

IARTEM 1991-2016: 25 YEARS DEVELOPING TEXTBOOK AND EDUCATIONAL MEDIA RESEARCH

edited by
Jesús Rodríguez Rodríguez
Tânia Maria Braga Garcia
Eric Bruillard



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EDUCATIONAL MEDIA RESEARCH**

Jesús Rodríguez Rodríguez
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(Editors)

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RESEARCH ON PRIMARY SCHOOL NATURAL SCIENCES TEXTBOOKS IN PORTUGAL

FERNANDO GUIMARÃES

The main aim of this research paper is to understand the place given to Botany in Natural Science textbooks used in Primary School Education in the last century in Portugal. In order to interpret the shifts in the content approach for Botany, didactical books at this educational level were studied based on eleven principles: Form, Kingdoms, Classification, Organs, Roots, Stem, Leaf, Flower, Fruit, Reproduction and Dimensions. This study used a qualitative methodological approach supported by a content analysis and the establishment of *a posteriori* categories, as well as a *cluster* analysis through the construction of dendograms. The latter constructions were intended to promote the comparison of first hand sources – textbooks – taking into account the pedagogical and didactical orientations, the educational and curricular policy recommendations as well as the educational and scientific values suggested. Data analysis shows that changes have occurred in the terms used for the teaching of Natural Sciences and in the contents approached, which have taken on different relevance over time. Therefore, one may find the conservation of various botanical contents distributed throughout different botanic dimensions; namely, the notional dimension, the morphological dimension, the functional dimension and the ecological dimension.

INTRODUCTION

With the development of different perspectives regarding the scientific knowledge of biological classifications (i.e., botany and systematics, including nomenclature and classification, history of several classification systems, and taxonomic schools, as well as Kingdoms of living beings), a number of authors report that many gaps arose in the Portuguese teaching system. Throughout the last century, various governments have attempted to correct existing weaknesses by introducing new Botany contents into the curriculum for Natural Sciences at the compulsory basic education level (Guimarães & Santos 2011).

The teaching of botany gradually became more complex along with curricular and didactic changes that accentuated dimensional metamorphoses. Changes regarding the curricular area to be studied are reflected in Portuguese legislation, from the so-called Natural Sciences, Geographical-Natural Sciences, Physical and Social Environment to Environmental Studies: Decree of October 18th, published in the Official Government Gazette of October 20th, 1902, approving the list of

subjects that make up Primary School; Decree No. 7.311 of February 15th, 1921, published in the Official Government Gazette, approving the General Primary Education curriculum annexed to the same decree; Decree No. 16.730 of April 13th, 1929, published in the Official Government Gazette, approving the new Elementary Primary Education curriculum; Decree-Law No. 42.994 of May 28th, 1960, published in the Official Government Gazette, which updates the Primary Education curriculum to be adopted in subsequent school years; and, finally, Law No. 46/86 of October 14th, 1986, published in the Official Government Gazette, registering the Basic Law of the Educational System.

The focus of our analysis is the complex reality of Botany teaching in Portugal, a knowledge area affected by the process of reorganization as well as by Portugal's historical and educational circumstances. This knowledge area is undergoing important changes, is faced with new challenges as a result of significant environmental and political alterations, new practices, and a curricular debate that has been felt in diverse national and international forums. Therefore, we adopt an interpretative and critical perspective of educational processes, emphasising documentary research on the representations of the study objects: school textbooks.

School textbooks are truly important to schools in shaping forms and contents of pedagogical knowledge, and integrating the sequence and rhythm of their transmission through, for example, the activities and evaluations they propose; in other words, they play an important pedagogical and didactic function (Molina 1987, Fracalanza & Megid-Neto 2003). From this perspective, textbooks can provide knowledge of underlying pedagogical and curricular ideology, teaching and learning processes in the classroom, and the roles of students and teachers.

The focus of our research is one of the most characteristic domains of the primary school subject called "Study of the Environment", i.e., Botany. In fact, by analysing curricular texts and textbooks, we can see that both theory and practice of Natural Science teaching places Botany as its fundamental structuring component. It is one of the subjects that traditionally define the discipline most consistently and systematically.

