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Knowledge and Society: The Role of Two Universities in Southern Europe in the Early Nineteenth Century – the Case of Coimbra and Salamanca

Abstract: Based on the methodological approaches in the history of knowledge, this article carries out a comparative analysis of the creation of university curricula while taking into account the objectives of the central government favouring a certain type of practical knowledge, for reasons of public health and economic development. In this sense, the Portuguese and Spanish reformers chose to value the various disciplines that encapsulate natural philosophy. This decision, which sought to meet the interests of the objectives of the central governments, ended up causing a complete change in the hierarchy of knowledge at Salamanca and Coimbra. Starting in the early 1770s, we begin to see the introduction of disciplines such as natural history, experimental physics, and chemistry. In turn, these disciplines were accompanied by an obligation to attend practical classes in the various laboratories created as a result of this process.

Keywords: knowledge, curriculum, university, Coimbra, Salamanca

Introduction

In the wake of the Enlightenment, the third wave of university reforms in Europe (c. 1750–1780) left its mark on curricula[1] and led to the emergence and valorisation of new forms of knowledge.[2] This paper follows the periodisation of these three

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1 Laurence Brockliss, "Os Curricula", in *Uma História da Universidade na Europa As Universidades na Europa Moderna (1500–1800)*, vol. 2 (Conselho de Reitores das Universidades Portuguesas; Fundação Eng. António de Almeida: Imprensa Nacional-Casa da Moeda, 2001), 541–594.
2 Willem Frijhoff, "Modelos", in *Uma História da Universidade na Europa. As Universidades na Europa Moderna (1500–1800)*, vol. 2 (Lisbon: Imprensa Nacional-Casa da Moeda, 2002), 70; Robert D. Anderson, *European Universities from the Enlightenment to 1914* (Oxford: Oxford University Press, 2004), 23–24.

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waves, acknowledging that further analysis may be necessary. Whereas the first wave took place in the period 1612–1625, the other two occurred in the eighteenth century,[3] during the reforms in Piedmont and Catalonia (1714–1729), and the period 1759–1780, following the expulsion of the Jesuits. The last wave differed from the others in terms of scope, reaching countries such as Portugal,[4] Spain,[5] Italy, and France.

Among the different areas of knowledge that changed during the third wave, the teaching of philosophy (in all its branches) varied significantly. The philosophy and arts faculties (where philosophy courses were often taught) had to significantly update their teaching.

However, this paper only concerns natural philosophy, one of the branches of philosophy associated with the study of nature and its resources, which was taught at universities for a considerable amount of time[6] and encompassed several additional forms of knowledge. After the third wave of university reforms, the evolution of natural philosophy was more rapid and diverse, giving rise to several other disciplines and coming to play a central role at many universities, as in the case of Coimbra and Salamanca.

Nevertheless, the pace of the reform regarding the philosophy curriculum looked different at Coimbra compared to Salamanca.[7] At the Portuguese university, the teaching of philosophy, and the faculty itself, gained autonomy as early as 1772, whereas this process took longer at Salamanca. This was due to the fact that only the arts course (where philosophy was taught together with mathematics) was reformed in 1771, while no new philosophy course was created. At the Spanish university, moreover, philosophy was for a long time considered purely propaedeutic teaching, which provided the basis for training professions such as physicians.

3 For the state of European universities in the old regime, see François Cadilhon, Jean Mondot, and Jacques Verger, *Universités et Institutions Universitaires Européenes au XVIIIe Siècle. Entre Modernisation et Tradition* (Bordeaux: Presses Universitaires de Bordeaux, 1999); Jaqcques Verger, "Les universités à l'époque moderne", *Histoire mondiale de l'éducation* II (1981).

4 Ana Cristina Araújo, ed., *O Marquês de Pombal e a Universidade*, 2a ed. (Coimbra: Imprensa da Universidade de Coimbra, 2014).

5 George M. Addy, *The Enlightenment in the University of Salamanca* (California: Duke University Press, 1966).

6 The discipline of natural philosophy already existed. At the University of Salamanca, for example, it had been taught since the fifteenth century. See Cirilo Flórez Miguel, "Ciencias, Siglos XV-XVII", in *Historia de la Universidad de Salamanca*, vol. III. 1: *Saberes y confluencias* (Salamanca: Ediciones Universidad de Salamanca, 2006), 409–432.

7 Carlos Fernando Teixeira Alves, "A Ordem Natural nas reformas universitárias de Salamanca e Coimbra (1769–1820)" (PhD diss., Universidade de Lisboa, 2021), 153–159.

These two reasons would define the difference in pace regarding the reform of the philosophy course at Coimbra and Salamanca, respectively.

Albeit to varying extents, the valorisation of the disciplines making up natural philosophy eventually resulted in a new hierarchy of knowledge in the university curriculum.[8] At Coimbra and Salamanca, this process was long and troubled, and it was the result of the governments preferring certain types of knowledge over others.[9] However, this decision was an attempt to further modern science and improve the lives of the respective populations through various scientific advances. Hence, these reforms redefined the university as an institution, placing it at the service of the state and conceptualising knowledge as politically, culturally, socially, and economically relevant.

In analysing this appreciation of natural philosophy, this paper argues that it was part of a strategy adopted by Portuguese and Spanish reformers aiming to improve the national productive sector and to favour the economy, commerce, and industry. At the same time, this valorisation of natural philosophy also reflects a new belief in the mission of the university, as represented by two of the main figures involved in these educational reforms. The marquis of Pombal, the Portuguese reformer, was a diplomat and later secretary of state (1756–1777) and might be considered King José I's right-hand man. He is known today not only for his reforms in education, but also for his work on the state apparatus and the economic and religious sectors.[10] His counterpart in Spain was Pedro Rodríguez de Campomanes y Pérez,[11] the first count of Campomanes and minister of the treasury (1760–1762), who enjoyed the support of the Spanish King Carlos III, another promoter of these reforms. He played a key role in the expulsion of the Jesuits, was appointed inspector in charge of reforming the University of Salamanca, and drew up and

8 Notker Hammerstein, "As relações com as autoridades", in *Uma História da Universidade na Europa. As Universidades na Europa Moderna (1500–1800)*, vol. 2 (Lisboa: Imprensa Nacional-Casa da Moeda, 2002), 105–46; Notker Hammerstein, "O Iluminiso", in *Uma História da Universidade na Europa: As Universidades na Europa Moderna (1500–1800)*, vol. 2 (Lisboa: Imprensa Nacional-Casa da Moeda, 2002), 595–614; Robert Anderson, "Before and after Humboldt: European Universities between the Eighteenth and the Nineteenth Centuries", in *History of Higher Education Annual*, vol. twenty (Pennsylvania: PennState, 2000), 5–14; Frijhoff, "Modelos".

