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ARTICLES

Chemistry in the Statute of the Faculty of Philosophy of Coimbra (1772): origins of a School Subject[1]

A Química no Estatuto da Faculdade de Filosofia de Coimbra (1772): origens de uma Disciplina

La Química en el Estatuto de la Facultad de Filosofía de Coimbra (1772): origenes de una Asignatura

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Abstract

It aims to characterize the origin and development of the discipline of Chemistry in the environment of clashes between the humanist tradition and scientific rationality in Portugal in the 18th century. The methodology used is the Content Analysis of the Statute of the Faculty of Philosophy of Coimbra, considering a dialogue with Chervel (1990) on the history of the school subjects. The results point to aspects related to Chemistry in fourteen guidelines. Content Analysis allowed to construct three categories related to the genesis, organization and development of the discipline: objectives, contents and methodology, based on a categorization that admits the movement between Chemistry as a reference science and as a school discipline, highlighting key words like examine, separating, body, substance, composition, affinity, property, combination, mixtures, comparison, lens / teacher, theory and experiment / practice / laboratory. Real aims - related to school practices - and objective aims - prescribed in the official text, were analyzed, outlining Chemistry as a discipline linked to historical transformations.

Keywords: History of school subjects. Chemistry. Statute of the Faculty of Philosophy of Coimbra.

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Resumo

Objetiva caracterizar a origem e desenvolvimento da disciplina de Química no ambiente de embates entre a tradição humanista e a racionalidade científica em Portugal, no século XVIII. A metodologia empregada é a Análise de Conteúdo do Estatuto da Faculdade de Filosofia de Coimbra, considerando um diálogo com Chervel (1990) sobre a história das disciplinas escolares. Os resultados apontam aspectos referentes à Química em quatorze diretrizes. A Análise de Conteúdo permitiu construir três categorias relacionadas à gênese, organização e desenvolvimento da disciplina: objetivos, conteúdos e metodologia, com base numa categorização que admite o movimento entre a Química enquanto ciência de referência e como disciplina escolar, destacando palavras-chave como examinar, separar, corpo, substância, composição, afinidade, propriedade, combinação, misturas, comparação, lente/professor, teoria e experiência/prática/laboratório. Foram analisadas finalidades reais - relacionadas às práticas escolares - e finalidades de objetivo - prescritas no texto oficial, delineando a Química enquanto disciplina vinculada às transformações históricas.

Palavras-chave: História das disciplinas escolares. Química. Estatuto da Faculdade de Filosofia de Coimbra.

Resumen

Tiene como objetivo caracterizar el origen y desarrollo de la disciplina química en el ambiente de enfrentamientos entre la tradición humanista y la racionalidad científica en Portugal en el siglo XVIII. La metodología empleada es el Análisis de Contenido del Estatuto de la Facultad de Filosofía de Coimbra, considerando un diálogo con Chervel (1990) sobre la historia de las disciplinas escolares. Los resultados apuntan aspectos referentes a la Química en catorce directrices. El Análisis de Contenido permitió construir tres categorías relacionadas con la génesis, organización y desarrollo de la disciplina: objetivos, contenidos y metodología, con base en una categorización que admite el movimiento entre la Química como ciencia de referencia y como asignatura escolar, destacando palabras clave como examinar , separación, cuerpo, sustancia, composición, afinidad, propiedad, combinación, mezclas, comparación, lente / profesor, teoría y experiencia / práctica / laboratorio. Se analizaron finalidades reales - relacionadas a las prácticas escolares - y finalidades de objetivo - prescritas en el texto oficial, delineando la Química como disciplina vinculada a las transformaciones históricas.

Palabras clave: Historia de las disciplinas. Química. Estatuto de la Facultad de Filosofía de Coimbra.

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Introduction

This article demonstrates the result of a research that aims to trace a historical path of the discipline of Chemistry, considering its genesis and subsequent institutionalization in the educational field. We highlight a particular source taking into account its protagonism and seminal character, originating from the Reform of the University of Coimbra: the new Statute of the Faculty of Philosophy, issued in 1772. We have started from the hypothesis that, in the context of the clashes between the humanist tradition and the emerging scientific rationality of enlightenment inspiration that motivated the reform process undertaken by the Portuguese government at the time, the Statute expresses, under historical perspective, characteristics of origins, development and organization of the Chemistry discipline. The text is structured in four sections. Initially, we present the methodology used, detailing the analysis treatment as well as the related theorist. Then, we bring a brief contextual approach concerning the Reformation at the University of Coimbra. In the denser part of the article, which either contains the elements of an analytical and interpretative order, we delineate the Statute of the Faculty of Philosophy of Coimbra. Finally, we present some considerations linked to the results.

The Methodology utilized: Notes

The methodology is inspired by the exploration of a theoretical body linked to the History of Education, developed by André Chervel (1990). Chervel presents a conceptual discussion on the history of school subjects, arguing about their definition and constitution, considering their functions in the cultural sphere, questioning their purposes and, alongside this, exploring the forms of their writing. In the dialogue with such reference, we combined it with the Content Analysis method, defined by Laurence Bardin (2004), applied to the analytical activity of the chosen documentary source.