The current paper focuses on the teaching of Natural Sciences, mainly Botany, from the perspective of school textbooks, using a diachronic approach and based on a set of assumptions: throughout the 20th century, the teaching of Natural Sciences underwent an evolution in structure, contents and pedagogical methods; even today teaching is influenced by concepts such as the so-called Lessons of Things (Melcón Beltrán 2000, Gómez Rodríguez, Somoza Rodríguez & Badanelli Rubio 2003); changes have been more or less marked by the evolution of Science as well as by new approaches in Educational Sciences (particularly Pedagogy and Didactics); textbooks are important tools in the development of teachers' professional practice (Tormenta 1996); textbooks reveal the way Natural Sciences have

been approached in primary education since the beginning of the 20th century. Thus, they constitute a relevant documentary corpus for the analysis of contents, pedagogical methods implemented by teachers, educational policies, educational reforms, and curricular changes. The analysis of school textbooks makes it possible to deconstruct the teaching of Natural Sciences and reconstruct the teaching of Botany, which has been the king of Natural Sciences (Guimarães 2010).

METHODOLOGY

Our sample consisted of 194 Natural Sciences textbooks published from 1900 to 2000. We found that these fell into four main groups according to their denomination. There were textbooks for Natural Sciences, Geographical-Natural Sciences, Physical and Social Sciences, and Environmental Studies. These textbooks mostly contained information on authors' names, edition numbers, publishers, official approval, harmony with programs, level of education, and classes/years of schooling. We came across a problem regarding publication dates, as most of our sample did not include it. We also verified the existence of botany contents in different textbooks.

The corpus of pedagogical texts upon which our study was carried out comprised Primary level, Natural Sciences school textbooks. Textbook selection was carried out from the sampling universe targeting Elementary School levels. A sample of 25 books (published from 1903 to 1998) was considered for analysis; textbooks were excluded if they did not mention official approval, were not in line with the adopted programs, and did not include publication dates.

Data analysis became an essential issue in this research, as it was important to find evidence that would make it possible to describe and interpret the situation based on reality features. Given the analysis framework, assumptions, objectives, and object of study of our research, it was necessary to gather information from the textbooks to elaborate suitable instruments for analysis and treatment. A set of tools was used to achieve the mentioned objectives: i) content analysis, which essentially consists of a systematization effort, attempts to make contents fully analysable and involves relatively complex procedures. The analysis is split into various phases that encompass the determination of category and analysis units (Bardin 1988) so that different features on Botany in Primary school textbooks are gathered; and, ii) *cluster* analysis is used as an exploratory tool for data analysis and classification problem solving. It is also known as taxonomic analysis and attempts to identify homogeneous case groups within a given population, i.e. it aims to identify a set of groups in which intravariations are minimized and inter-variations and maximized. There is a relationship between case similarity and distances on graphic representations in such analysis. For instance, similar cases share a high level of similarity in dendrograms (Maroco 2003).

SCHOOL KNOWLEDGE, CURRICULA AND TEXTBOOKS

Investigating school knowledge and analysing textbooks reveals that the existence of Botany contents within Science teaching cannot be understood (over the last century in Portugal) without considering the nature of educational and curricular policies, as well as teaching-learning processes. School knowledge sets are marked with various relationships established with agents from multiple possibilities of interests, emphases, transmission ways, complexity of analyses, and articulation of contents and practice of school textbook usage (Santos 2000). Such knowledge is found in school curricula, built by the development of learning paths foreseen in normative proposals; moreover, learning of more tacit sets of rules, values, and practices immersed within school cultures is also involved (Lacasa 1994).

