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A curricular morphology of *arithmetic to teach* in Schools of Craftsmen Apprentices

Uma morfologia curricular da *aritmética a ensinar* nas Escolas de Aprendizes Artífices

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Abstract

This article aims to characterize the Document of Consolidation of Provisions Concerning Schools of Craftsmen Apprentice as a prescriptive and curricular document, based on the indication of the arithmetic knowledge to teach. The theoretical-methodological framework used mobilizes the concept of knowledge to teach. Based on this framework, the structure and organization were analyzed to understand the meanings of the elements included in this document. Then, based on the analysis of the arithmetical contents and their disposition as elements of the *Consolidation Document*, we sought to characterize it as a curricular document. As a result of the analysis, it was concluded that the fragmentation and organization of arithmetic content leads to the development of an arithmetic to teach, dichotomous, theoretical and practical, which can be characterized as prescriptive elements that carry the curricular notion.

Keywords: History of mathematics education; History of professional-technical education; Curriculum; Schools of craftsmen apprentices.

Resumo

Este artigo tem como objetivo caracterizar o *Documento de Consolidação dos Dispositivos Concernentes às Escolas de Aprendizes Artífices* como um documento prescritivo e curricular, a partir da indicação dos saberes aritméticos a ensinar. O referencial teórico metodológico utilizado mobiliza o conceito de *saberes a ensinar*. Com base neste ferramental, analisou-se a estrutura e organização para compreender os sentidos dos elementos postos neste documento. Em seguida, a partir da análise dos conteúdos aritméticos e sua disposição como elementos do *Documento de Consolidação*, buscou-se caracterizá-lo como um documento curricular. Como resultado da análise, concluiu-se que a fragmentação e organização dos conteúdos de aritmética conduzem para o desenvolvimento de uma *aritmética a ensinar*, dicotômica, de base teórica e prática, que podem ser caracterizados como elementos prescritivos que carregam a noção curricular.

Palavras-chave: História da educação matemática; História do ensino profissional-técnico; Currículo; Escolas de aprendizes artífices.

Introduction

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The Schools of Craftsmen Apprentices (SCA) were created from Decree No. 7.566, September 23, 1909, promulgated by the then president of the republic Nilo Peçanha. According to Fonseca (1986), Soares (1982) and Cunha (2000), the creation of these schools is an initiative of the federal government to spread the technical professional education[3] in Brazil. Also, still according to the authors, the schools, together, become a network of technical vocational education.

In carrying out the historical study of the SCAs, one realizes that the dynamics related to teaching in these institutions are not linear. For example, in the period from 1909 to 1918, successive decrees[4] were passed and each of them had the purpose of bringing new regulations and devices to improve the functioning of their teaching. Among the documents that had this purpose, the *Consolidation Document of the Provisions Concerning the Craftsmen Apprentices* (*Consolidation Document*), published on November 13, 1926, stands out, prescribing significant changes for the dynamics of SCA teaching (Barbaresco, 2019).

For Queluz (2000), the *Consolidation Document* represents a legal instrument to persuade school principals to implement the devices found therein. Such devices, according to Cunha (2000), were intended to establish a standardized curriculum for the teaching of these schools. However, the document was promulgated by an ordinance, which places it in a position of an administrative act of the Ministry of Agriculture, Industry and Commerce (MAIC), an organ to which the SCA were subordinated. Even though it was not of a normative nature, there are authors who, when analyzing its structure, state that there was a legislative character and that it was presented as a prescriptive document, establishing a new organization for the teaching of schools (Barbaresco, 2019). In view of this, it was decided to problematize its nature and curricular dimension.

The *Consolidation Document*, as stated, had a purpose of establishing a "new" organicity for the teaching of the SCA. But talking about teaching is a very broad topic and this term establishes several possibilities for discussion. In this sense, it becomes necessary, at least in this study, a conceptualization of what is being considered as teaching. According to Hofstetter & Schneuwly (2017) teaching is "making known, making accessible by signs" (p. 124). It is the action of forming, that is, a constructive activity, in which the subject is transformed from intentional learning. According to the authors, school institutions are configured as access spaces for this specific learning, because:

> In this school, what is taught is the object of a modeling process. The contents are gradually constituted into school subjects or disciplines [...] that constitute a particular organization of knowledge according to the purposes of the school system. This

[3] In this article, the expression technical professional education will be written in lowercase letters, since technical professional is just an adjective of the type of education provided in that institution. At the time researched (1909-1937), there was no understanding of the teaching modality, so writing with capital letters will not be considered.

[4] Decrees nos. 7,566 and 7,763, of 1909; Decree no. 9,070, of 1911. Decree no. 13,064, of 1918.

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> organization itself embodies the idea of a training whose logic is different from everyday learning: it is about "disciplining", about giving access to new ways of thinking, speaking and acting, which constitute the cultural foundations of society (Hofstetter & Schneuwly, 2017, p. 118).