9 On the relationship between universities and governments and local authorities, see Hammerstein, As relações com as autoridades".

10 On Sebastião José de Carvalho e Melo or the Marquis of Pombal (from 1769), see Kenneth Maxwell, *Pombal, Paradox of the Enlightenment* (Cambridge: Cambridge University Press, 1995).

11 Antonio Álvarez de Morales, "La crisis del reformismo en Campomanes", *Revista de Historia Moderna. Anales de la Universidad de Alicante* (1990), 185–195.

oversaw the implementation of the new syllabus in collaboration with the Council of Castile.[12]

The teaching administered at the universities complied with predefined parameters set by the supervisory bodies, namely the Council of Castile for Salamanca and the Ministry of the Kingdom in the case of Coimbra. From the eighteenth century and onwards, efforts were made in both countries to coordinate the various levels of education, although this took a long time to establish. It would thus be premature to talk about the existence of a structured education system at the beginning of the nineteenth century, as this only began to take shape decades later.

For these reformers, the new mission consisted of training specialists in new areas of knowledge, which would allow for mapping, studying, and efficiently exploiting natural resources, especially in colonial territories.

This analysis begins by evaluating the statutes and study plans as sources for identifying changes in the understanding of new forms of knowledge. At the same time, they must also be read as the result of a clash of ideas, motivated by strategies to achieve concrete aims. Second, it focuses on the new perception of philosophy courses created during this wave of reforms at many universities. The creation of philosophy courses followed a logic of specialisation and modernisation designed to respond to the aims outlined by the interests of governments. Finally, a detailed and specific analysis of the different disciplines comprising natural philosophy from the eighteenth century and onwards illustrates how these reforms played out in practice. Subjects such as natural history, chemistry, and experimental physics were introduced at Coimbra and Salamanca during this period, and the contents of these disciplines reveal the motivations of the Portuguese and Spanish reformers and show how the creation of knowledge was governed by particular political and social circumstances.[13]

At the beginning of the nineteenth century, the aims of the reformers had not changed, and the curricular changes we see only represent essential updates following the rapid evolution of subjects such as botany or chemistry. In this sense, the period from 1800 to 1820 preserves the firm notion that knowledge seeks to transcend the university environment and have a concrete impact by re-

12 Later, other figures stood out, such as Gaspar Melchor de Jovellanos, José Moñino y Redondo, the Count of Floridablanca, Pedro Pablo Abarca de Bolea, the Count of Aranda and Manuel Godoy y Álvarez de Faria.

13 Simone Lässig, "The History of Knowledge and the Expansion of the Historical Research Agenda", *Bulletin of the German Historical Institute* 59 (2016): 29–58.

sponding to social problems,[14] thus leading to the chronological framework for this study. Although the focus is on the first two decades of the nineteenth century, our analysis starts in the 1770s with the beginning of the university reforms at Coimbra and Salamanca. Curricular changes that were initially introduced during this period continued throughout the following decades and would be significantly updated at the beginning of the nineteenth century.

The two case studies, involving the University of Coimbra and the University of Salamanca, are closely related and there are many similarities in their reforms.[15] This study aims to identify and explain the similarities and differences between the two cases being compared[16] while also examining the causes, the level of analysis, and the issue of interconnections, both in an Iberian and a European context. Despite national differences, which resulted in certain specificities, both reforms took place during the Enlightenment and share some of its ideas. Moreover, the reforms began in the 1760s with an exchange of ideas between Portuguese and Spanish reformers.[17] The choice of only two case studies also allows for a more in-depth comparative analysis, working with several primary sources (from both countries).[18] At the same time, the Catholic background influenced the introduction

14 Johan Östling et al., "The history of knowledge and the circulation of knowledge: An introduction", in *Circulation of Knowledge Explorations in the History of Knowledge* (Lund: Nordic Academic Press, 2018), 7–24.

15 On issues related to the comparative method, widely utilised in this work, see the volume edited by Deborah Cohen and Maura O'Connor, *Comparison and History: Europe in Cross-National Perspective* (New York: Routledge, 2004).

16 Deborah Cohen and Maura O'Connor, "Introduction: Comparative History, Cross-National History, Transnational History – Definitions", in *Comparison and History: Europe in Cross-National Perspective* (New York: Routledge, 2004), ix–xxiv; Charles Tilly, *Big Structures, Large Processes, Huge Comparisons*, 75th anniversary series (New York: Russell Sage Foundation, 1984).

17 Carlos Fernando Teixeira Alves, "A Ordem Natural".

18 The main primary sources used here are: *Estatutos da Universidade de Coimbra (1772)*, vol. *Livro I: Do curso theologico* (Coimbra: Por Ordem da Universidade, 1972); *Estatutos da Universidade de Coimbra (1772)*, vol. *Livro II: Cursos juridicos das Faculdades de canones e de leis* (Coimbra: Por Ordem da Universidade, 1972); *Estatutos da Universidade de Coimbra (1772)*, vol. *Livro III: Cursos das sciencias naturaes e filosoficas* (Coimbra: Por Ordem da Universidade, 1972); *Plan general de estudios dirigido a la Universidad de Salamanca por el Real y Supremo Consejo de Castilla y mandado imprimir de su orden.* (Salamanca: Antonio Villagordo y Alcaraz, y Thomás de García de Honorato, 1771). In the case of Salamanca, I also focus on Juan Antonio Caballero's Plan of Studies from 1807 (transcribed in full by Addy and used here) and the 1820 plan, Addy, *The Enlightenment*; *Informe de la Universidad de Salamanca. Sobre Plan de Estudios, ó sobre su fundacion, altura y decadencia, y sobre las mejoras de que es susceptible: con cuyo motivo presenta un proyecto de Ley sobre la Instruccion Publica* (Salamanca: En la Imprenta de Don Vicente Blanco, 1820). For this work, several primary sources were consulted at the General Historical Library of the University

of many of the innovative ideas in both locations, while the use of censorship reoccurred at both universities. Both Portugal and Spain found themselves in what they perceived to be a state of significant economic, cultural, and scientific stagnation, which led them to become increasingly committed to more practical education.