In the first proposed methodological option, we emphasize the basis proposed by Chervel, particularly when he explains innovative characteristics regarding the studies that involve the production of knowledge about school subjects. According to him, there is an epistemic stance that encompasses the historical and social constitution of determined discipline, part of laws and definitions inserted in the cultural plan and reaches its insertion in the school environment. The author also presents both aspects of concepts and terminology that involve the word discipline, and related etymologies. Therefore, it is necessary to present a dialogue between the constitution and the purposes of a discipline. Demonstrating socio-political or religious attributes, for example, these purposes fit in a given time, having as main destination the type of education to which they are directed (CHERVEL, 1990, p. 190).

We now highlight Content Analysis, according to which the research sheds light on a specific documentary corpus. Initially, the procedural requests the fluctuation reading, which, although it can be repeated several times, means a first contact with the chosen document, lending itself to data collection. Its rigorous application helps to detect particularities inserted in writing. This systematic application has the consequence of generating a textual overview that presents new characteristics in relation to its original text. With this exploration and a concomitant classification of terms, the keywords result, from which it is possible to extract attributes that will make it possible to focus on research (BARDIN, 2004, p. 40).

Considering that the documentary body is the Statute of the Faculty of Philosophy of Coimbra, the keywords taken from the source may, since they are impregnated with historicity,

ratify some characteristic elements of the discipline of Chemistry. According to Bardin (2004), in addition to the detection of keywords, indicating their frequency throughout the text facilitates the analysis. Based on this, it is possible to adopt initial categories that, a priori, dialogue with the objectives of the investigation. This stage corresponds to coding, comprising the enumeration of terms, their quantitative and qualitative analysis, thus enabling the achievement of a representation of contents present in the document, which will serve as indexes of analysis, which will be categorized and explored in the next moment. Then the stage of inference and interpretation is reached, at which point the researcher strives to either capture explicit and hidden contents, resulting in the possibility of comparing the initial categories, in the search in order to highlight elements of similarity or differentiation. Finally, the terminological grouping that results in the final categories is generated (BARDIN, 2004, p. 97-137).

The Reform of the University of Coimbra

Throughout the 18th century, Portugal was involved in social, economic and political transformations, a fact that had repercussions in the educational field. Jesuitic control over educational institutions, until that hegemonic moment, began to suffer questions in relation to the traditional teaching method, intensified with the spread of modernizing Enlightenment ideals.

With this, the development of the Empire begins with the irradiation of empiricist and utilitarian aspirations, within the most diverse social and economic sectors of Portuguese society (SAVIANI, 2011, p. 80).

In the search for the insertion of aspects of the rational enlightenment that spread throughout Europe, the Portuguese placed in education a concentration of efforts as the key to a change and sought to free it from the Jesuit monopoly. In this context, the attack on the Jesuits is taking shape, and the Reform of the University of Coimbra, organized by the Marquis of Pombal, becomes a landmark of the Enlightenment influence in Portugal (GAUER, 1996, p. 30-1).

It was with the arrival of Dom José I in power that Portugal started to adhere to the enlightened thought in vogue, having as one of the focuses the educational field. The appointment of Sebastião de Carvalho e Melo as minister of the Foreign and War Secretariat, in 1750, is a milestone for the introduction of the aspirations of the Philosophy of Lights. In 1759, the now called Marquês de Pombal, through the license of June 28, instituted the closure of Jesuit schools in all Portuguese courts and in their colonies, establishing royal classes (CARDOSO, 2004). It is worth highlighting the Reform of Major Studies, targeting the University of Coimbra, a vigorous effort for the predominance of scientific education. It is based on this Reformation that two documents were produced: initially, the Historical Compendium of the University of Coimbra, from 1771; then the new Statutes of the University of Coimbra, published in the following year.

Some characteristics about the elaboration and constitution of the Statute of the Faculty of Philosophy of Coimbra, fruit of the reformist character, we believe it is necessary to be highlighted. According to Saviani (2011, p. 90-1), before the Reformation, the University of Coimbra had four faculties: Theology, Canons, Law as well as Medicine, which had presented relevant changes after the Reformation. For instance, there was the insertion of new subjects and changes in the workloads required for training. In addition to these changes, two new Faculties were created: Mathematics and Philosophy (GAUER, 1996, p. 107).

These new institutions were created with modern characteristics, since, within the Faculty of Philosophy, there were studies related to the natural sciences. The Philosophy course lasted four years, in which rational and moral philosophy, natural history, experimental physics as well as practical and theoretical chemistry were taught. Fundamentally, it presented a pedagogical and educational aspect in accordance with the clarification of the Enlightenment hue, as it propagated the rupture with Aristotle's scholastic philosophy and incorporated the so-called synthetic demonstrative method, in which the teacher should provide a general image of the discipline by reducing the material to an ordered and systematic doctrinal set, subordinating the expository evolution to a line of increasing complexity (NUNES, 2011, p. 12). The students formed two groups: on the one hand, the ordinary ones, who dedicated themselves to studies in an optional way or as preparation for the profession they intended to follow; on the other, those called as obliged, compelled to study philosophy or mathematics as a prerequisite of the Faculties to which they addressed (SAVIANI, 2011, p. 92).