School textbooks are important pedagogical, cultural and ideological tools that contribute to the transmission and consolidation of skills, thus assuming a crucial role in terms of contents and working methods. A complex analysis of textbooks can contribute significant information for characterizing school knowledge, Botany teaching in Portugal, and its educational processes. The idea that textbooks play a decisive role in the transmission of scientific knowledge has been put forward in recent times. According to Morgado (2004, 25) textbooks “have been playing an important role in organizing and delivering teaching-learning processes, being able to survive different educational and curricular policies, in very different cultural contexts”. Given that there is a dominant approach at each moment, textbooks may reflect the approach that conditions activity and affects the image of the scientific area presented to society. The study of school textbooks is a way of understanding a certain time period and characterizing policies and educational models, because textbooks are objects of culture and they represent and contain “cultural options more or less explicit, more or less assumed and as such, value and prescribe as truth and as knowledge certain kinds of knowledge, but silence, neglect, and marginalize many other kinds of knowledge” (Magalhães 1999, 285).

According to this perspective, textbooks hold a criterion of truth, since it is interpreted as being the truth, even though they conceal other kinds of knowledge considered uncomfortable or less relevant for the development of science in a particular socio-educational context. An extraordinarily fruitful field of inquiry is, in our view, the way we look at textbooks about cultural representations - scientific, material, axiological and know-how - as well as about the visions of the world and educational goals that structure them. By doing so, textbooks can be analysed not only from a cultural perspective, but also in terms of pedagogical and didactic views (Guimarães 2015).

School textbook history may be understood by considering three major directions to which distinct disciplinary perspectives correspond. One of the more recent

research lines involves the internal history of education. This analysis field, which studies the interior of educational institutions seeking to find the meaning of activities that occur within them, essentially favours curriculum history (Magalhães 1999, 279). An approach to curriculum history involves the study of tools with which a national curriculum is settled at a certain given historical moment. These tools include study plans, programs, tests, and textbooks. This study is extremely relevant in order to reconstruct curriculum history, because the whole textbook is historically and geographically defined, being the product of a social group and a specific period of time (Sacristán 2000). In this paper, we have taken school textbooks as differentiated didactic and pedagogical sources to structure school cultures “whose production corresponds to a complex configuration involving text, shape and speech, [being] a combination of knowledge/ skills/ (in)formation” (Magalhães 2006, 6).

RESULTS

As can be seen in Figure 1, the first *cluster* shows the Shape features in textbooks from 1900 to 1920; the second *cluster* shows particularities of Shape in textbooks from 1920 to 1940; the third *cluster* shows the Shape features from 1940 to 1980; the fourth *cluster* shows singularities of Shape in textbooks from 1980 to 1990; and, finally, the fifth *cluster* shows the Shape features in textbooks from 1990 to 2000.

We should not forget the particular cases found in the textbook from 1925 (first *cluster*), and in textbooks from 1989 and 1990 (with position change in *clusters* four and five).

Our analyses suggest relationships which result from similarities among textbooks. We found, by considering our analysis matrix, that textbooks published in the first two decades of the 20th century in Portugal are similar in Shape, thus presenting the same name (“*Sciências Naturais*”, i.e. Natural Sciences); they belong to the Primary level; teaching was split into classes; texts had no images, except the 1910 textbook, in which images are found at the bottom side of the text; and, didactic activities that promote memorization and questionnaires and summaries.

The textbooks of the following decade are similar in Shape, mostly presenting the denomination “*Sciências Naturais*” (Natural Sciences), although, in 1933, a textbook entitled “*Ciências Naturais*” (Natural Sciences) was published; they belong to the Primary level; teaching was split into classes; images took up a smaller area than the text; no didactic activities were proposed. Textbooks from the 40s, 50s, 60s and 70s (20th century) in Portugal are similar in Shape, although different names are found, such as “*Ciências Naturais*” (Natural Sciences) and “*Ciências Geográfico-Naturais*” (Natural-Geographical Sciences); they belong to the Primary level; teaching was split into classes; coloured images are found, covering the same area as the text; didactic activities aim at memorization and experimentation.

Textbooks from the 80s (20th century) are similar in Shape, and are named “Meio Físico e Social” (Social and Physical Environment); teaching was split into school years; coloured images are found, covering the same area as the text (in the 1989 textbook, images are bigger than the text); didactic activities aim at memorization, experimentation, research, banner production, and herbarium build-up.