From the previous quote it is understood that teaching is an intentional activity, in other words, it is not an unconscious movement. That said, it is considered that the organization of teaching is not causal, but refers to a thoughtful action. Its structure is the result of modeling, in which the objects of teaching are constituents of this activity. Such objects are organized with the purpose of establishing a logic for teaching knowledge. In view of this, it is understood that organization is also an intentional act, because it has the purpose of achieving a result. Therefore, the terms structure and organization are not considered synonymous. The first term refers to the essential elements that give body to a teaching activity of an institution or school system. The second refers to the form, that is, the characterization of this teaching. This interpretation helps in the way the *Consolidation Document* will be analyzed. In other terms, one seeks to verify the modeling of the objects that are linked to the teaching of SCAs. By taking into consideration the structuring and organization of these objects, it is intended to apprehend the logic of the teaching of knowledge.

For Hofstetter and Schneuwly (2017) the teaching objects constitute a set of *"knowledges to which to form*" (p. 132), or even, *the knowledges to teach*. Also according to the authors, the educational institution (or educational system) defines what will be taught, these prescriptions are materialized in "study plans or curriculum, by manuals, training devices, prescriptive texts of different types" (p. 132). For the authors, the choice of this knowledge and its transformation are the result of complex processes, which can lead to the creation of knowledge specific to the institution, which makes the knowledge to teach assume functions with specific purposes. In this sense, the concept *of knowledges to teach* is the theoretical and methodological framework that guides the analyses in this research. It is assumed as theoretical hypothesis the existence of an *arithmetic to teach*, that is, of an object determined by the SCAs for the teaching of arithmetic. This hypothesis stems from studies already conducted in this sense, which point to the existence of this arithmetic (Barbaresco, 2019). It is understood that the objects of teaching have a structure, which are presented as elements of technical vocational training, and an organization, arranged in an ordering to serve a purpose. It is from this structuring and organization of the arithmetic contents that we intend to think about the *arithmetic to teach* in the curriculum proposal of the SCAs.

The guiding question of this study is: What is the morphology of the *arithmetic to teach* in the curriculum proposal presented by the *Consolidation Document* for the Artificial Apprentices Schools? To this end, it is intended to discuss that it is not anachronistic to speak of a curriculum in the period of existence of the SCAs (1909-1937), since the meaning of the term in each period and context is taken into consideration. Next, we seek to describe the *Consolidation Document* as a curricular proposal for the Technical Professional Education of the SCAs. Finally, we analyze how the *arithmetic to teach* is configured in the curricular proposal determined by the Consolidation Document. For the development of this work were

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used as primary sources Official Documents such as Decrees, Ministerial Reports, issued by MAIC. Also, as secondary sources were used theses and dissertations that have as themes the local SCAs of certain states.

Is it possible to speak of a Curriculum for Schools Craftsmen Apprentices?

Cunha (2000) refers to the *Consolidation Document* as a curriculum. But at no time, or in other documents of the SCAs, is there reference to this term. It is important to emphasize that we are not trying to refute the author, on the contrary, we even agree with this statement. However, we see in this gap an opportunity to characterize such document as a curriculum. This word is currently presented as a polysomic word. Therefore, it is necessary to problematize its meaning in a historiographical perspective. According to Hamilton (1993), who conducted a historical study of the term, one of the first records of this expression can be found in the *Oxford English Dictionary*. In this dictionary, the use of the word curriculum is located in records of the University of Glasgow, in 1633, more specifically in a graduation certificate. For the author, it was used to refer to the elements of an educational course as a unitary whole. In this sense, curriculum carries the idea of "discipline", which describes a structured plan of studies, and of "order", establishing a sequence for the educational course. Thus, it is understood that the term curriculum, historically, refers to a structure ("discipline") and an organization ("order"), thus constituting a unitary whole that describes the teaching activity of an institution or school system.

This idea also seems to be repeated in Brazil. In a brief search in the Hemeroteca of the National Library, we identified occurrences of this term during the Empire period. In the newspaper *Diário de Pernambuco*, December 9, 1869, in the section entitled "*Secondary Education in Europe*" the term curriculum appears in the following contexts:

> [...] In case of any modest boarding-subsidy, these poor students are immediately directed to one of the Scottish universities, where they live cheaply and do not have the expensive distractions of Oxford and Cambridgeshire, and where, starting from the inside, they **go through the whole literary and scientific curriculum**. […] The program of studies of these new didactic institutions is not exclusively scientific: **Latin is continued until the end of the curriculum,** and the mathematical, physical and natural sciences occupy most of the course [...] (Diário, 1869, p. 8, emphasis added)[5].

Another relevant document is the Ministerial Report of the Empire, from 1882, presented by Minister Manoel Pinto de Souza Dantas to the General Legislative Assembly. In the *Public Instruction* section, the term *curriculum* also occurs:

> The school organization, I think, would be convenient if the primary course were broken down into three teaching levels, with the first two being the obligatory

[5] Jornal Diário Pernambuco. Available in: http://memoria.bn.br/docreader/029033_04/24646

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> preliminary for the third, which would constitute an elementary and practical professional course, and for secondary studies.
>
> Under these conditions, at the end of the **curriculum of the second grade** of primary studies [...] (Dantas, 1882, p. 20, emphasis added)[6].