Based on the scientific character, the Statutes guided a path that conceived nature as a space in which man could act aiming at progress. This modern view of science, based on observation, so characteristic of the 18th century, dismembered the philosophy of science. Hence, the Reformation imprints on the educational process the mark of attending to the knowledge of the things of nature, which would determine the spirit and the way of relation of the apprentice subjects with certain disciplines.

> [...] guided a line of thought and action that was consistent with the reality experienced. The link between theory and practice is evident throughout the proposal for Reform, Historical Compendium and Statutes. The modern age has inverted the pole of attention, focusing on the subject the question of knowledge. The student, for the reformers, should, from observation and experience, formulate the bases of knowledge of nature. (GAUER, 1996, p. 115).

Ab Ovo: the Statute of the Faculty of Philosophy of Coimbra as the Originator of the Chemistry Discipline

One of the clues about the origin and development of the studies and contents of the discipline of Chemistry, as well as its teaching in Portugal, is based on a document from the Reform of the University of Coimbra.

> [...] one of the most objective texts on the teaching of Chemistry that has access, still in its original form, is that which is located in the statutes of the University of Coimbra, published in 1772, when it was reformed. This statute was published fac-similarly when the celebrations of its bicentenary [...] More than being a significant document to understand the teaching of Chemistry in this lavoisier´s environment in Europe, and more specifically in Portugal, we have to consider that it is a product of the Reform of the University of Coimbra ... (CHASSOT, 1994, p. 76).

Bearing these aspects well focused, we emphasize the need to analyze this document in order to understand, under historical perspective, the modus operandi of the discipline of Chemistry, contemplating conceptions about the objectives, methodologies and contents worked on. And it is in Chapter IV of the Statute of the Faculty of Philosophy of Coimbra where we find the part that deals with Chemistry. Its structure consists of fourteen guidelines, which should be used by the teacher in the exercise of his function, describing program contents, strategies and instruments and some methodologies applicable to the teaching of contents related to Chemistry as well. We emphasize that the content of this indisputable source allows us to affirm about the existence of a disciplinary character of Chemistry, in the sense of a historical dynamic of evolution between disciplinary and scientific teachings, which sets thresholds in the study of the history of school subjects, in which we consider the genesis and the functioning of a given discipline (cf. CHERVEL, 1990, p.186).

Through the procedures provided for in the Content Analysis, we begin with the fluctuating reading of the Statute. After repeated readings of each of the guidelines, we highlight keywords that relate to the dynamic development of Chemistry; that is, these terms were categorized and analyzed in the context of the writing that emanates the content and the constituent purposes of the discipline. For example: the term substance is directly related to chemical studies, being inserted in a context that justifies its study, in addition to presenting itself as a basic and important content for the associated scientific basis. Finally, after the intermediate steps aforementioned, we reach the final categorization stage.

The resulting first category, identified as objectives, encompass words corresponding to the instructions given to the teacher for the selection of content and the choice of teaching strategies (GIL, 2011, p. 43). As components of this category, we highlight the objectives for teaching Chemistry in the new Philosophy Course at the University of Coimbra. Keywords such as studying, examining, separating, presenting and explaining stand out, due to the number of occurrences, among others that also point to the objectives. Given the official character of the Statutes, the objectives category allows to estimate the relationships between the analyzed text and the purposes of teaching, even if there is no explicitly formulated correspondence (cf. CHERVEL, 1990, p.188-9).

The second category is called content and incorporates the most cited terms that refer to the contents and fields of study explored in the Reform carried out in Coimbra.
We consider the main ones: Body, substance, composition, History of Science, affinity, property. A subcategory emerged from it, which we call specific contents, adding the words salts, acids, water, bases, metals, oils. The assumption of this category is in line with the statement by Chervel (1990, p.219), according to which the history of school subjects "[...] placing teaching content at the center of their concerns, renews traditional problems". In this sense, the process of creating disciplines is centralized, related to the historical transformations that the school goes through.

The third category, methodology, is determined by the objective-content relation, which exposes mechanisms for achieving the objectives (LIBÂNEO, 1994, p. 149). In this case, the coding was more complex, because when we deal with methodology we have a two-way street between the objectives and the contents. In addition, as problematized by Chervel (1990, p.194), it is necessary to consider "[...] the theoretical freedom of disciplinary creation of the master who exercises himself in a place and over an equally well-determined public [...] .The material conditions in which teaching takes place are closely linked to disciplinary content ". This set of conditions is defined through the terms lens / teacher, theory, experience / practice / laboratory.

We organized a table that exposes the categories created, the terms that inform them, the frequency of occurrence and the guideline in which it is present.

Chart 1 - Terms referring to the three categories, Objectives, Contents and Methodology, their occurrence and guideline in which it is located in the Statute of the Faculty of Philosophy of Coimbra.

