

# **BOTANY TEACHING IN PORTUGAL AND BRAZIL: ANALYSIS OF SCHOOL TEXTBOOKS AND THEIR APPLICATION IN ELEMENTARY SCHOOL CLASSES (2001- 2010)**

**Fernando Guimarães**

Institute of Education – University of Minho

Braga - Portugal

[fguimaraes@iec.uminho.pt](mailto:fguimaraes@iec.uminho.pt)

**Fernando Santiago dos Santos**

Institute of Education – Sao Paulo State University

Sao Paulo - Brazil

[fernandoss@usp.br](mailto:fernandoss@usp.br)

## **Abstract**

We have privileged the study of Botany contents in our research. Such contents derive from re-organizational approaches within the teaching of Natural Sciences at the elementary level in Portugal and Brazil. Along with the development of scientific knowledge on biological classifications and attempts to solve existing weaknesses in both countries, various governments introduced, throughout the last century, new programmatic Botany contents within the teaching of Natural Sciences at the elementary school. Thus, the teaching of Botany becomes more complex with the emergence of new realities, as well as curricular and didactic changes that emphasize such dimensional metamorphoses, which can be seen within classroom contexts and during the teaching-learning process.

We aim to study such complex dimensions within the teaching of Botany, which is placed into a knowledge area undergoing a re-organizational approach where historical and educational circumstances mark Portuguese and Brazilian realities. This knowledge area faces important changes and new challenges resulting from significant environmental and political modifications, new practises and programmatic speeches that have been heard throughout various national and international debates. Such scientific approach on Natural Sciences favours the questioning and conceptual role played by Botany, and should clearly take into consideration the existing approaches in education and science teaching.

The start point of the current study is the relevance of the teaching of Botany within the curricular and didactic structure and the importance texts have in it. Such texts come from outside the classroom and may be seen as regulating tools for the teaching practise by configuring reference universes – school textbooks and programmatic texts are examples. These texts are analysed in their specificity, articulation with the scientific speech, and relationship with the pedagogical transmission. An articulated, diachronic analysis shall be used for such aspects, i.e. with the use of an evolutionary and historical approach.

The methodological approaches taken in our investigation will be both qualitative and quantitative. So that objectives are met, the overall strategy consists of the analysis of samples of various school textbooks, which will be chosen according to their application and use frequencies throughout the Portuguese territory, and within the Sao Paulo state, Brazil. Document, content and cluster analyses will be used to do so.

We also aim to reach through several levels, as follows: i) Academic level, at which multiple mechanisms are allowed, i.e. deeper analyses of the educational processes to be studied, investigation team build-up and investigation unit selection; ii) Social level, at which results will be shared with the educational community directly involved with the study object; and, iii) Educational level, at which new dynamic procedures will be introduced in the teaching-learning process regarding Botany, with the production of elements that enhance its comprehension and, perhaps, its transformation.

The final phase of the current project aims to build a virtual environment, with a specific website, through which researchers, teachers, scholars and other educational actors from Portugal and Brazil may share the obtained results and keep a dynamic and open tool to discuss issues related to the teaching of Botany.

**Keywords** - Botany, school textbooks, elementary school.

# 1 INTRODUCTION

We have privileged the study of Botany content in our research. Such content is a result of re-organizational approaches within the teaching of Natural Sciences at the elementary level in Portugal and Brazil (2001-2010). Along with the development of scientific knowledge on biological classifications (namely taxonomy, systematics, nomenclature, history of classification systems and taxonomic schools, and biological kingdoms) and attempts to solve existing weaknesses in both countries, various governments introduced, throughout the last century, new programmatic Botany contents within the teaching of Natural Sciences at the compulsory, elementary school. Thus, the teaching of Botany becomes more complex with the emergence of new realities, and curricular and didactic changes that emphasize such dimensional metamorphoses, which can be seen within classroom contexts and during the teaching-learning process.

We aim to study such complex dimensions within the teaching of Botany, which is inserted in a knowledge area undergoing a reorganizational approach where historical and educational circumstances mark Portuguese and Brazilian realities. This knowledge area faces important changes and new challenges resulting from significant environmental and political modifications, new practises and programmatic speeches that have been heard in different national and international debates.

Such scientific approach on Natural Sciences favours the questioning and conceptual role played by Botany, and should clearly take into consideration the existing approaches in education and science teaching, as well as the theoretical confront assigned. The current study aims to set new light upon the way of understanding the curricular domain into which Botany is inserted by considering previous studies [1]; [2]; [3].

Botany is one of the most characteristic domains of Natural Sciences at the elementary level; actually, it is intentionally and extensively a core structural component and one of the subjects that traditionally and systematically define Natural Sciences. This can be corroborated by reading programmatic texts, analysing school textbooks, observing and collecting data from teaching practises, and analysing both theoretical and practical approaches in Natural Sciences.

