that are closer to the reference sciences". In this regard, the following example highlights a practice of dissecting a mouse, in which we verified the scientific nature of such activities, bringing Biology teaching practices closer to Biological Sciences. However, we can also see that the careful details of the description, procedures and what should be observed are also coated with pedagogical traits related to concern over the active participation of students in the activity.

> Rats are among the most commonly used animals as a "model" for mammals in dissections.
>
> They are commonplace all over the world and easy to handle. They adapt to life in captivity and reproduce well in laboratories. Anesthesia should be performed in a wide-mouthed glass of adequate size, in which cotton soaked in ether or chloroform is placed. For a simple experiment or observation in which the animal must remain alive, we must anesthetize it lightly and keep a funnel

> made with a card and in which cotton with ether is placed. This is done by placing the funnel on the animal's snout as it begins to wake up. [...] Anesthetized or dead, the animal can be pinned to a paraffin-covered board or tied to a duratex board with the ventral side facing upwards [...] (Log Book..., undated., p. 183-185).

It should also be highlighted that the objects used for dissection procedures were referred to as "surgical materials". Once again, we can see the intertwining of scientific culture and laboratory culture in the Natural History office laboratory. Recalling the words of Ribeiro (2010, p. 89), "[...] understanding material objects simultaneously as bearers and producers of social values, assuming that people and things are equally significant and capable of acting with intensity in the course of their interactions [...]" is essential in order to realize that such "surgical materials" contributed to the creation of rituals and arrangements that demonstrate how the teaching of Natural History/Biology in practice was linked to scientific culture. On 09/18/1974 (Log Book, undated, p. 295-296), there is a reference to these materials and how they should be placed "[...] to the right of the technician, one next to the other in this order: 1 - scalpel; 2 - scissors; 3 - tweezers. The animal to be dissected will be right in front of us." As for the teaching materials used, these were: size 4 scalpel with fixed or swivel blade; pointed scissors, blunt tip, mixed (curved and straight); rat tooth tweezers; dissecting forceps and tray.

According to Selles (2008, p. 598), "[...] at the places (and times) in which teaching and learning processes occur, experimental practices in this subject are crossed with a selection of elements of scientific culture, which are recreated and resignified in school culture". From this perspective, the artifacts used in laboratory practices, in addition to promulgating aspects of scientific culture, create school arrangements associated with pedagogical "traditions". In other words, there were school imperatives correlated to the evaluation process in which students should write a description, according to Teacher A, or in the words of Teacher C, a report.

> They had to be punctual and deliver their description on time. Part of the description had to be drawn. There were two circles for them to draw in and questions to be answered. [...]. They could only leave the room after completing this task, with their drawings done and the questions answered [...]. If not, it was zero.

In this way, students were asked, in practical classes, to write out a description of "[...] what was discussed, what was discussed during class, did they have some product of what they did which, normally, is in the form of a report" (Teacher C). From the practical class log book, we find mentions of this report preparation by students, which they had to complete with "goals, procedures, results and conclusions". Asked about the importance of students producing reports, Teacher C stressed that this type

of preparation by the student was important for determining content. The report was an educational product manufactured by the student, in which the practices related to a certain class were summarized. The production of the report had many characteristics of academic traditions regarding laboratory work in Biological Sciences, and highlighted the pedagogical purposes that strengthened the training of students in a historical context of movements for change.

They had to draw the things they had observed, such as cells, dissected animals or plants. When Teacher A arrived at the Natural History office, the students were already, in the teacher's words, "profiled", and the papers for the descriptions had already been printed by the laboratory technicians. This tells us how the didactic materials aided the sharing of procedures that had to be followed systematically by the students based on schematic drawings of their practices and the corresponding completion of the report.

> They had to draw what they observed under the microscope. [...] There were microscopic things. When it wasn't, they had to draw it too. If it was a cockroach they were cutting open, they had to draw the cockroach, the cockroach's intestines. And they had to fill in a questionnaire below. And it had on the same sheet the description of the procedure, with the title of the class, the procedure they were going to do, the necessary material (Teacher A).

Consequently, we argue that the set of didactic materials in the Natural History office enabled the process of modernization of Natural History/Biology teaching, implementing practical teaching, modifying the way this was conceived at the institution. According to Barra and Lorenz (1986, p. 1973), from these objects, "[...] students participated in activities that allowed them to 'practice' or 'do' science through the so-called scientific method". Therefore, the circumscription of laboratory practices in the aforementioned school enclosure led to the emergence of materialized these meanings of schooling, breaking with curricular provisions linked to teaching that were considered traditional.