CATEGORIES	TERM	OCCURRENCE	GUIDELINE
Objectives	Study	1	I
	Examine	2	II
	Separate	1	II
	Perform	3	III, XIII, XIV
	Explain	7	I, IV, V, VII, VIII(2x), XI.
Content	Corpus	13	I(2x), II, IV(3x), V(3x), VI, VII(3x)
	Substance	13	II(2x), IV, V, VI, VII(2x), VIII(2x), IX(2x), X(2x)
	Composition	4	II, IV, V, VII
	History of Science	1	III
	Affinity	7	V, VI(2x), VII(3x), XI
	Property	4	II, V, VIII, X
SUBCATEGORY			
Specific contents	Salts	2	VIII(2X)
	Acids	3	VIII(2X), X
	Water	1	VIII
	Bases	1	VIII
	Metals	2	IX(2X)
	Oils	2	X(2X)
CATEGORY			
Methodology	Lent/teacher	4/2	III, VII, XIV(2X) / IV, XII
	Theory	2	XI, XII
	Experience/Practice/ Laboratory	7/2/ 1	IV, VI(2X), VIII, IX, XI, XIII / XII, XIII / XIII

Source: Elaborate by the authors.

Considering the relationship between the new Statute of the Faculty of Philosophy and the Reform of the University of Coimbra, for the purpose of a broader analytical-interpretative composition, we add references to the fourth chapter of Book III of the University Statutes, where the list of guidelines is. The fourth chapter begins its writing as follows:

> Chapter IV
> From the Lessons of the Fourth Year
> I- In the previous year the Philosophical Students learned the truths of fact, which the Magisterium of Experience has shown in the Bodies, considered as homogeneous masses; and applied mechanically to work one to another: They will spend the fourth year **studying** the truths,

> which the same Experience has shown on the parts, of which the same **Bodies** are composed; and about the Phenomena, which result from the intimate application, and contact of the same parts; Phenomena, which cannot be explained by the ordinary Laws of Mechanics; and that constitute a separate Science. (STATUTES OF THE UNIVERSITY OF COIMBRA, 1772, p. 387-88, emphasis added).

Thus, it was from the fourth year that studies of Chemistry at the Faculty of Philosophy began. Chassot (1994, p.77) states that: "In the guidelines [...] transcribed, the students of the Philosophy Course had already studied in the previous year Mathematics and Physics (and in this particularly Mechanics), now they are presented with a new Science".

This new science is presented with the objective of studying the veracity and the constitution of the parts of a body. They characterize it as possessing authenticity and accuracy of knowledge regarding the interaction of bodies, surpassing the laws hitherto existing. In particular, it came to add understanding to one of the main contents exposed in the Statute, the study on bodies.

By analyzing the second guideline, we extracted the importance and the need for insertion of this new science, which would benefit the study of interaction between the elements that the substances are composed of: Chemistry.

> II - This Science is called **Chemistry,** and it is the Third Part of Natural Philosophy. This discipline teaches you to **separate** the different **substances** that go into the **Composition** of a **Body;** to **examine** each of its parts; to inquire about the **properties**, and its analogy; comparatives, and combinations with other substances; and to produce new compounds by differently combined mixtures, of which in the same Nature one does not find model, nor example. (STATUTES OF THE UNIVERSITY OF COIMBRA, 1772, p. 388, emphasis added).

We understand that in relation to the objectives category, this guideline is perfectly clear. He explains that the teaching of Chemistry has the following objectives: to separate, examine and produce new compounds based on others; that is, it reinforces what was said in the first guideline. In this case, based on the content category, we observe an insertion that is justified with the treatment of the different substances, their composition and properties. It is evident that these substances are subject to mixtures, rearrangements and the formation of new compounds starting from the interaction of their parts.

In guideline II Chemistry is characterized: Science that would allow the separation of different substances, using chemical techniques, would allow to organize, compile and produce new compounds not found in nature (ESTATUTOS DA UNIVERSIDADE DE COIMBRA, 1772, p. 388). According to Chassot (1994, p.78), one of the issues that draws attention is the non-use of the concept of chemical element, although it had already been proposed by Robert Boyle in his book The Skeptical Chemist, published in 1661, or that is, more than a century before the publication of the Statute. Next, we will pay attention to the third guideline:

> III - Nevertheless, before the Lessons of this Science, the **Lens will give** an abbreviated Summary of its own history: Showing the origin it had; the progress it has made; revolutions; the successes: the decay; and the disbelief, in which he stood for the obscure mysteries of the **Alchemists**, and for the frivolous pretensions of the Philosopher's Stone, and other secrets, whose invention was proposed by men of

> greater temerity, and prudence: And exposing more thoroughly the restoration of this Science in recent times; and the utilities, which it has produced in the Arts, which depend on it. (STATUTES OF THE UNIVERSITY OF COIMBRA, 1772, p. 388-89, emphasis added).

With guideline III, a methodological and content orientation directed to the lens is initiated. It also aimed to present students with questions regarding the history of Chemistry. It was understood that it was necessary to have knowledge about the beginnings of Chemistry, how it was being constituted; the intellectual disputes over knowledge and, mainly, its evolution in the scientific field. There were concerns about the distinction between alchemists and chemists, since the former were considered deceitful and did not correspond to the new directions of science. In the view of the authors of the Statute, we sought to breach some barriers present in the teaching of science. In other words, to overcome obstacles that highlighted the dispute between scientific teaching and humanistic teaching.