1 Statutes and Study Plans

The idea defended by the Iberian reformers (the valorisation of natural philosophy and its component disciplines as a growth-enhancing strategy) is properly understood through a detailed analysis of the various statutes and syllabuses from the universities of Coimbra and Salamanca from 1771 to 1820 (see note 19). These sources were crucial not only for the universities, but also for the Portuguese and Spanish governments. Throughout this period, the statutes and study plans (also understood as a regulatory component) reflect these governments increasingly intervening in educational affairs.[19] In the various facets of their statutes and study plans, the universities saw a broad set of rules and provisions that had to be scrupulously respected. In practice, however, this was not always the case.[20] Many of the statutory revisions known today may have simply served as a response to changes already underway, and even when they were intended to stimulate innovation, they may have become obsolete before further statutory revision. Thus, while there are limitations with regard to this type of primary source, their research value should be highlighted when it comes to exploring the intentions and aims of the Portuguese and Spanish governments, especially by cross-referencing the data being analysed with other sources, such as legislation, minutes, correspondence, or reports. To a certain extent, the sources analysed here show us the university as a central agent in the history of knowledge.[21]

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of Salamanca (BGHUS), the Coimbra University Archive (AUC), the University of Salamanca Archive (AUSA), and the National Archive of the Torre do Tombo (Lisbon, Portugal (ANTT)).

19 Juan Luis Polo Rodriguez and Jacinto de Veja Domínguez, "Fuentes para el estúdio de las Universidades Hispánicas de Antiguo Régimen", in *Historia de la Universidad de Salamanca*, vol. IV: *Vestigios y Entramados* (Salamanca: Ediciones Universidad de Salamanca, 2009), 131.

20 Laurence Brockliss, "Os Curricula", in *Uma História da Universidade na Europa. As Universidades na Europa Moderna (1500–1800)*, vol. II (Lisbon: Imprensa Nacional-Casa da Moeda, 2002), 543–594.

21 Östling et al., "History of Knowledge", 10; Lorraine Daston, "The History of Science and the History of Knowledge", *KNOW: A Journal on the Formation of Knowledge* 1, no. 1 (2017): 143.

Moreover, the way in which knowledge is understood is influenced by several factors.[22] The key factor in the cases under study concerned how governments understood economic and scientific backwardness, assuming that the main goal of scientific knowledge was to provide concrete improvements for society. As argued by Anderson, the university reforms in Spain aimed for total modernisation, considering "educational reform as part of a wider effort to regenerate Spain, to promote economic development, and to catch up with Europe."[23] The lengthy university reforms at Coimbra and Salamanca that began in the eighteenth century and continued into the next one were not understood as a goal in themselves but as part of a broader project aimed at transforming/modernising the Portuguese and Spanish societies. In both Spain and Portugal, educational reforms were accompanied by administrative, economic, and political reforms. In the case of universities, governments viewed these institutions, together with their agents (professors), as part of the preparation to respond to the needs of the Portuguese and Spanish societies in the transition from the eighteenth to the nineteenth century.

With regard to the various forms of knowledge[24] addressed in this study on the basis of study plans, it is important to share Philippe Sarasin's definition of *rational knowledge.*[25] Although this type of knowledge is not confined to educational institutions, it is strongly linked to universities, academies, or other types of educational institutions. This rational knowledge is derived from the educational functions of universities identified by Willem Frijhoff,[26] who defines five essential functions of the university: 1) setting up teaching, 2) providing a form of education, 3) promoting professional training and the study of scientific knowledge, 4) the formation of an elite, and 5) the provision of (a) certain type(s) of discipline. The academic disciplines may also be identified within the context of educational institutions as the result of a rational creation of knowledge taught in a structured way[27] and linked to formal education.[28]

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22 Lässig, "History of Knowledge", 33.

23 Anderson, *European Universities*, 31–32.

24 Peter Burke, *A Social History of Knowledge*, vol. I: *From Gutenberg to Diderot* (Cambridge: Polity, 2000).

25 Philippe Sarasin, "Was ist Wissensgeschichte?", *Internationales Archiv für Sozialgeschichte der deutschen Literatur* 36, no. 1 (2011): 159–165.

26 Frijhoff, "Modelos".

27 Pierre Bourdieu, *Homo Academicus* (Stanford: Stanford University Press, 1990).

28 Ludwig Fleck, *Entstehung und Entwicklung einer wissenschaftlichen Tatsache: Einführung in die Lehre vom Denkstil und Denkkollektiv* (Basel: Schwabe, 1935); Robert K. Merton, "Science, Technology and Society in Seventeenth Century England", *Osiris* 4 (1938); Edmund Husserl, *Die Krisis der europäischen Wissenschaft und die transzendentale Phänomenologie* (The Hague: M. Nijhoff, 1954);

Through an analysis of these disciplines, in line with the work of Foucault,[29] it is possible to see the relationship between power (in this case, the Portuguese and Spanish governments through their ministers, inspectors, and other representatives) and knowledge (in natural philosophy, conceived of in its broadest sense). Greater bureaucratic demands, combined with the need to reform the business, commercial, and financial fabric of these countries, converged in the creation of the study plans, which were designed – in collaboration with professors from these institutions – to achieve improvements and advances in the respective societies. Thus, the education offered at these universities may serve as an illustration of variations in the understanding of knowledge in different social circumstances.