Activities of a practical nature were identified in the historical context investigated here as a way to break free of the "shackles" of traditional teaching methods, developing scientific and technological awareness in both teachers and students. Therefore, we consider the school objects, mobilized in the school practices of teaching Biology, as promulgators of rhetoric that both identified the teaching of this discipline with the Biological Sciences and conferred a high status on the subject, linked to experimentation and an active teaching method.

At this juncture, proposals of an experimental nature became more evident, elevating experimentation to an effective methodology and combating traditional teaching, thereby becoming part of "[...] a broader process of modernization of the

country and a form of active teaching, along the lines of the New School, which opposed methodologies considered that were backward" (Selles, 2008, p. 600). This can be seen in the declarations of the teachers, in which they signaled that the practical classes were not demonstrative. In the words of Teacher A, the "students were active", and a whole set of procedures had to be followed to guide the class.

Evidence of the students' participation in the practical activities can also be found in the practical classes log book. There are classes in which students demonstrate "how to use a Bunsen burner", explaining its uses in the laboratory, the component parts of this artifact and the functions of each part of the flame (neutral, reducing and oxidizing). Other examples can be found in classes where students presented content related to filtration, purification, homogeneous and heterogeneous mixtures and density. These classes took place in 1973 and correspond to a total of 11 classes in which students were responsible for coordinating activities.

The operationalization of practical activities in the Natural History office also employed two types of teaching modalities, one correlated to the individual activities of using the microscope, and the other associated with the technique of dissecting animals. According to Teacher A, all students had their own material and microscope.

> Researcher: But were the students divided into groups? Did each group have its own material?
>
> Teacher A: No, it was individual. The material was individual. Each student had their own microscope. It was individual. [...] There were 50 microscopes in the room. Good ones, you know? You could fit 50 students in there. But they put half that number to make it very comfortable. No, students worked alone with their own material [...]. And there were two technicians going around the room to clear up doubts, right?

Meanwhile, the other modality, animal dissection classes, were given in groups. Students worked together around a set of dissection material. According to Teacher B, these practices had to be done in groups because "[...] otherwise, a lot of animals would have to be sacrificed". Furthermore, students actually "[...] brought their own rat, each with their own, or they would bring a little guineapig or maybe a rabbit, etc., depending on what the subject was that day" (Teacher B). According to Teacher C, the kind of didactic strategy that was adopted depended on the content of each practical class. Therefore, to avoid a "killing spree" of animals, the students were grouped around several work tables. Teacher C explained what happened next:

> Yes, we had quite a few microscopes. Microscopes, yes, we had quite a few. However, if you're going to do dissecting, you can't have each student with a tray full of their material and their own animal. You

> can't do that, so you divide it over different work tables. You had a tray with all the instruments and the animal for dissection, so it was by table. But as for the optical material, Pedro II always had all this infrastructure with microscopes, magnifying glasses, etc.

From the examples that have been given, we can see that there are curricular provisions that materialize meanings of teaching Natural History/Biology at school, actions that imply different conformations regarding aspects that lie outside of the field of Biological Sciences. Although we can see combinations of the disciplinary teaching culture and the scientific culture, there are also elements that serve the purposes of schooling. Reflecting on the history of the constitution of Biology as a school subject, we perceive, inspired by Marandino et al. (2009, p. 92), that "[...] the choices of content and teaching methods are not only based on the Biological Sciences, but also on aspects such as the needs and demands of schools, students and the community". In this respect, we found, in the declarations of the former teachers, characteristics of the practical practice of Natural History/Biology that correlate with the consideration given by the aforementioned researchers. In the following excerpt, we observed that, in Teacher A's practical fermentation classes, she added aspects of the students' daily lives:

> Teacher A: There were some classes that were very interesting, for example, the fermentation classes, right? They were important classes because we made a correlation with life, with wine, with bread, with yogurt, with fermentative, aerobic, anaerobic processes and how cachaça was produced from sugarcane. So, if the teacher managed to make this connection with real life, the classes would be better. I've always liked to make this connection with real life a lot, so I'm not just looking at yeast under a microscope. Okay, you look at yeast under the microscope, so what? So, in the yeast class, I brought baker's yeast. [...]. It's about connecting with the real world, you know? They understand how things work in nature, in life. It's not getting there and looking at a figure in mitosis, yeah, so what? Now, in your body, where is this happening here? [...].