Guideline number IV presents limitations and existing barriers for the study of Chemistry and highlights the role of the teacher as the main agent formulator of solutions.

> IV - As for Analyze, and **Body Composition** is limited; and if not able to promote, if not to a certain extent; finally stopping at the barriers of certain unalterable substances to the full force of **Chemicals Artifices;** these in relation to our use are, and must be taken as Principles, and elements of the Bodies. And about these, the **Professor will explain** everything that has resulted from the combination of the **Chemical experiments**; without intending to investigate the nature of each of the simple elements of which the Bodies are composed; replacing imaginations, where experiences are lacking. (STATUTES OF THE UNIVERSITY OF COIMBRA, 1772, p. 389, emphasis added).

As aforementioned on the content, the existing limitations should be considered; chemical concepts, knowledge and techniques would not solve all the questions. With that, it would be up to the teacher to explain what results would come from experimentalism. In this case, chemical experience falls into the methodology category, also being called Chemical Artifices, presenting concepts about the composition of bodies and their interaction. It is considered that when such possibilities and devices are exhausted, the characteristic of the body under study must be taken into account; however, it is the teacher's role not to digress or create conjectures about knowledge not yet substantiated, as it would make the mistake of presenting aspects from medieval scholasticism, already depreciated.

In addition to this fact, we emphasize the general content referring to the bodies, because as in the first three guidelines, this would be the focus of the studies of Chemistry, a matrix for the development of other contents. What draws attention is the search for proof of the theories studied based on the realization of experiments, as well as the primordial role of the teacher with regard to the explanation of each event. Guideline IV presents characteristics of a distance from humanistic studies, as it seeks through experiments to substantiate laws and present limitations of knowledge, resulting from attributes of bodies not yet known.

The fifth guideline in its very beginning presents a general objective, which means an explanation of the contents referring to the properties of substances and their insertion in the composition of bodies, being this object of particular study of Chemistry. It is in this guideline that the concept of affinity emerges, which we also consider as content.

> V - After this, it **will give a general idea** of the relative **properties** of the **substances**, which enter the **composition of the Bodies**, and belong to the particular object of Chemistry: Because just as in Physics the facts are explained, which result from the attraction and impulse of the Bodies, considered human outside of others; likewise in Chemistry the facts are considered, which result from the intimate union of the same Bodies, which in terms of Art has been called **Affinity**. (STATUTES OF THE UNIVERSITY OF COIMBRA, 1772, p. 389-90, emphasis added).

Similarly, the term affinity is mentioned seven times throughout the fourteen guidelines, mainly in the number VI and VII, which stands its importance. Let's see:

> VI - In fact, all **experiments** seek to prove that among the different **bodies,** both simplified and composed, there is a certain convenience, relationship, or affinity, as a result of which some of the said **substances** are intimately linked together; at the same time that they are loathe to contract union with others. This general effect (whatever its cause) is what is called **Affinity**; and it has the same place in Chemistry, as Universal Gravitation in the Mechanism of the Universe; **serving not only to give reason for all the particular Phenomena, but also to connect them in a System of Doctrine**. (STATUTES OF THE UNIVERSITY OF COIMBRA, 1772, p. 390, emphasis added).

And in the following guideline:

> VII - For that reason, the **Lens** will firstly **expose** the fundamental truths, which have proved decisively about the **Affinity of the Bodies;** as for example: that if there is a Compound of two **substances**, a third Body is applied, which has no affinity with any one; and having with the other, greater than them both on themselves, necessarily results in a **decomposition**, and a new union; that is, that the third Body separates the two substances, one from the other, and joins with the one, with which it has affinity; forming with it a new compound, and leaving the other free, and free, as it was before she contracted the union. Similar to these are other general facts, which must be explained before entering the examination of individuals. (STATUTES OF THE UNIVERSITY OF COIMBRA, 1772, p. 390-91, emphasis added).

Guideline VI once again brings as content the study of bodies and substances. However, it represents the concept of affinity, which we categorize as general content. We remember that affinity is defined as the reason for the union of substances. And this concept is presented, up to the present day, as basic to the development of the study of Chemistry. In addition, it serves "not only to give reason for all the particular Phenomena, but also to link them in a Doctrine System" (STATUTES OF THE UNIVERSITY OF COIMBRA, 1772, p. 390).

In guideline VII, the term show is part of the objective category that in this case we understand placed in the sense of explaining and presenting the fundamental truths of the study of Chemistry, starting from the principle of affinity. In this writing it is explored, being, as in the other guidelines, essential for contents that deal with substances. The combination of two substances that would result in a third and the degree of that union would be explored and

explained through affinities. This is considered a general fact, common in chemical reactions and rightly precedes the concepts covered in guideline number VIII.

It is also important to realize how the figure of the teacher is permanent throughout the guidelines. And guideline number VII is no different. This also presents a methodological script, very detailed, which outlines the way in which the content should be followed and addressed by the teacher. The analysis that follows corroborates our analysis.

> Perhaps the most significant in this paragraph are not the conceptual difficulties of the author, as he does not use the term molecule yet and thus cannot clearly explain the formation of new substances, even trying to convey the idea that elements would be free; however, what is striking is how in a text whose title is Statute, details in such a precise way what the teacher must explain about the important affinity. (CHASSOT, 1994, p. 82).