For instance, the evidence provided by Francisco de Lemos, rector of the University of Coimbra between 1770–1779 and 1799–1821, in his analysis of the importance of the natural sciences, including natural philosophy and many of its associated disciplines, sheds light on the true nature of this reform while also reflecting a general trend present in all university reforms carried out in this period. Amorim da Costa, a Portuguese expert in the history of science, summarises the rector's thinking as follows:[30]

> the establishment of the natural sciences at the university would enable a better knowledge of the natural riches existing in the country, bringing new material resources for industry, with the subsequent development of trade … The teaching of natural sciences reflects the development of new arts, new manufactures, new factories, and the improvement of existing ones

Iberian reformers, who shared similar ideas due to regular contacts,[31] favoured the introduction of more practical knowledge to promote the rational exploitation of natural resources. In this sense, the (more modern and updated) philosophy

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Alexandre Koyré, *From the Closed World to the Infinite Universe* (Baltimore: Johns Hopkins, 1957); S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962); Michel Foucault, *The Archeology of Knowledge* (New York, 1972); Jan Golinski, *Making Natural Knowledge: Constructivism and the History of Science* (Chicago: University of Chicago Press, 2005); Kostas Gavroglou and Jürgen Renn, eds., *Positioning the History of Science* (Dordrecht: Springer, 2007); Lorraine Daston, "Science, History of", in *International Encyclopedia of the Social and Behavorial Sciences* (Oxford: Elsevier, 2015), 241–247; Daston, "History of Science".

29 *Foucault, Archeology of Knowledge.*

30 A. M. Amorim da Costa, "As Ciências Naturais na Reforma Pombalina da Universidade – 'Estudo de Rapazes, não ostentaçã de Príncipes'", in *O Marquês de Pombal e a Universidade* (Coimbra: Imprensa da Universidade de Coimbra, 2014), 188, 207–208. Translated from the original by the author.

31 Archivo Historico Nacional de Madrid (AHN), Conde de Campomanes, Caixa 34/Documento 5.

courses were designed with the aim of preparing specialists able to exploit such resources.

Turning to the decision-making process involved in designing curricula, in line with the questions raised by Simone Lässig,[32] we see that, except for isolated instances, decisions were often the result of collaborations between different actors. A large portion of this dialogue and decision-making took place outside the official bodies. For example, Pedro Luis Blanco, the rector at Salamanca, often addressed government representatives in a personal capacity, as did several of the professors. Moreover, the faculty congregations would defend their own interests, communicating directly with the governmental supervisory bodies. The Council of Castile not only went directly to the University of Salamanca congregations when it wanted to propose a change, but also consulted them on a regular basis on issues related to the university.[33]

Hence, during the second half of the eighteenth century and the first decades of the nineteenth century, many decisions were made jointly, with different factions often sharing similar goals. Sources suggest that the final decisions were mainly made by the governments and the Ministry of the Kingdom – which was also the supervisory body for the University of Coimbra – or the Council of Castile, in the case of the Spanish university. However, the administrative and educational boards also influenced many of these decisions, interacting directly with their supervisory bodies.[34]

One notable difference concerns the degree of government intervention. The rescinding of professorships at the University of Coimbra may here serve as a useful example. In order to remove teaching staff who were less supportive of the reforms, 13 professors were forced to retire in 1772, while 33 new professors whose ideas were closer to those of the reformers were appointed, together with 20 additional replacements.[35]

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32 Lässig, "History of Knowledge", 40.

33 Alves, "A Ordem Natural", 18–22.

34 See, for example, the draft of the 1766 medical plan, Archivo de la Universidad de Salamanca (AUSA), Informes y correspondencia de assuntos universitarios. Lecciones inaugurales, XVII-XIX, AUSA 2031.

35 Teófilo Braga, *Historia da Universidade de Coimbra. Nas suas relações com a Instrucção Publica Portugueza*, vol. III: *1700 a 1800* (Lisbon: Por ordem e na Typographia da Academia Real das Sciencias, 1898), 420–425.

2 The Philosophy Course: A Comparative Approach

The university reforms at Coimbra and Salamanca began in the eighteenth century and extended throughout the following century, accompanied by profound changes in the curriculum. The University of Coimbra had a total of six faculties from as early as 1772 – when the faculties of philosophy and mathematics were added – whereas no new faculties were created in Salamanca until the 1790s, when the new faculty of philosophy was founded. This only occurred after a thorough reform of the curriculum for the arts, as well as theology and canonical and civil law.

Natural philosophy, one of the disciplines retaining a close connection with the study of nature and natural products,[36] remained on university curricula in Europe until well into the nineteenth century. Its great advantage was its constant adaptability, which enabled it to cover a considerable number of subjects within its confines.[37] As William A. Wallace observes, natural philosophy seems to serve as the origin of the modern scientific disciplines.[38]

The revised curricula for the Iberian universities clearly reflect the attempt to promote a new hierarchy of knowledge, prioritising more practical subjects, just as in other European universities. As seen in Table 1, Coimbra and Salamanca offered a wide range of disciplines related to natural philosophy.

Table 1: Philosophy courses at Salamanca and Coimbra between 1800 and 1820.

Coimbra – 1772 statutes[39]	**Salamanca – 1807 study plan**	**Salamanca – 1820 statutes**
Rational and Moral Philosophy – ceased in 1801 to be replaced by Botany and Agriculture (since 1801)	Elements of Arithmetic, Algebra and Geometry	Second Course in Pure Mathematics
Natural History and Geometry (in Mathematics, as preparation for the following year)	Logica and Metaphysics	Natural History and Chemistry

36 Janet Browne, "Natural History", in *The Oxford Companion to the History of Modern Science* (Oxford: Oxford University Press, 2003), 559–561.

37 William A. Wallace, "Traditional natural philosophy", in *The Cambridge History of Renaissance Philosophy* (Cambridge: Cambridge University Press, 2008), 201–235.