Therefore, we point out that considerations such as these that emerged during the interviews symbolize "[...] movements of selection, organization and transformation of scientific knowledge that occur within educational processes, with Biological Sciences not being the only reference for the formation of our school curricula" (Marandino et al., 2009, p. 92). Within the sphere Natural History office, the conformation of practices, in addition to exposing elements of scientific culture, was associated with other school singularities, as the above excerpts indicate. As Selles (2008, p. 613) suggested, in the 1960s and 1970s, "[...] investments [...] focused

on methodological changes in the subject of Biology that reflected broader processes, which occurred in macro-social spheres and, in particular, in places of scientific production". Consequently:

> [the] selection of scientific cultural elements referenced by school culture becomes complex in the meshes of the social fabric in which both political forces that modulate teacher training and school practices that respond to the profound demands of the student body, constrained by specific times and places, interact (Selles, 2008, p. 613).

If, according to Selles (2008, p. 612), "[...] the identity of the disciplines of Science and Biology at school was historically built with the marks of experimentation and with these they differed from other didactic activities that are used simultaneously in several disciplines [...]", we can affirm that the collection of objects mobilized in the practices of the office also identified the teaching of Natural History/Biology. Moreover, the teaching materials, in general, brought an idea of curriculum innovation through which the meanings disseminated both by the science teaching renewal movement and by the secondary education reforms materialized. This can be exemplified by the statement given by Teacher C, below:

> So, I think that the fact that we had a laboratory, the fact that we had a space for a well-equipped laboratory with all these objects, with all these materials available, this made the teachers feel that desire, that they believed a lot in this practical work that they could develop and innovate in some way because the students began to live a different reality. They go beyond theory simply to start experiencing and visualizing it in a different way. So, I think this brings an innovation to the students and a new thing in which they will see science in a different way. And I think that sometimes this even ends up influencing their careers.

Based on Goodson (2013), Selles (2008, p. 613) stated that, in the historical context under study, "[...] an attempt was made to 'invent a tradition'" through experimental teaching. Therefore, the existing materiality in that office can also be viewed as inventing traditions that were predominantly correlated with the Biological Sciences, but which, in dialogical contact with the teacher, also provided the production of traditions of a pedagogical nature, related to everyday life and students' experiences. Furthermore, school objects also introduced students to laboratory practices, allowing them to experiment with scientific methodology. To summarize this point, we may refer to Ferreira (2014, p. 193), emphasizing that:

> [the] unifying and modernizing discourse of Biological Sciences was being resignified in a form of experimental teaching that explicitly intended the use of laboratory materials and the adoption of more scientifically controlled procedures in a physical space similar to research laboratories.

In the same way that science centers acted to promulgate the definition of a "good" teacher and the ideal student, we may refer to Valla, Lucas and Ferreira, (2009, p. 4) in the sense of attributing to the mobilization of artifacts and the respective curricular practices this same function in the process of producing "[...] socially legitimate curricular standards of themes and teaching methodologies for school subjects in science, as well as what would constitute 'good' and 'bad' teachers and students for them". From this perspective, didactic materials can be viewed as playing a central role in the materialization process of this rhetoric of associating experimental and practical teaching as "ideal" in the teaching of Natural History/Biology.

Final Considerations

The structuring of a corpus of behaviors and habits in the laboratory of the Natural History office materialized meanings regarding the teaching of Natural History/Biology, mobilizing a *modus operandi* in this respect that identifies it with a series of material devices that delineate and specify it, making it different from other school subjects. In general, school and curricular practices at Colégio Pedro II allowed students to experiment with scientific methodology. This introduced an idea of curricular innovation through which the meanings disseminated by the movement to renew science teaching and secondary reforms materialized and, at the same time, the identity of Natural History/Biology teaching was forged with traits of experimentation. The materiality existing therein, combined with school practices, can be seen as inventing traditions that were predominantly correlated with the Biological Sciences (which contributed to a scientific character regarding the teaching of Natural History/Biology at Colégio Pedro II). However, this, in dialogical contact with teaching, also led to the production of traditions of a pedagogical nature, related to the daily life and experiences of students. Through the mobilization of different ergological devices, such actions also created rituals of this teaching, characterizing the teaching staff and teaching in question.

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