Both in the newspaper *Diário de Pernambuco* and in the Ministerial Report of the Empire, it was verified that the term curriculum applied in the context of education was already used since the Empire period. In both documents, as well as in others, it is used to refer to a properly structured course, constituted by disciplines, or even school subjects. The context of its use in Brazil converges with what is presented by Hamilton (1993). It is understood that referring to the curriculum, in the concept of a structured teaching and with an outlined sequence, in historiographic studies of Brazilian education does not configure anachronism, since it is present in different periods and documents. However, the meaning given changes with time. Thus, it is understood the need to assume a conception that is coherent to the researched temporality. This study covers the period from 1920, the beginning of the Remodeling Service's work, to 1926, when the Consolidation Document was published.

In 1918, John Franklin Bobbitt (1876-1956) published the book *The Curriculum*[7] establishing the curriculum as a field of study. In this book, the author proposed the conception of school as a business. Thus, the educational system should be based on goals and efficiency, two terms that are the basis for Bobbitt's theorization about curriculum. Thus, the school organization should follow the Taylorist ideas, that is, be focused on a scientific administration. This conception of curriculum was aligned to a matter of organization, working as a mechanical structure. It competes with John Dewey (1876-1956), who published *The Child and the Curriculum*[8] in 1902. In this book, the author presented a more political-ideological perspective on curriculum planning. However, Bobbitt's work prevailed in the development of curriculum as an area of study (Silva, 1999). Bobbitt's conception points out that the notion of curriculum did not have significant changes regarding its theorization aspect, the first ideas were still projected, that is, as a mechanism that structured the teaching in school institutions. This mechanism should be composed of basic elements organized, in a given order, according to a goal and in search of efficiency. For this reason, the notion of *curriculum* adopted in this article is from Rey (2006), who puts:

> [...] **an organized sequence of learning situations**. This sequence is planned. This means, first of all, that it is **designed according to a progression**: we go from easy or difficult, from simple or complex, or even to any other order inspired by a didactic model, but always according to the progression that is thought to be **the most favorable to the learning process.** This progression is combined: the course to which

[6] Ministerial Report of the Empire. Available in: http://memoria.bn.br/docreader/720968/15984 . Acessed on: 07 Nov. 2021.

[7] The book *The Curriculum*, written by Franklin Bobbitt, is available in its digitized version at: https://archive.org/details/curriculum00bobbrich/page/n3/mode/2up . Accessed on: 07 Nov. 2021.

[8] The book *The Child and the Curriculum*, written by John Dewey, is available in its digitized version at: https://archive.org/details/childcurriculum00dewe_0/page/n3/mode/2up . Accessed on: 07 Nov. 2021.

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> the student will be bound is instituted by one or more actors who are no longer just experts in what is to be learned, but are responsible for establishing the progression and controlling it. In this sense, **any curriculum tends to take the institutional form of a school** (Rey, 2006, p. 84, emphasis added)[9] .

Given the above, in this article the *curriculum* will be considered as a document that structures the teaching in a unit through an ordered sequence, which according to Rey (2006) "the order considered is the best for learning the operations of a practice" (p 86). This order is structured from basic elements, which are organized, in turn, in a sequence, establishing the curricular order. It is in the interpretation of this sequence that one will capture its structuring elements and their organization, which allows characterizing the *Consolidation Document* as a curricular document.

The Consolidation Document and its prescriptive character

The *Consolidation Document* is the result of the work of Professional Technical Education Remodeling Service (*Remodeling Service)* – a commission that had its beginning with the hiring of João Lüderitz by the federal government. According to Barbaresco and Costa (2020), the Minister of Agriculture, Industry and Commerce, Ildefonso Simões Lopes, in his ministerial report of 1920, points out the need for a movement to reform the technical professional education of the SCAs, in order to bring a resoluteness to the problems related to the physical structure and teaching. Still according to the authors, Lüderitz's contraction was based on the existence of *expertise*[10] in the field of technical vocational education. Lüderitz created a commission, which was later named the Service for the Remodeling of Technical Vocational Education. The purpose of this commission was to evaluate the teaching of the SCAs and propose solutions to the problems existing in the schools.

During the period from 1920 to 1926, inspections were carried out in the SCAs by the *Remodeling Service* team, which identified the problems existing in the teaching of these schools. Work was begun to overcome these problems. The physical structure of the schools was renovated. The schools were also equipped with machinery to make them look like industrial environments. One of the problems identified in the SCAs was the lack of uniformity in their teaching (Barbaresco, 2019). Decrees nos. 7,566 and 7,763, of 1909;

[9] Original text in French: Au sens où elle est prise dans le cadre du présent ouvrage, il s'agit d'une suite organisée de situations destinées à faire apprendre. Cette suite est planifiée. Cela signifie d'abord qu'elle est conçue selon une progression: on va du facile ou difficile, du simples ou complexe ou bien dans tout autre ordre inspiré par un modèle didactique, mais toujours selon la progressivité qui est jugée la plus favorable à l'apprentissage. Cette progression est concertée: le parcours auquel sera astreint l'apprenant est institué par un ou plusieurs acteurs qui ne sont plus seulement des praticiens experts de ce qui est à apprendre, mais qui sont chargés de mettre en place la progressivité et d'en contrôler la mise en œuvre. En ce sens, tout curriculum tend à prendre la forme institutionnelle d'une école (Rey, 2006, p. 84).