38 Wallace, "Traditional natural philosophy", 213.

39 The philosophy course introduced in 1772 at Coimbra was maintained, with occasional changes, until 1820.

Table 1: Philosophy courses at Salamanca and Coimbra between 1800 and 1820. *(Continued)*

Coimbra – 1772 statutes[40]	**Salamanca – 1807 study plan**	**Salamanca – 1820 statutes**
Experimental Physics	Application of Algebra to Geometry	Rational Mechanics
Chemistry	Physics and Chemistry	Astronomy
——-——-——-——-——-	Moral Philosophy	Optics and Acoustics
——-——-——-——-——-	Astronomy and Natural History	Agriculture (bachelor's degree)
——-——-——-——-——-	——-——-——-——-——-	General History and Literary History
——-——-——-——-——-	——-——-——-——-——-	Medical Physiology and Spanish Constitution

The way in which the two governments understood natural philosophy was similar at Coimbra and Salamanca, and the two governments had similar goals, even though these materialised differently in the philosophy curricula.

At Coimbra, natural philosophy received more attention throughout the period being studied. According to the statutes, it was to include all disciplines aiming to study nature.[41] Described as a course in physics (*Curso da Fysica*), it was structured as a four-year course,[42] in which the first year, via natural history, would focus on the three *kingdoms of nature*[43] by means of demonstrations and experiments.[44]

The need for more concrete and detailed knowledge of nature and its products required a structured approach, progressing from hypothesis to experiment. The latter, known as the experimental part, involved two goals. The first, related to ex-

40 *Estatutos da Universidade de Coimbra (1772)*, 1972, *Livro III: Cursos das sciencias naturaes e filosoficas*, 229–230.

41 In the remaining years of the course, the students studied subjects related to moral and rational philosophy.

42 In the statutes consulted, the term *kingdoms of nature* refers to its three constituent elements, namely the animal, vegetable, and mineral components. It is often accompanied by expressions such as the *animal kingdom* (animals), the *plant kingdom* (plants), and the *mineral kingdom* (minerals).

43 *Estatutos da Universidade de Coimbra (1772)*, 1972, *Livro III: Cursos das sciencias naturaes e filosoficas*, 229–230.

perimental physics, consisted of identifying (and observing) the universal characteristics of bodies, while the second (chemistry), sought to identify their characteristics.[45] This more practical part, in which knowledge was acquired from close interactions with the material world, also led to the greater use of scientific equipment and infrastructures. At Coimbra, for example, new facilities were constructed, including the botanical gardens and a natural history cabinet. The aim was to supply first-hand knowledge of objects and products of various origins as well as to provide students with a place where they could conduct their experiments.[46]

At Salamanca, the division between the various components comprising (natural) philosophy did not emerge until the nineteenth century. In 1780, one professor (Martinez Nieto) still considered natural philosophy eclectic, as it complemented moral philosophy and theology.[47] This change in the understanding of philosophy on the part of the Spanish authorities differed from the process underway in Portugal. However, the initiative came in 1788, when a new philosophy course, more similar to the one already offered at Coimbra, was designed and sent to the Council of Castile.[48] Nevertheless, this proved to be a lengthy process, and it was only in 1820 that a broader change, in the form of the *Estudio de la Natureza* (nature study[49]), took hold based on Enlightenment ideas.

The new statutes prescribed a division focusing on all aspects in the study of nature and its products. Cosmography, natural history, zoology, botany, mineralogy, physics, and chemistry were all considered essential for understanding the natural world. The remaining disciplines, which included rational mechanics, astronomy, optics and acoustics, agriculture, and arts and crafts, ended up belonging to the category of natural sciences and useful arts.

However, this profound curricular change and the greater support provided by the governments for a certain type of knowledge resulted in internal conflicts at the universities themselves. The opposition came from already established knowl-

44 *Estatutos da Universidade de Coimbra (1772)*, 1972, *Livro III: Cursos das sciencias naturaes e filosoficas*, 229–230.

45 *Estatutos da Universidade de Coimbra (1772)*, 1972, *Livro III: Cursos das sciencias naturaes e filosoficas*, 229–230.

46 Roberto Albares Albares, "La Filosofía, Siglos XVIII-XIX", in *Historia de la Universidad de Salamanca*, vol. III. 1: *Saberes y confluencias* (Salamanca: Ediciones Universidad de Salamanca, 2006), 611–612.

47 Albares Albares, "La Filosofía", 605.

[47] *Informe de la Universidad de Salamanca. Sobre Plan de Estudios, ó sobre su fundacion, altura y decadencia, y sobre las mejoras de que es susceptible: con cuyo motivo presenta un proyecto de Ley sobre la Instruccion Publica*, XXIII.

edge, such as theology and canonical law. At the University of Salamanca, there was widespread opposition,[50] as illustrated by the following example.

In 1796, a meeting occurred at the University of Salamanca in which professors of theology, law, and even medicine opposed the curricular changes proposed by the professors of philosophy. This tension was only resolved by the new secretary of state and justice, Gaspar Melchor de Jovellanos, authorising the proposals of the philosophy professors.[51]

Further difficulties arose from the question of how this new philosophy course would relate to the medicine course. In 1801, the Portuguese regent, João of Bragança, expressed his concern to the rector of the University of Coimbra as follows:[52] "the new Philosophical Faculty, comprising the particular object of the Faculties of Medicine and Mathematics, is, however, due to the importance of this great establishment, not merely a subsidiary course for the other Faculties, especially the aforementioned Faculties of Medicine and Mathematics".