Still on the concept of affinity, its diffusion within Chemistry occurred in the middle of the 18th century; however, it lost strength after the publication of Lavoisier's work, Traitè Élémentaire, in the year 1789. Thus, it is evident that the approach of affinity brought in the guidelines of the Statute of the Faculty of Philosophy of Coimbra is considered as basic for the deepening of studies of Chemistry and its constitution as a discipline. Its main definition is about an interaction between bodies, formation of new compounds and decomposition of others. Below we address guideline number VIII,

> VIII - Having **explained** the general principles, or the generalized facts, by combining the **experiments**; it will enter into the examination of **substances,** which constitute particular species, always starting with the simplest ones, and going from them to the most composed ones. In this way, it **will start** with **saline substances** in general, and in particular; showing the **properties**, and affinities of the **acids** with the adsorbent **Land**, with the **Water**, and with the **Phlogiston**; and explaining the particular observations of the fixed and volatile **Alkalis**; **neutral** salts; **vitriolic, nitrous acids**, etc. (STATUTES OF THE UNIVERSITY OF COIMBRA, 1772, p. 391, emphasis added).

As a goal the guideline presents the explanation of the general principles taught up to that point. With a methodology based upon the experiments already listed, the teacher should approach the concepts about substances, starting from the simplest to the most complex. Based on this, an ordering of specific contents follows, starting with the study of salts and acids and their possible affinities with land, water and phlogiston[2]. Chassot (1994, p.82) draws attention to a situation:

> [...] this paragraph receives a special historical significance, as already in 1774, just two years after the Statute was published, Lavoisier, sensing that the Theory of Phlogiston, established by the German physician GE Stahl (1660-1734) was based if in an erroneous hypothesis, he seeks new explanations and successfully presents the results of his programmed combustion experiments.

[2] The phlogiston (or phlogiston) theory was developed by the German chemist and physician Georg Ernst Stahl between 1703 and 1731. According to Stahl, combustible bodies had a material called phlogiston, released into the air during combustion processes (of organic material) or calcination (of metals).

After the study of these substances considered as simpler, the study of the bases - treated in the Statute as Alkalis - would begin and the study of acids, represented there by Vitriolicos acids, which are called by the modern nomenclature of sulfuric acids. Therefore, this guideline includes a set of specific contents for the study of Chemistry, which are based on previously taught concepts, such as affinity and property of bodies.

Guideline IX highlights the importance of studying content focused on metals. The objective of studying them consists of improving the techniques already used for their extraction and processing, either in Portugal and Brazil Colony. Therefore, contextual historical factors of economic base are closely related to the purposes of the discipline of Chemistry.

> IX - From there it will pass to **metallic substances** in general, and in particular; demonstrating the result of the **Experiments,** which has been done on **gold, silver, copper, tin, lead, mercury, antimony regulation,** etc; about what will not forget the most important facts, which relate to the use of the Arts, which work in the manipulation of said metallic substances; as a means of easily seeking **fusion, dissolution, separation, amalgamation**, etc. (STATUTES OF THE UNIVERSITY OF COIMBRA, 1772, p. 391-92, emphasis added).

At that moment, an area from the then discredited alchemy is approached. The study of metals was instituted and organized as one of the first scientific studies, mainly with regard to mineral exploration. According to the text, the teacher should treat the metal content, first presenting the main metallic substances such as gold, silver, copper, tin, lead and mercury; then, presenting their mergers, dissolutions and separations. These metals, in the great majority, were used as currency of exchange and in the minting of arms. Therefore, the need to know the chemical techniques and procedures used for the processing of metals is evident. This fact affirms the concern of Portuguese government officials with regard to economic development based on scientific progress. And here we move forward in the sense of saying, following the terminology coined by Chervel (1990, p.190), of the new objective and real purposes that the discipline of Chemistry incorporates throughout its history.

Guideline number X presents the very beginning of studies aimed at a set of chemical contents which in the future would be inserted in the constitution and development of the current Organic Chemistry.

> X - After this it will pass to **oily substances** in general, and in particular; dealing with mineral oils, vegetation, and animals; the preparations, and the use of them. Whence it will lead to fermentation in general, and to its particular species: Examining the different **properties**, and phenomena of witty, **acidic** and putrid fermentations: Gathering the necessary reflections on the means, and operations, which are used in the analysis of the substances animals, vegetation, and minerals, such as **distillations, emulsions, dissolutions,** etc. (STATUTES OF THE UNIVERSITY OF COIMBRA, 1772, p. 392, emphasis added).

The objectives demonstrate a purpose of the theoretical part of Chemistry. The teacher then has the purpose of teaching content related to oily substances. The approach to this content would begin with the presentation of the properties of animal, vegetable and mineral oils and end with the identification of methods and techniques that separate, unite or dissolve these oils. According to Fonseca (2013), animal oils such as capybara and cod liver oil are found, but also vegetable oils, of which olive, soy and sunflower are well-known examples.

To end the theoretical part of Chemistry, guideline number XI aims to insert a teaching tool that may assist the teacher and students in the teaching and learning of Chemistry: the Table of Affinities.