[10] Expertise is understood as [...] an instance in principle as legitimate, assigned to one or several experts - supposedly distinguished by their knowledge, attitudes, experiences - in order to examine a situation, to evaluate a phenomenon, to ascertain facts. This expertise is requested by the educational authorities in view of the need to make a decision. The request for expertise, we shall see, participates decisively in the production of new knowledge in the pedagogical field (Hofstetter, Schneuwly & Freymond, 2017, p. 57, emphasis added). About the expertise of João Lüderitz read Barbaresco and Costa (2020).

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Decree no. 9,070, of 1911; and, Decree no. 13,064, of 1918 established that the programs of the courses (Primary and Drawing) and workshops would be developed by the teachers and workshop masters. These programs were to be adopted by the principal and to be approved by the minister. This orientation, expressed in the form of an article in the respective decrees and written in the prescriptive textual typology, was intended to establish a task of the teaching work. In expressing themselves in this way, the decrees established a subjective teaching space among the schools, since each school could adopt an organization of its contents different from the other. According to Soares (1982) and Cunha (2000) this is what happened: the lack of this unity in teaching was identified and it was found that this difference caused an asymmetry in the quality of teaching offered by the schools. In other words, there were units of the SCAs that presented quality in the teaching offer, while others could not perform well.

It is in this context of problematization regarding the quality of teaching in the SCAs that the *Consolidation Document* was prepared. From the diagnostic work of the Remodeling Service, a set of information and knowledge was developed, which gained a design and a written form. Thus, in this article, this document should not be seen as a research tool, but to problematize it is to attribute to it the condition of an epistemological status, in which it is possible to capture the objectification of knowledge. The knowledge, to which we refer here, is related to the institutional doing, established based on a discourse that comprises acts and/or tasks that act on the activities of all agents linked to the SCAs, collectively or individually.

The analysis of the document begins by identifying its structuring elements. The *Consolidation Document* has: articles, single paragraphs, clauses, paragraphs, and items. In relation to Decree no. 13,064, of 1918, it can be seen that both documents have the same number of articles, that is, 46. However, it is noted that there is an addition of incises, legal elements that serve to discriminate an article. In particular, the changes made to Article 2 and Article 5 of the decree stand out. Both articles bring in their contents an organization for the teaching of SCAs. The second article states that:

> In the apprentice schools, it will be sought to train workers and counter-masters, providing practical teaching and technical knowledge necessary for minors wishing to learn a trade, there being for this the manual or mechanical workshops that were most convenient to the States in which the schools operate, consulting, as far as possible, the specialties of local industries (MAIC, 1926, p. 244).

We can see that it deals with the purpose of the schools and courses, as well as the form of teaching (practical and theoretical). The clauses included in this article, by the *Consolidation Document*, aim to provide guidance on how the practical teaching will take place. The clause I describes that in the first two years of the primary and drawing courses there would be an apprenticeship in manual labor, as a pre-vocational stage, for the practice of the trades. The clause II states that the practical teaching of the trades should take place after the first two years. Also in this clause, there are guidelines about the physical spaces, called sections of related trades, to be created in schools, so that the teaching of certain practices can be offered. For example, the woodworking section is the space in which it will be possible to learn woodworking and carpentry practices. In other words, the school will no

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longer have a physical space for learning woodworking and carpentry, as was proposed in the first decrees. In the *Consolidation Document*, the organization is given by the correlated practices existing among the trades, thus, a reorganization in the learning of the practice of a trade is perceived here. The document establishes a "new" model for practical teaching. The clause III informs that no other workshop can be created that fits the seriation outlined in the clause II. Behold, this clause somehow restricts the actions of school managers to the "new" modal system of practical teaching.

The fifth article states that "The school year shall cover the space of ten months and the work in the workshops and manuals shall not exceed four hours a day for the pupils of the 1st and 2nd years and six for those of the 3rd and 4th" (MAIC, 1926, p. 246). In this article, an organization of school time and the teaching of trade practices was observed. The *Consolidation Document* includes two incises to this article. Incision I describes the structure of the primary and drawing course by means of disciplines it indicates:

> I The primary and drawing courses will cover the following subjects: Portuguese, Arithmetic, Practical Geometry, Lessons, Drawing and Manual Work, calligraphy, gymnastics and choral singing, chorography and Brazilian history, moral and civic instruction, elements of algebra, notions of trigonometry, rudiments of physics and chemistry, industrial design and technology of each trade (MAIC, 1926, p. 246).