The 90s textbooks (20th century) in Portugal are similar in Shape, and are named “Estudo do Meio” (Environment Study); they belong to the Basic level; teaching was split into school years; images are bigger than the text; didactic activities aim at memorization, experimentation, research, banner production, herbarium build-up, and group and field work.

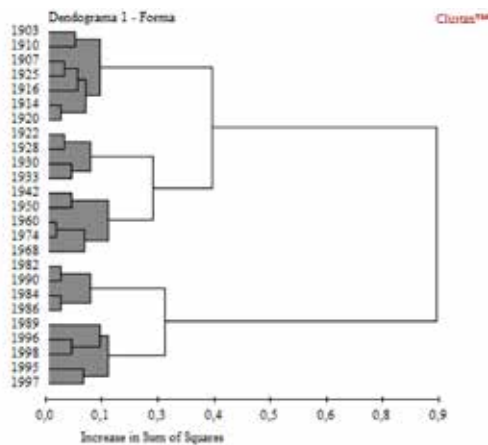


Figure 1 – Dendrogram Shape.

As can be seen in Figure 2, the first *cluster* shows the Dimensions features in textbooks from 1900 to 1920, and from 1925 to 1990; the second *cluster* shows particularities of Dimensions in textbooks up to the end of the 1960s, the beginning of the 1980s, and mid-1990s; the third *cluster* presents the shape features of textbooks for the end of the 1980s and 1990s; the fourth *cluster* shows singularities of Dimensions in textbooks for the 1920s (except the 1925 textbook), 1940s, 1950s, transition to the 1960s, and 1974, 1984 and 1997; the fifth *cluster* presents Dimensions features in textbooks for the 1930s and 1990s (1996).

Reference to the 1925 textbook is made, as it is found in the first *cluster* and is not related to the 1920s textbooks; the 1990 textbook is also grouped in the first *cluster* (and not in a *cluster* with more contemporary textbooks).

Our analyses suggest relationships which result from similarities among textbooks. We found, by considering our analysis matrix, that textbooks from the first

two decades, and those from 1925 and 1990, are similar in Dimensions, thus presenting an approach to Botany teaching focusing on the *notion dimension*. Textbooks from the end of the 1960s and beginning of the 1980s and 1990s in Portugal are similar in Dimensions, presenting an approach to Botany teaching focusing on the *notion dimension*, *functional dimension* (1968 and 1995), and *ecological dimension* (1995). Textbooks from the end of the 1980s and from 1998 in Portugal are similar in Dimensions, presenting an approach to Botany teaching focusing on the *morphological dimension* (1989), *functional dimension* (1998), and *ecological dimension*. Textbooks from the 1920s (except the 1925 textbook), 1940s, 1950s, transition to the 1960s, and 1974, 1984 and 1997 in Portugal are similar in Dimensions, presenting an approach to Botany teaching focusing on the *notion dimension* (except the 1974 textbook), *morphological dimension*, *functional dimension*, and *ecological dimension* (1984). The Natural Sciences textbooks for Primary level students in the 1930s in Portugal, and from 1996, are similar in Dimensions, presenting an approach to Botany teaching focusing on both *notion* and *morphological dimensions*.

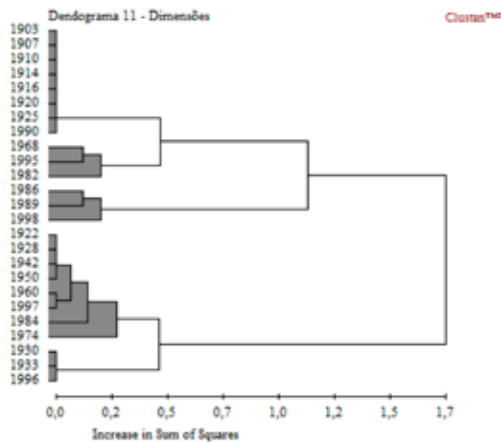


Figure 2 – Dendrogram Dimensions.