> XI - And the **Theoretical** part of this Science will end, **explaining the Table of Affinities**, in which the fundamental truths of Art are artificially recapitulated, which in the course of the lessons are shown by the results of the **Experiments.** It will not; however, hide the defects and imperfections that are still there. Rather it will show (if possible) the means of making it more and more perfect and complete. (STATUTES OF THE UNIVERSITY OF COIMBRA, 1772, p. 392-393, emphasis added).

It is worth resuming elements already described about the concept of affinities, treated in the guidelines of the Statute of the Faculty of Philosophy of Coimbra. Its main definition refers to an interaction between bodies, the formation of new compounds and the decomposition of others.

From the guideline number XII, the practical part regarding the contents of Chemistry begins. According to this, practical elements are complementary in the development of theoretical classes and constitute factors of the teaching of the discipline that facilitate the understanding of theoretical lessons. The segmentation between theory and practice is evident.

> XII - As the **Theoretical Lessons** in this Science cannot be well understood, without the **practice** of them; the **Professor** must show his **Disciples** all the **Chemical Processes**, which are known in the Art: Dealing with Analyze, and the operations on the different products of the three Kingdoms of Nature. Not limited to the choice of Processes related to the use of some particular art: And extending the view over all those that depend on the general Chemistry, and Philosofical. (STATUTES OF THE UNIVERSITY OF COIMBRA, 1772, p. 393, emphasis added).

It is possible to compare this dissociation between the theoretical and practical part with an educational perspective, the classic one. In this situation, the teacher's mastery and an excessive emphasis on the topics to be taught within the classroom define the student as a passive element in the teaching process. We agree with Gil (2011, p.24) that, with this, teachers see themselves, at the end of this first doctrinal part, as characters who control the exposure of the facts taught. We also converge, in this analysis, with the statement of Chervel (1990, p.202) regarding the constituents of a school discipline: “Of the various components of a school discipline, the first in chronological order, if not in order of importance, is the exposure by the teacher or the manual of a knowledge content”.

And as stated in those guidelines, the first part of the teaching of Chemistry at the Faculty of Philosophy of Coimbra was directed exclusively at a theoretical constituent, mainly with regard to the role of students. Thus, the assignment of teaching work was the use of classes of an expository character, composed based on objectives that aimed at the transmission of knowledge.

However, it would also be a scope for the teacher to teach his students as many practical chemical processes as possible, which involved not only specific content, but encompassing everything that is available to man as an object of study. In this sense, the three kingdoms of nature should be explored to carry out this methodological and transmitting task.

Guideline number XIII does not differ much from twelfth. The objective was to raise students' appreciation for this science, aside from the contribution of its development through

concrete facts and conclusions that are based on practical Chemistry. The teacher's objective was to encourage and support students in the participation in practical classes and, as their content, to explore everything that had been studied so far. We emphasize the presence of the laboratory - the place of experiments - as a nuclear training environment for the discipline to be developed.

> XIII - For that, he will give the Lessons of competent of **Practical in the Laboratory**; in which he will not make his **disciples** mere spectators; but it will oblige them to work in the same **Experiences,** to form themselves in the taste of observing Nature; and to contribute for themselves to the advance, and progress of this Science. Which is not enriched with empty systems, and idle speculations, but with real discoveries, which are not found in any other way, but observing, experimenting, and working. (STATUTES OF THE UNIVERSITY OF COIMBRA, 1772, p. 393, emphasis added).

In this sense, we underlined the analytical perspective according to which it would now be up to the students to get involved with the experimental perspective, assuming an active posture in the process:

> The emphasis on experimentation goes beyond the demonstration of chathedra ir, which offered many opportunities for sparkles, inherited from the medieval University and even then, much to taste. There is a very explicit recommendation that students are not spectators, but manipulators, so that they become fond of experimenting and do not remain in idle speculation. (CHASSOT, 1994, p. 85).

Guideline XIV ends the analysis. In this, the role of the teacher during classes is once again characterized. The teacher would have the obligation to be an example of work and dedication for the students. More than that, his teachings should be consistent with the evolution that permeated science. Termination with scholastic teachings and precepts was requested, with the main target being the search for progress in the treatment and study of scientific knowledge.

> XIV - The **Lens** will therefore be **obliged** to give to its disciples an **example** of the work, and constancy, which are required in the Observatory of Nature: Disabling them of senseless ideas of the Schools, which put their glory in making chimerical worlds in his endlessly imaginations: and in ignoring the name, and wealth of the present World, which God had created for use, and contemplation of Man. And lacking this essential part of your obligation, (which I do not expect) you will be subject to what I have disposed of regarding Doctors in the First Part of this Book, Title Third, Chapter First, Paragraphs Thirty-one, and Thirty-two. Provision, which will also be understood in relation to other Lenses, if they are lacking in the same way, in what concerns the practice in their respective Lessons. (STATUTES OF THE UNIVERSITY OF COIMBRA, 1772, p. 393-94, emphasis added)

After analyzing the fourteen guidelines organized for the development of pedagogical activities in the new Faculty of Philosophy of Coimbra, in which the discipline of Chemistry was inserted, we verified a pattern in writing, with well-written and detailed rules regarding

teaching. As it is a guiding document for the development of the work of chemical contents, it was expressly addressed to the teachers who would conduct the classes.