The clause II indicates the time of frame for the primary course, drawing and handicrafts in the first three years of study. The orientation is that the primary course should be taken in the morning period and the drawing and handicrafts course in the afternoon period. The clause III points out guidelines for the organization of the subjects in a time perspective. It refers to the number of weekly classes for each subject and their distribution throughout the years of education.

Table 1 - Distribution of the disciplines throughout the training time.

Year	Subjects
1st Year	Reading and writing; Calligraphy; Accounts; Lesson of things; Drawing and manual labor; Gymnastics and singing.
2nd Year	Reading and writing; Accounts; Elements of geometry; Geography and practical history; Calligraphy; Moral and civic education; Lesson of things; Drawing and manual work; Gymnastics and singing.
3rd Year	Portuguese; Arithmetic; Geometry; Geography and practical history; Lesson of things; Calligraphy; Moral and civic instruction; Ornamental and scale drawing; Learning in the workshops.
4th Year	Portuguese; Arithmetic; Geometry; Rudiments of physics; Moral and civic instruction; Ornamental and scale drawing; Industrial design and technology; Learning in the workshops.
1st Year Complementary	Offices and correspondence; Applied geometry and notions of algebra and trigonometry; Experimental physics and notions of chemistry; Notions of natural history; Industrial design and technology Learning in the offices.
2nd Year Complementary	Correspondence and officinal writing; Elementary algebra and trigonometry; Notions of physics and applied chemistry; Notions of mechanics; Natural and elementary history; Industrial design and technology Learning.

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Source: Prepared by the authors from the 1926 Ministerial Report.

There are also a few more considerations: it can be observed that in the training time there are two years called complementary. This is due to the fact that all the decrees establish the technical professional education of the SCAs as being of primary level. According to Barbaresco (2019) in the organization proposed by the *Consolidation Document* it was noted disciplines that are linked to secondary education such as, for example, algebra and trigonometry. For Queluz (2000) this is an attempt to change the level of teaching of these schools from primary to secondary. However, this attempt was not successful and the *Consolidation Document* continued to refer to professional-technical education, in its Art. 1, as being of primary level, but subdivided into two levels: elementary, of four years, and complementary, of two years. Complementary education has a post-primary sense, consisting of subjects aimed at scientific education. Elementary education, on the other hand, is made up of subjects aimed at instruction. These statements are initial conclusions that will be discussed in the next section. However, even though they have this meaning, in practice, elementary school subjects are not only aimed at instruction.

As said, from the *Consolidation Document* it is possible to grasp a knowledge related to an institutional doing. In this article, a distinction is made between the terms knowledge and knowing. It is understood that knowledge is a set of information and/or data that is incorporated to a subject. Knowledge becomes knowledge through the process of writing and is constituted of statements that undergo a process of depersonalization and de-contextualization (Lahire, Thin & Vincent, 2001). Somehow this is what happened with the devices of the *Consolidation Document,* which were elaborated from the gathering of information and data, raised by the inspections. This knowledge was produced by Lüderitz and his Remodeling Service committee, based on an expertise (Hofstetter, Schneuwly & Freymond, 2017), that is, the summation of pre-existing knowledge and experience. They were then written as Incises thus acquiring their own decontextualized existence. From this process, the knowledge emanating from the *Consolidation Document* seeks to objectify an understanding of what technical vocational education is and how it is structured and organized. It is an education with a post-primary level, but not secondary, that is constituted by basic elements, the disciplines, sets of contents grouped with a purpose, thus representing the decomposition of the practice of a craft. Such disciplines are organized in an "efficient" way so as to allow the development of a know-how related to the student's learning of a trade. In other words, from *the Consolidation Document* it is possible to grasp the conception of a technical professional education that is characterized by the process of modeling the learning of a trade through a closed system that is imposed by a gradual teaching process.

What was found, from what was exposed in the previous paragraphs, is that the Consolidation Document when including the "new" devices, for example, in Art. 2 and 5, describes a "new" way of organizing teaching; based on protocols that gain Inciso configurations in the document. This configuration gave a status of legality to the protocols and legitimacy to the "new" organization. However, the publication of this document was by means of an ordinance. This type of document is of an administrative nature, in which it

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seeks to instruct on a subject, mainly regarding people management and organization/functioning of services. In general, these are acts of ministers, not of the chief executive (Presidency of the Republic, 2002). However, to think of it this way, as an administrative act, reduces the prescriptive power of the document. It is important to note that the *Consolidation Document* as well as Decree No. 13,064 of 1918 have the same structure. What the analysis shows is the inclusion of some provisions that, in particular, will bring complementarity to the articles already existing in the decree. This complementary character of the provisions of the *Consolidation Document* in relation to the articles of the decree is what gives it a prescriptive status. Moreover, as has been discussed, the document imposes a closed system of technical vocational education, which must be implemented by school managers.