A decade later, in 1811, José Bonifácio de Andrade, a professor of philosophy, again expressed a similar concern:[53] "I also know that the School of Philosophy … the most highly esteemed today in Europe for its subject and the great benefits it brings to nations … seems, by an inexplicable fatality, to be a mere subsidiary establishment of Medicine in Portugal". This coexistence was not easy, resulting in occasional interventions by the supervisory bodies. The struggle shows the importance of new knowledge for the Portuguese and Spanish governments, and an analysis of the valorisation of (natural) philosophical knowledge at the universities of Coimbra and Salamanca underscores Lorraine Daston's conclusions: the governments' new understanding of knowledge promoted a new hierarchy of knowledge, which resulted in a conflict of knowledge.[54]

However, after the profound changes introduced in the eighteenth century, the Iberian reformers did not alter their understanding of natural philosophy and the

49 For an enlightening example of this type of problem see Addy, *The Enlightenment*, 193.

50 Archivo de la Universidad de Salamanca (AUSA), Actas de Claustros y Juntas de la Universidad, 1794–1796, Ausa 251, 419r–20, 430v–31, 448–50, 508r–508v; José Luis Peset and Mariano Peset Reig, *Carlos IV y la Universidad de Salamanca* (Madrid: Consejo Superior de Investigaciones Científicas, Instituto "Arnau de Vilanova", 1983), 119; Addy, *The Enlightenment*, 168–202; José Luis Peset, "La Nueva Ciencia, Siglo XVIII", in *Historia de la Universidad de Salamanca*, vol. III. 1: *Saberes y confluencias* (Salamanca: Ediciones Universidad de Salamanca, 2006), 452.

51 Arquivo da Universidade de Coimbra (AUC), Processos de Professores, Cx. 326. Original translated by the author.

52 Arquivo Nacional da Torre do Tombo (ANTT), Ministério do Reino. Instrução. Consultas do Concelho de Decanos da Universidade de Coimbra, 1779–1831, Mç 517. Cx. 643. Original translated by the author.

53 Daston, "History of Science", 145.

disciplines it included. On the contrary, at the dawn of the nineteenth century, these innovations were only reinforced.[55]

In 1801, for instance, the University of Coimbra received a royal letter demanding that the teaching of philosophy, especially its natural component, should be strengthened:[56]

> the investigation of the numerous and useful productions of almost all countries and parts of the world, which easily adapt to the happy climates and lands of Portugal and its colonies … the observation and evaluation of the weak practices in Agriculture, and Arts, and the bad state in which the Factories and Manufactures find themselves … it is convenient to reform and improve, to perfect the productions of Art, which can compete and enter into competition with foreign countries

The clearest consequence was the creation of a new subject – metallurgy – and the closure of the chair of moral philosophy in favour of the creation of a new chair of agriculture, taught together with botany.[57] In the same year, the regent D. João (the future King João VI) once again justified the need for this change to the rector, Francisco de Lemos, "as most of the kingdoms and states of Europe have already done … to promote in every possible way their growth and prosperity, so that they may become as useful and important to my Royal Treasury and the general good of my people through their products and industry".[58]

In the case of Salamanca, several steps were taken, leading to the 1807 plan, which appears to approximate the ideas of the governments while including several disciplines associated with natural philosophy (see Table 1).

One crucial point to remember is that the innovations in the field of natural philosophy, which began in the second half of the eighteenth century and continued until 1820, strengthened the teaching of this subject for decades to come. The incentive for more practical teaching and constantly updating the philosophy curriculum was mainly due to the need to meet the objectives of the Spanish government.

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54 This seems to have been a trend at several universities in Europe. From 1780 and onwards, the strengthening of philosophy faculties was a result of developments in the various disciplines. See Hammerstein, "O Iluminismo", 606.

55 Arquivo da Universidade de Coimbra (AUC), Legislação Académica, 1772–1824, IV-1° E 8, Tab. 3, n° 4, 127v–28. Original translated by the author.

56 *Actas das Congregações da Faculdade de Filosofia (1772–1820)* (Coimbra: Publicações da Comissão promotora das Comemorações do II Centenário da Reforma Pombalina da Universidade, 1978), 268–271.

57 Arquivo Nacional da Torre do Tombo (ANTT), Ministério do Reino. Instrução. Consultas do Concelho de Decanos da Universidade de Coimbra, 1779–1831, Mç 517. Cx. 643. Original translated by the author.

Two of the most important thinkers on educational reform in Spain, namely Benito Jerónimo Feijoo y Montenegro and Pablo de Olavide, already offer evidence of this.[59] Spanish historian Francisco Sanchéz-Blanco concludes that these thinkers introduced the notion of creating a new secularised university stripped of customs and traditions, whose mission was to train "men useful to the state".[60] This was to be achieved by valorising natural philosophy (and its constituent disciplines) as a tool for the rational exploitation of natural resources.

The creation of these new philosophy courses also shows how knowledge transcends spaces, as phrased by Lässig.[61] Although knowledge might not have circulated freely, it was disseminated in various fields and interacted in different contexts.[62]

3 The Core Subjects

The new philosophy courses included a variety of disciplines that could provide solid and correct training in the exploitation of natural resources, and the case of Coimbra is particularly instructive in this respect.[63] The reformers divided the teaching of philosophy into three branches: rational, moral, and natural. The first included subjects such as logic, ontology, and pneumatology. Thus, rational philosophy encompassed fields such as natural theology and psychology and metaphysics. Moral philosophy, in turn, was intended to instruct students in ethics.

However, natural philosophy received the most attention since the various disciplines dedicated to the study of nature and its products were to be found in this third branch of philosophy. It was designed to emphasise elements such as observation and experimentation involving different natural materials from various parts of the respective colonial empires. Among the subjects introduced by the reforms focusing on the study of nature and natural objects, the following appeared at both universities.

58 Francisco Sánchez-Blanco, *El Absolutismo y las Luces en el reinado de Carlos III* (Madrid: Marcial Pons. Historia, 2002), 106–109; Angela del Valle López, *La Universidad Central y su distrito en el primer decenio de la Restauración borbónica (1875–1885)* (Madrid: Ministerio de Educación, 1990), 435.

59 Sánchez-Blanco, *El Absolutismo*, 106–109. Original translated by the author.

60 Lässig, "History of Knowledge", 38–40.

61 Sarasin, "Was ist Wissensgeschichte?".

62 *Estatutos da Universidade de Coimbra (1772).*

Table 2: Transversal subjects to philosophy courses at Coimbra and Salamanca.