FINAL CONSIDERATIONS

A range of signs suggest that botany teaching in Portugal during the last century is a disciplinary area filled with tension. Fluctuations should be acknowledged in the very designations used to identify school textbooks, from Natural Sciences, Natural-Geographical Sciences, Social and Physical Environment to Environment Study. Such modifications reflect changes from a disciplinary approach – Natural Sciences –, to a disciplinary annexation – Natural Sciences with Geography: Natural-Geographical Sciences –, and going on to an environment approach. There

has been a transition from a disciplinary approach to a contextualized approach, with different conceptions of the environment, from a pre-analytical syncretism to a post-analytical, systemic view (Drouin & Astolfi 1986). In this approach, the specific context is the environment, initially the Social and Physical Environment, and later, the Environment Study.

The relation of textbook similarity, principles of appreciation Shape and Dimensions, and the analysis period reveal changes and new approaches in botany teaching (referred to as dimensions in this paper), as well as the inclusion or not of different dimensions of botany teaching in textbooks.

Regarding changes and the appearance of new dimensions of botany teaching, our findings show that the notion dimension has existed throughout the 20th century, with the exception of textbooks published in 1974, 1986, 1989 and 1998. The morphological dimension first appeared in textbooks in 1920, and has remained except for textbooks published in 1925, 1968, 1982, 1986, 1990, 1995 and 1998. The functional dimension appeared in textbooks in 1920 and has remained throughout the 20th century, except for 1925, 1930s, 1980s (but there is an appearance in 1984), 1990 and 1996. The ecological dimension appears in textbooks in 1982 and appears in all textbooks up to the present, except for those published in 1990, 1996 and 1997.

We have found that there are textbooks that only consider the notion dimension in Botany teaching from 1900 to 1920, and in 1990 (seventy years later). We found two textbooks that, besides the notion dimension, only focus on the morphological dimension in the 1930s (1930 and 1933) and in the 1990s (1996). The textbook from 1968, besides the notion dimension, presents only the functional dimension of Botany teaching. The textbook published in 1982 presents only the ecological dimension of Botany teaching, besides the notion dimension. Finally, the textbook from 1998 presents only the functional and ecological dimensions of Botany teaching.

Natural Sciences teaching has undergone significant curricular changes as study contents have broadened. Although a more active attitude is seen in students' teaching-learning processes, we have found textbooks aimed at promoting teaching methods based on the reproduction of knowledge and competencies. This is significant when one considers the weight of textbooks in didactic activities and their importance for the promotion of a written culture in the 20th century. Therefore, school textbooks have been the basis of important pedagogical work by contributing to cultural and social adaptation, even though they have not fostered the strengthening of intervention and reflection capabilities. We have, thus, reported a limited interpretation of Natural Sciences teaching and teaching-learning processes, as well as an instrumental uplift of the scientific culture in which school textbooks have become the core pedagogical medium within the schooling process.

Moreover, we can affirm that the results have shown a relational tendency among teaching programs and textbooks in our sample of school botany. It has been suggested that the rudiments of natural sciences do not comprise a course, but merely general knowledge that should be taught to children through intuitive processes with objects themselves (when available) or with printed aid. Furthermore, the importance has been emphasized of knowing how to read, write and count – the first three types of excellence during Elementary education. Finally, we have observed the use of methods based on observation and experience, suggesting a school botany reminiscent of Lessons of things. We would like to mention the following important points: awareness of the surrounding environment, such as the contact with local plants and their use, satisfies children’s curiosity and enables them to obtain useful knowledge for practical life; botany teaching should be availability via various media to study nature objectively, e.g. plant collection by students, plant museums, orchards, and school gardens (Santos 2006); students need to learn how to observe the environment and think deeply about it, so that they may reach the conclusion that people live and get organized in diverse ways interdependently with the environment; the transformation of Nature through work, life experiences, and the interest in distant places are all situations that seek to value and systematize ideas from references provided by the environment in an inference to morphological principles and a national treasure within a manipulative school botany approach. Lastly, a preventive school botany can be inferred from botany contents regarding the transformation, defence, and conservation of the environment.

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