Consolidation Document: the structuring and organization of arithmetic knowledge

The Decrees n. 7.763, 1909; n. 9.070, 1911; and, n. 13.034, 1918 determine that the technical professional education of SCAs should be of four years. In this period, the indication is that the primary courses, drawing and workshops are taught concomitantly. In other words, all three courses would take place concurrently during the four years of training. This means that the student did not have only one course, but three, which had to be completed in the period indicated by the decrees. In view of this, it can be seen that technical education did not have a unity, but was composed of apparently independent courses, since none of them preceded the other or were taken as a prerequisite.

As for the contents that were prescribed for the teaching of each course, one can see the indication of a path to be followed. Arithmetic was taught in the primary course. In Decree 7.763, of 1909, more specifically in an annex to this document, are the Instructions to which Decree n. 7.763, of December 23rd, 1909, refers. In the section on Teaching, in the second paragraph of article 3, it is stated that in the primary course "*Arithmetic up to the rule of three"* would be taught (Decree n. 7.763, 1909). Given this, it is understood that in the primary course the teaching of arithmetic was organized in the form of content called, according to Valente (2015), as a school subject, which is characterized by "a set of contents interconnected to the teaching process that involves the triad read-write-count" (p. 358). Corroborates with this statement the indication, in all decrees, that the primary course was aimed at students who cannot read, write and count, that is, intended for students in illiterate condition. The purpose of this course was to provide a first instruction to these students, indicated by the triad read-write-count.

As said in the previous section, before the *Consolidation Document*, the organization of the contents in each of the courses was the responsibility of each SCAs teacher. Thus, the programs were not unified, and there was a diversity in the way of teaching. In this article, we present two examples of courses of arithmetic contents, one related to the School Craftsmen Apprentices of Santa Catarina (SCA-SC) and the other to the School Craftsmen Apprentices of Alagoas (SCA-AL), Tables 2 and 3, respectively.

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Table 2: 1916 SCA-SC Primary Course Program.

Year	Arithmetic Contents
1st Year	Study and construction of Arabic and Roman numerals; absolute and relative numbers; magnitudes; homogeneous and heterogeneous quantities, preliminary definitions, mental exercises on the tables of addition and diminution.
2nd Year	Unit, formation of units; reading numbers; spoken and written numeration; even and odd numbers; abstract and concrete; addition and reduction, exercises on multiplication and division tables.
3rd Year	Decimal system of numeration, multiplication and division of whole numbers by one or more digits; simplification of operations on whole numbers, arithmetic proofs, divisibility characters; maximum common divisor; prime numbers and their properties, ordinary and decimal fractions; reduction of fractions; first four operations on ordinary and decimal fractions.
4th Year	Squares and cubes; decimal metric system; complex numbers; operations on complex numbers; arithmetic ratio: proportion and progression; currency exchange, conversion and reduction; Brazilian currency; interest formulas; simple and compound threes.

Source: Barbaresco (2019).

Table 3: 1911 SCA-AL Primary Course Program

Year	Arithmetic Contents
1st Year	The four fundamental operations, practicing up to 20 with the help of objects and the mechanical counter. Use of the signs +, -. Counting up to 50 or 60 with the aid of objects and the mechanical contact.
2nd Year	Counting from one to a thousand. Arabic and Roman numerals. Multiplication and division tables up to ten. Fractions: study to practice means, thirds to decimals. Operations on Roman numerals. Federation of units and tens. Counting up to 1,000,000 by units, tens and hundreds. Tables of addition, subtraction, multiplication and division. Continuation of fractions. Reading and writing compound numbers of two and more classes. Solve the four operations. Metric System: Money. Read and write from twenty reais to ten thousand reais.
3rd Year	Fundamental operations and ordinary proper and improper fractions. Problems and practical questions. Metric system: meter, liter, gram, multiples and submultiples. Ordinary and decimal fractions. Read and write decimal numbers. Problems. Metric system and exercises on measures of stores and warehouses.
4th Year	Divisibility of numbers and maximum common divisor. Ordinary fractions and decimals. Transformation in them and vice-versa. Problem and Metric System. Problems and practical essays on interest and metric system, with comparison of modern and ancient measures.

Source: Lima (2020).

According Forquin (1992), "one of the essential morphological characteristics of school knowledge is its organization in the form of subjects (or disciplines) of teaching endowed with a strong institutional identity and between which there are clear boundaries" (p. 37). Based on this quote, it can be seen that the organization of the arithmetic content of the primary course in the SCA-SC and SCA-AL are different, although they may address the same content. The SCA-SC program follows the prescription of the Decree n. 7.763, 1909, that is, arithmetic up to the rule of three, while the SCA-AL program makes no mention of

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the rule of three, although one can imagine that when working the Metric System, it may have made use of the principles of the Rule of Three. In the primary course of Santa Catarina, the organization of the contents emerges an idea of a preponderance of theoretical knowledge, focused on establishing concepts, in relation to practical knowledge, understood here as contents that are mobilized in problem-solving contexts. In the primary school of Alagoas, the understanding is contrary, there is an indication of the teaching of arithmetic contents mobilized in problem solving. Also, the organization of the teaching of the contents related to the Metric System stands out. In the school of Santa Catarina, they are taught only in the fourth year, while in the school of Alagoas these teachings occur the second year. This reinforces the inference that the teaching of arithmetic in the primary course of the SCA-AL prioritized an organization of content that shapes a practical school knowledge that prevails over theoretical knowledge. From these programs, it is verified the existence of different ordering of the arithmetic contents and it is deduced that in relation to the curricular aspect of the SCAs, the decrees were not able to establish a unity for the technical professional teaching of both schools.