Objective, content and methodological issues were addressed, which were in line with the Reform that the University was going through. Even in the face of the fact that, in some passages, there was no update regarding advances in chemical studies, as we saw in the reference to the Theory of Phlogiston. On the other hand, there is the presentation of concepts used and discussed later by Lavoisier[3], which indicates an evident realization of the objectives proposed by the Reform of the University of Coimbra, with the escape of teaching with a humanistic character and the elaboration of the offer of a discipline based on emerging theories and scientific concepts, later reaffirmed.

Final considerations

We return to the theoretical and methodological references used for our analyses and interpretations, in order to reinvigorate the conceptual burden inserted in the textuality of the used source. We had adopted the methodological procedure of Content Analysis, proposed by Bardin (2004). The stages of the process, either in their quantitative and qualitative aspects, helped to find words related to aspects of the history of the discipline of Chemistry and that were suitable for categorization. In the theoretical repertoire of Chervel (1990), we find the aspects related to school discipline that challenge researchers, since it is a historically elaborated and moving concept.

Based on the analysis of the Statute of the Faculty of Philosophy of Coimbra, it was possible to answer some of the questions raised by Chervel, applying them to our questions regarding the genesis of the school discipline of Chemistry. As for the purposes associated with the configuration of the discipline embedded in the scope of the Reformation, in addition to serving economic interests, its creation and insertion at the University of Coimbra brought the effects of the change. Through Content Analysis it was possible to verify the importance given to the discipline of Chemistry, since the Faculty of Philosophy presented disciplines that approximated scientific studies, ignored by the Jesuits. The change in the pedagogical and educational character is compatible with the new Portuguese political and social anxieties based on Enlightenment ideas. Notably, it illustrates the transition from humanistic to scientific teaching. In other words, the discipline was created with the objective and function of leveraging scientific studies, something that would benefit human development. Based on the Statute, Chemistry would serve as one of the flagships for this change.

In the Statute of the Faculty of Philosophy of Coimbra, we have identified fourteen guidelines for teaching Chemistry, addressed to the teacher. From the applied Content Analysis, three categories emerged: objectives, content and methodology.

In reference to the objectives category, it includes the terms that refer to guidelines given to the teacher on the selection of content and teaching strategies and the most frequent keywords that constitute it are studying, examining, separating, presenting and explaining.

Incorporating terms that refer to the contents and fields of study explored, the content category is outlined by the terms bodies, substance, composition, History of Science, affinity, property, combination, mixtures and comparison. This category also allowed the registration of terms that involved the design of specific contents directly related to the discipline, such as salts, acids, water, bases, metals and oils.

[3] Lavoisier (1743-1794): known for careful observations and the methodical planning of his experiments. Considered one of the founders of Modern Chemistry.

The third category, methodology, is a factor determined by the objective-content relationship that exposes mechanisms for achieving the objectives. In this case, the constitutive terminology presents the terms lens / teacher, theory and experience / practice / laboratory.

Considering the categorical ensemble, it was possible to draw some conclusions based on the content of the guidelines, which establish relationships on the importance of studies of the discipline of Chemistry in that historical context, allowing to verify both the existence of seminal contents and others that would be validated in the future. For instance, the use of the term body, as a synonym for substance, serves as an initial point for the study of this new science. In the historical development, this content served as a basis for the development of other chemical contents, starting from its composition and possible combinations, coming to present the following classification: liquid, solid, soft and hard.

Regarding the functioning of Chemistry as a discipline, we observe that the guidelines are detailed, dealing with the work of the teacher and the contents to be addressed, as well as a proposal for a teaching methodology. In this case, the theoretical and practical classes are reported, distinguishing them, but not delving into how they would be developed according to this bipartite nature.

Nonetheless, when questioning about the procedures used, we found references to the synthetic demonstrative method, in which the teacher was responsible for compressing the content, so that it could be approached in a systematic way. In this case, it would be initiated from the simple to the complex.

Finally, we reaffirm that the analytical procedure used provide support to establish some of the factors present in the early days of the school discipline of Chemistry. It should also be noted that, in the continuity of our studies, we followed the subsequent circulation process of the discipline of Chemistry, with its appearance in Brazil.

In this case, considering factors such as the irradiation of the influence of the statutory dictates for the teaching of the discipline present in the Statute of the Faculty of Philosophy of Coimbra, the return to Brazilian territory of Brazilians who went to study Chemistry at the institution in Coimbra and the writing of books and compendiums of the discipline that were used in secondary and higher education institutions.

From this moment on, Chemistry continues its path as a school discipline, collaborating, as confirmed by Chervel (1990, p.220), as one of the driving elements of schooling, preparing the acculturation of students in accordance with certain purposes, which comes explain its genesis and leads to the constitution of its corporate name. Absolutely in tune with the emerging modernity, Chemistry will not only be strengthened as a reference science, but it will find its place in the school to, in a concomitant and dynamic movement, cross the school walls and, once again, penetrate society.

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