Discipline	Year
Natural History	1772 (C) 1807 (S)
Experimental Physics	1771 (S) 1772 (C)
Botany	c.1790 (C) c.1799 (S)
Chemistry	1772 (C) 1807 (S)

Although the discipline of natural history was introduced at different times at Coimbra and Salamanca, the material taught was similar. The subject underwent significant changes, although the advances in the discipline had a common goal: the physical and social improvement of the respective populations.[64] However, the evolution of the subjects included in natural history would also contribute to its fragmentation.[65] According to the Portuguese authorities, where the curriculum included knowledge related to zoology and botany, the aim was to produce exact descriptions of the various natural objects. The language used in the statutes at the University of Coimbra is revealing. In the case of zoology, students were expected to have full knowledge of the "Animals, which belong to Commerce, Agriculture, and other more sensitive and important uses of human life."[66] Introduced later at Salamanca, the same discourse can be found in 1820. Emphasising a stronger connection with medicine, the statutes stipulated that "The teacher of this sub-

63 José Luís Cardoso, "Natural law, natural history and the foundations of political economy", in *The Elgar Companion to Economics and Philosophy* (Cheltenham: Edward Elgar Publishing, 2004), 14; Emma Spary, "The 'Nature' of Enlightenment", in *The Sciences in Enlightened Europe* (Chicago and London: University of Chicago Press, 1999), 179.

64 Arquivo Nacional da Torre do Tombo (ANTT), Ministério do Reino. Instrução. Negócios diversos da Universidade de Coimbra, 1643–1831, Mç. 519, Cx. 645; Arquivo Nacional da Torre do Tombo (ANTT), Ministério do Reino. Instrução. Voto dos Decanos da Universidade de Coimbra Séc. XVIII, Mç. 516, Cx. 642; *Estatutos da Universidade de Coimbra (1772)*, 1972, *Livro III: Cursos das sciencias naturaes e filosoficas*, 27.

65 *Estatutos da Universidade de Coimbra (1772)*, 1972, *Livro III: Cursos das sciencias naturaes e filosoficas*, 239–244. Original translated by the author.

ject will make known the natural substances that are used in medicine … He will explain particularly botany".[67]

But how was the interest in natural history justified? Two events may provide the answer to this question. The first involved both universities adopting the works of Swedish scientist Carl Linnaeus, which were studied in various disciplines, even though the knowledge that the reformers wanted to extract was very selective. While the taxonomic division proposed by Linnaeus was to be presented to the students, teachers were not allowed to spend too much time on this. Instead, they were expected to spend most of their time teaching students to identify the plants considered useful and the best ways of exploiting their properties.[68]

The second was the appointment of Domingos Vandelli, an Italian naturalist, in 1772. The Italian naturalists found the chair of natural history important due to its ability to provide a "rigorous and systematic inventory of mineral, vegetable and animal resources and raw materials, with a view to their exploitation or economic use."[69] Accordingly, the statutes of the University of Coimbra for the first time promoted the work of naturalists to a discipline worthy of higher education.[70] Vandelli and his natural history syllabus thus highlight the valorisation of disciplines linked to physiocracy[71] and a vision of natural history favouring knowledge that was of practical use to commerce and finance.[72]

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66 *Informe de la Universidad de Salamanca. Sobre Plan de Estudios, ó sobre su fundacion, altura y decadencia, y sobre las mejoras de que es susceptible: con cuyo motivo presenta un proyecto de Ley sobre la Instruccion Publica*, 53. Original translated by the author.

67 *Estatutos da Universidade de Coimbra (1772)*, 1972, *Livro III: Cursos das sciencias naturaes e filosoficas*, 242. Original translated by the author.

68 José Luís Cardoso, "Domingos Vandelli, a história natural e a economia política", *Memórias da Academia das Ciências de Lisboa, Classe de Letras*, n. Tomo XXXV (2003 de 2002): 101.

69 Ana Cristina Araújo, "O governo da natureza no pensamento da geração universitária de finais do século XVIII: os Estatutos Literários e Económicos da Sociedade dos Mancebos Patriotas de Coimbra", in *A Univeridade Pombalina. Ciência, Território e Coleções Científicas* (Coimbra: Imprensa da Universidade de Coimbra, 2017), 90.

70 Eduardo Escartín e Francisco Velasco Morente, "Quesnay y los conceptos generales de la Fisiocracia", in *Ilustración, ilustraciones*, vol. 3 (Real Sociedad Bascongada de Amigos del País: Sociedad Estatal de Conmemoraciones Culturales (SECC), 2009), 275–288; Ernest Lluch, "La Difusión del cameralismo y de la fisiocracia a través de Europa y en especial de España durante el siglo XVIII", *Sapere aude: el "atrévete a pensar" en el siglo de las luces*, no. 3 (1996): 17–26; Lars Herlitz, "Art and nature in pre-classical economics of the seventeenth and eighteenth centuries", in *Nature and Society in Historical Context* (Cambridge: Cambridge University Press, 1997), 163–75; Simon Schaffer, "The Earth's fertility as a social fact in Early Modern England", in *Nature and Society in Historical Context* (Cambridge: Cambridge University Press, 1997), 124–147.

71 Emma C. Spary, *Utopia's Garden: French Natural History from Old Regime to Revolution* (Chicago and London: The University of Chicago Press, 2000), 13.

In the case of experimental physics, there was a longstanding debate over its exact content. The position of the Spanish government was clear already from an early stage: a preference for approximation to the medical curriculum, focusing on the study of plants. Campomanes, still in 1771, reinforced this idea:[73] students of medicine could only enter the first year of the medical course after acquiring this knowledge.

The Council of Castile consulted several advisors who shared similar ideas. For example, physician and surgeon Antonio Fernandez Solano clearly voiced his preference: "the purpose of which is to provide students pursuing a career in medicine with the physical knowledge useful for the greatest progress in this Faculty [of medicine]".[74] Later, the Council of Castile reinforced this dependency, stipulating that the chair of experimental physics should be taught by a professor of medicine.[75] All these decisions would restrict the content of the experimental physics syllabus to the study of natural materials for medicinal purposes.