It was because of this lack of unification in teaching that the Remodeling Service, under Lüderitz's coordination, elaborated the *Consolidation Document*, which had as one of its devices a "new" organization of the school contents to be taught. In this document, the contents would be organized as a school subject: Accounts and Arithmetic. This configuration is modeled on what was implemented at the Parobé Institute. In this institute, in the 1912 program, the subject of Accounts appears in the organization of the elementary course, and the subject of Arithmetic in that of the professional course (Barbaresco, 2019). According to Queluz (2000), the presence of the discipline Arithmetic in the professional course was intended to review "basic elements of the disciplines (algebra and arithmetic) by applying them to everyday problems of workshop practice, such as calculation of interest and percentages, applied to budgets" (p. 129). In other words, the presence of the discipline Arithmetic in the organization of the professional course had the purpose of mobilizing such contents for a professional practice.

According to Bertini, Morais, and Valente (2017), from the conception of knowledge to teach it is possible to develop the understanding of a mathematics to teach, conceived as that in which the teacher should teach his students. In this same perspective, there are other works developed by GHEMAT Brazil researchers that show the existence of an arithmetic to teach. It is understood that in SCAs, the work done by Lüderitz on the arithmetic contents to be taught determines an arithmetic to teach specific to this school.

The *arithmetic to teach* should not only be characterized by its structure, its organization that meets the purpose of the institution should also be considered. After the reformulation, primary education is subdivided into two levels: elementary (4 years) and complementary (2 years). According to ministerial reports from 1920 and 1926, in the first two years of elementary school the student took manual labor, a pre-vocational course. In the third and fourth year of elementary school the student would start the technical courses, learning practical trades from the correlated sections. Also, according to the 1920 ministerial report, the first two years are reserved for the adaptation of illiterate students to the school,

DOI: 10.20396/zet.v30i00.8667630

that is, intended to offer the first instruction. Also, "it has been insistently stressed that there is a need for a complete distinction between preparatory elementary education and professional technical education" (MAIC, 1920, p. 455). That is, before the *Consolidation Document* the primary course was intended for illiterate students, with the purpose of offering a first instruction when it occurred parallel to the learning of trades (technical education); after the reformulation the function of literacy no longer occurs concomitant to the learning of the trade, it should be before and of preparatory character. It can be seen, then, that the *Consolidation Document* established a new order for the apprenticeship of the trade, first preparing the student, making him literate and instructing him, to then go on to technical education.

In this order the subject of Accounts is prescribed for the first two years of elementary education, and *Arithmetic* in the third and fourth year of the same education. It should be noted here that the SCAs' technical vocational education is at the primary level. That said, from Barbaresco (2019), Queluz (2000) and the ministerial report (MAIC, 1920), it is understood that Accounts presents an organization of arithmetic content whose purpose is to invest in the literacy of students entering the schools. However, as presented, it also has the purpose of providing, theoretically, basic elements to be mobilized in the learning of the trade. The subject of *Arithmetic*, being indicated in the third and fourth year, when technical education begins, aims to mobilize the basic elements for learning trades and also to teach content that can be applied to the contexts of the professions as indicated in the ministerial report of 1920:

> It is not advisable to let run parallel, with no connection of one with the other, the manual learning of trades and humanistic education: there should be more intimate connection between the theoretical-practical classes and the workshop works, so that with few educational patterns of works to be executed by the students, we can give them, besides elements of technology and industrial design, the indispensable notions of elementary mathematics and rudimentary natural sciences applied to the professions [. ...] (MAIC, 1920, p. 452).

From the previous statements the question arises: how are the disciplines *Accounts and Arithmetic* structured in relation to the arithmetic content? Some traces are found in Luciano Candeia's 2013 thesis about the School of Craftsmen Apprentices of Paraíba. In his thesis, Candeia (2013) transcribes part of the management report of Eugenio Gomes Outeiro, director of the School of Craftsmen Apprentices of Paraíba. In this transcription, there are contributions from the director regarding the organization of teaching, since it seems that he had a discussion with the *Remodeling Service* team. In his contribution, the subject of *Accounts* should be organized as: 1st Year - the four operations among whole numbers; 2nd Year - up to the metric system. That said, and from the programs of the SCA-SC and SCA-AL, one can conjecture that the contents of numeration, whole numbers, decimal numbers, fractions, the four operations and metric system structured the subject *Accounts*. The subject of *Arithmetic* was structured from the contents such as: simple and compound rule of three, simple and compound interest, complex numbers, etc.