The content of experimental physics was similar at Coimbra, even though the range was wider and somewhat more varied. Containing a strong practical component, it required that experiments be carried out on a regular basis in the experimental physics laboratory. Since it had less of an explicit connection to medicine, students at Coimbra may have enjoyed greater freedom to perform experiments, aiming "to uncover the veil of Nature; and to ask the most hidden secrets of the operations, when Nature herself does not speak".[76]

The subject of botany appeared in philosophy curricula in the 1790s. In the case of Coimbra, this was due to the fragmentation of the chair of natural history. However, despite the changes to the chair of botany at both universities, the subjects lectured did not change significantly. In general, it always endeavoured to respond to the aims of the Portuguese government which, by the end of the eighteenth century, was to value what "has been discovered in the different species of Plants, which Nature copiously produces for the use of Man."[77] At Salamanca, the link botany and medicine was again clear, valuing plants mainly for medicinal

72 Archivo Historico Nacional (AHN), Consejos, Universidades, Legajos 5461-no23.

73 Archivo Historico Nacional (AHN), Consejos, Universidades, Legajos 5461-nº23, 46–46v. Original translated by the author.

74 Archivo General de Simancas (AGS), Secretaria de Gracia y Justicia. Instrucción Pública. Fechos de la Universidad de Salamanca, 1777–1788, Legajo 945.

75 *Estatutos da Universidade de Coimbra (1772)*, 1972, *Livro III: Cursos das sciencias naturaes e filosoficas*, 245. Original translated by the author.

76 *Estatutos da Universidade de Coimbra (1772)*, 1972, *Livro III: Cursos das sciencias naturaes e filosoficas*, 245. Original translated by the author.

and pharmacological purposes. The growing autonomy of botany changed the curricular structure offered at these universities.

In 1824, Félix de Avelar Brotero, a professor of philosophy at the University of Coimbra, justified this with some authority: "Zoology, Botany and Mineralogy did not cover such a vast scope of knowledge as today: since then there have been numerous discoveries in all of them, all of them have made extensive progress, and they are present in all of Europe and much cultivated due to their great utility in Medicine, Agriculture, Commerce, and Arts."[78]

Finally, it was important to understand transformation processes involving materials, focussing on the discipline of chemistry. In the nineteenth century, chemistry developed autonomously, even though its connection with philosophy, medicine, and mathematics remained clear in many university institutions. In Portugal, this subject was heavily influenced by the advances made in France, while at Coimbra, chemistry was compulsory for students of philosophy, medicine, and mathematics. They had one compulsory practical lesson once a week in the chemistry laboratory, which aimed to develop their knowledge in the preparation of different chemical substances.[79]

Once again, the significant difference in how this discipline was introduced at the two universities is found in its connection to medicine. At Salamanca, this tendency was the norm, partly limiting the variety of experiments carried out, which were always tied to the therapeutic nature of the materials used. At Coimbra, on the other hand, the practical classes offered students considerably more variety and depth. As students were to be taught to "separate the different substances that are part of the composition of a body; to examine each of its parts; to investigate their properties and analogies; to compare and combine them with other substances", they were encouraged to observe interactions with, for example, salty, metallic, and oily substances.[80]

Having analysed the contents of the various disciplines introduced at Coimbra and Salamanca, it is possible to identify their similarities and an obvious trend: the natural materials (regardless of origin) used by teachers and students in the classes were chosen according to their usefulness in terms of commercial, medical, and economic exploitation.

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77 Arquivo da Universidade de Coimbra (AUC), Processos de Professores, Cx. 26. Original translated by the author.

78 *Estatutos da Universidade de Coimbra (1772)*, 1972, *Livro III: Cursos das sciencias naturaes e filosoficas*, 27.

79 *Estatutos da Universidade de Coimbra (1772)*, 1972, *Livro III: Cursos das sciencias naturaes e filosoficas*, 251. Original translated by the author.

This trend may be explained by the common aims bringing the Portuguese and Spanish reformers so close together. The economistic view of nature, championed by these governments and supported by several professors, adopted a logic of modernisation regarding the balance of trade.[81]

Conclusion

Based on the hypothesis that the valorisation of natural philosophy (and the disciplines it included) was a strategy adopted by the Portuguese and Spanish governments to increase economic productivity, this paper has shown how this rationale led to a preference for more practical knowledge. Consequently, this decision altered the hierarchy of knowledge at the university and led to disputes with professors working with the more established types of knowledge, such as theologians.

The Iberian reformers mainly agreed in their understanding of the knowledge of natural philosophy, although there were slight differences in how it was applied in terms of content and timing. In the late eighteenth century, Coimbra introduced a broad and more varied curriculum, whereas this only appeared in 1807 at Salamanca. This delay can be linked to a range of factors, even though, as this paper shows, one key problem concerned the philosophy curriculum's constant subordination to medicine.

Since natural philosophy was understood as offering knowledge fundamental to a more rational exploitation of natural resources, it clearly met the aims of the Portuguese and Spanish governments, which particularly valued the practical and utilitarian nature of the disciplines it included.

This tendency was clear in the obligation imposed on students to conduct a large number of practical experiments in classes, in which they interacted directly with the various products. This understanding led to a specific kind of idealisation of natural philosophy when creating the philosophy course. At Coimbra, for instance, the philosophy course was designed to teach several components individually, but in a complementary way. It started with natural history (in which the various products were introduced), to then move on to experimental physics (conducting experiments in order to understand and describe natural laws), and finally to chemistry (involving the chemical transformations of the products). This triple set of disciplines, which were compulsory subjects for students of phi-

80 Costa, "As Ciências Naturais", 181–184.

losophy and other courses, represented a great novelty in the new philosophy course.[82]

The study of these reforms contributes to the conclusion that knowledge interacts in different contexts and at diverse levels.[83] The creation of new philosophy curricula was not simply imposed from above, but often involved contacts and exchanges between the government and university authorities.

We may thus conclude that in the case of Catholic Iberian universities, the profound changes carried out from the eighteenth century and onwards were due to pressure from certain professors, but mainly from the central governments. The most obvious consequence was a greater concession to the direct concerns of the respective governments.[84]

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81 Costa, "As Ciências Naturais", 185.
82 Lässig, "History of Knowledge", 38–40.
83 Hammerstein, "O Iluminismo", 607.