Based on the *Consolidation Document*, we can see that the arithmetic contents are fragmented into two disciplines, making it possible to establish a cognitive hierarchy. The

DOI: 10.20396/zet.v30i00.8667630

reorganization of the arithmetic contents establishes a new relation of pertinence among them. The subject *Accounts* is not necessarily an element of technical professional training. It is aimed at instruction and should precede professional technical education. Thus, this subject establishes a relationship among the contents that gives it a form of theoretical knowledge. *Arithmetic* is an element of technical education. This knowledge, in relation to the subject of *Accounts*, should serve to develop a know-how, that is, it should be mobilized in the learning of the practices of a craft. The subject of Accounts is a basic element of professional education, and the relationship between the contents gives it the form of a know-how. Here one can see that an attempt is made to establish a unity in relation to the arithmetic contents. From this analysis, it is understood that the consolidation of the disciplines Accounts and *Arithmetic* is the consolidation of a way of thinking about the teaching of arithmetic in technical professional education. It is a dichotomous teaching, in which the intention is to have one teaching to instruct and another to provide young people with elements to be mobilized in their professional practice. In view of this, it can be deduced that the *arithmetic to teach* present in the teaching of SCAs is thought out, aligned with the purpose of the institution. It is detached from a strictly mathematical order, in tow of elements of science. But it gains an orderliness to achieve objectives proper to the SCAs.

The *Consolidation Document* will establish such unity for the network of technical professional education that is established among the SCAs. This unity is materialized in the orderly and structured sequence of the learning of trades, proposed by the document. Starting from the arithmetic contents, it can be noticed that their reorganization into disciplines allows for their hierarchization. Thus, the organization of such disciplines, within a sequence, establishes an order in the educational path - the disciplines become components of a *curriculum*. The purpose of this curriculum is also to standardize arithmetic education. If before there was a diversity of arithmetic knowledge, it is now evident that there are two types of arithmetic knowledge: theoretical and practical. Each of them has a specific purpose in the student's education and has a well-defined role in the established sequence.

Final Considerations

The creation of the Schools of Craftsmen Apprentices represents an initial milestone in the constitution of a technical professional education network in Brazil. In the first years of its activities, there was no unification in the educational path. The teaching programs established by each school pointed to different ways of structuring technical vocational education and that, as a consequence, made some schools perform better than others in terms of offering apprenticeships. The difference in quality of technical vocational education among the schools motivated the Ministry of Agriculture, Industry and Trade to hire Lüderitz, who in turn established a commission, later called the Service for the Remodeling of Technical Vocational Education, with the purpose of evaluating the teaching of the schools and proposing solutions to the problems identified.

DOI: 10.20396/zet.v30i00.8667630

One of the first findings of the Remodeling Service was that the diversity of the teaching programs had implications for the quality of the technical vocational education offered by the schools. One way to address this problem was to produce the Consolidation Document Concerning the Schools Craftsmen Apprentices (Consolidation Document). This is a document issued in the form of an Ordinance, an administrative act. However, after an analysis of the document, it was found that its structure is identical to Decree n. 13,064, of 1918. The difference is that the Consolidation Document brings some incises to articles of the decree. Such incises give legitimacy to protocols that are established and aimed at teaching. The document by means of these legal devices establishes a "new" model of technical professional education. In this way, they give complementarity to the articles of Decree n. 13,064, of 1918, as well as, the guidelines for a "new" model of teaching. Thus, a conception of technical vocational education emerges, argued in this article as a knowledge related to the institutional doing. In this sense, both in the pragmatic aspect of the devices, and the judgment he attributes for the "new" conception, the Consolidation Document is interpreted as being of prescriptive property, since, it does not establish only acts, but institutes a way of thinking and acting.

From the reading of the documents, following the prescriptions, one can observe a process that articulates an organization of knowledge. From the theoretical point of view, an arithmetic to teach is established in the form of disciplines: Accounts and Arithmetic. Comparing the reorganization with the syllabuses prior to the Consolidation Document, it can be seen that the disciplines establish a hierarchy among the arithmetic contents, which leads to a "new" relation of pertinence among them. The contents of the subject of Accounts establish a relationship with each other, with the formation process of the Apprentice Craftsman of theoretical basis, focused on the instruction of the student, or even on his literacy. The contents of Arithmetic, on the other hand, establish a relationship with the educational process of practical basis, focused on problem solving. They are the basic elements for the development of the knowledge and know-how for learning the trade, the professional knowledge of the Apprentice Craftsman. From this analysis of the reorganization of arithmetic content, one can see the Consolidation Document's intentions to establish structured learning based on a unit, in other words, the reorganization of content reflects directly on the arithmetic to teach, assigning a curricular morphology to the Apprentice Artisan Schools.

The knowledge to teach is defined by the teaching institutions. Thus, each institution, or school system, will define them, including the arithmetic knowledge to teach. The way this knowledge is structured and organized characterizes the arithmetic to teach for that educational institution, or educational system. This is what this study shows for vocational technical education, more specifically for SCAs. In view of this, we sought to contribute not only to the history of mathematics education, but also to the history of vocational education. It is hoped that, based on this work, others will investigate the history of knowledge in the context of technical vocational education, which is still little explored.

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