The start point of the current study is the relevance of the teaching of Botany within the curricular and didactic structure and the importance texts have in it. Such texts come from outside the classroom and may be seen as regulating tools for the teaching practise by configuring reference universes – school textbooks and programmatic texts are examples. These texts are analysed in their specificity, articulation with the scientific speech, and relationship with the pedagogical transmission. An articulated, diachronic analysis shall be used for such aspects, i.e. with the use of an evolutionary and historical approach. Diachronic analysis shall be used for such aspects, i.e. with the use of an evolutionary and historical approach. The methodological approaches taken in our investigation will be both qualitative and quantitative. So that objectives are met, the overall strategy consists of the analysis of a sample of various school textbooks, which will be selected according to their application and use frequencies throughout the Portuguese territory, and within the Sao Paulo state, Brazil. Document and content analysis, and cluster analysis will be used to do so. Interviews with teachers (with various academic backgrounds) will be another technique to be used.

The current project aims to reach through several levels, namely: i) academic level. This allows a deeper analysis of the educational processes to be studied, investigation team build-up and investigation unit selection; ii) social level. Results will be shared with the educational community directly involved with the study object; iii) educational level. New dynamic procedures will be introduced in the teaching-learning process regarding Botany, with the production of elements that enhance its comprehension and, perhaps, its transformation.

## 2 TECHNICAL DESCRIPTION

### 2.1 Literature review

The investigation of school textbooks has clearly evidenced that Botany contents taught in Sciences during the last century, both in Portugal and Brazil, cannot be understood without getting to know the nature of educational and curricular policies, and teaching-learning methods and procedures as well. School knowledge is markedly printed with all relationships established by actors from multiple interest possibilities, focuses, transmission methods, and by considering the complexity of analyses and articulations between contents and use of school textbooks [4].

School textbooks, taken as important pedagogical, cultural and ideological instruments, contribute to the transmission and consolidation of various knowledge sets, and play a momentous role on content apprenticeship and work methods. Thus, a complex analysis of school textbooks is a consequential

source of information to characterize the teaching of Botany in Portugal and Brazil and its educational processes.

The school textbook timeline seems to rely on three large directions to which distinct disciplinary perspectives head. One of its recent investigation lines encompasses the inner Education history itself. Such analysis field investigates the inner part of educational institutions, tries to figure out the meaning of their activities, and favours the curriculum timeline. A historical approach on the curriculum leads to a study of tools through which a curriculum is established in a country at a certain moment in time. Such tools certainly include school textbooks. Their study is extremely relevant to rebuild the curriculum timeline, as every textbook is historically and geographically delimited, and is a product of a social group in a given time. In the current project, we see the textbook as a differentiated didactic and pedagogical source, concerning the school culture, "whose production corresponds to a complex configuration involving text, shape and speech, [being] a combination of knowledge/ skills/ (in)formation" [5].

There is a difference between the defined curriculum in a programme and the one in a school textbook: whilst the former is a prescribed curriculum, the latter is merely a suggested curriculum, i.e. a possibility of the first. That happens because the school textbook is always a subjective interpretation of its authors, who rebuild the meaning of prescribed curricula. As a consequence teachers and pupils are limited and depend on the view authors have over the textbook, as most curricular decisions on the selection and content/activity order, as well classroom applications, have been taken in the textbook [6]). That leads to two conditions: i) makes teachers be less autonomous, as they many times use only the textbook to prepare their classes, and ii) confines the pupil's perspective, whose learning process is strongly tied with the filtered content of the textbook author's subjective view. Thus the school textbook is a tool to examine pedagogical and didactic strategies that follow curricular contents; school textbook studies, so to say, are a way to oversee the evolution of educational contexts, as curriculum interpretations and pedagogical practises are found in them [7].

The "school textbook, as any other teaching means, will always be a means, and cannot be a goal itself" [8]. Many authors, such as [9], [10], [11], consider the textbook as a core piece within the teaching-learning process. By realising that there is always a dominant approach, we can verify whether school textbooks are representative or reflect an approach, as a dominant approach at a certain moment conditions an activity (e.g. how a scientific area is introduced to society). It is also important that school textbooks turn scientific speech into intelligible didactic speech to be understood by all pupils [12].

## 2.2 Plan and methods

The start-point for choosing a methodological approach relies upon the very study character, the nature of the investigated object, and the topic specificity. Such analysis approach is used to whom an approach represents "a world view that defines for its holder, the nature of the 'world', the individuals place in it, and the range of possible relationships to that world" [13]. It also stands for a way of investigation focused on a "meaning frame" [14], which gives foundation to an investigative conceptual structure.

We aim to analyse how Botany has been taught in elementary school textbooks and how it has been applied during classes in Portugal and Brazil. Our interpretative and critical approach focuses on multiple perspectives by examining texts (school textbooks on Natural Sciences) and carrying out interviews with key-informants. Such research depends upon the interpretation of what is understood about: a) the formal teaching of Natural Sciences (and more particularly, of Botany), b) the scientific knowledge, and c) the teaching practise.

Essentially, the current investigation follows interpretative approaches on study object analyses – it does not follow the sequence that goes from theory to hypotheses, with data collection and conclusion setting based on hypothesis testing that originated from the general theory. By considering the available concepts, one may say that in interpretative investigation there is a constant two-way flow between theory and data collection – there is no rigid set of predetermined steps that, "un tel processus est un modèle idéalisé; en d'autres termes, il est trop beau pour être vrai!" [15]. Thus, investigation resides on educational processes, works systematically with complex data, and precisely emphasizes such complexity of the educational reality.

The current project is based upon a set of presumptions that support the prospective investigation: throughout the 20th century, the teaching of Natural Sciences evolved in structure, content, pedagogical methods and so forth; such teaching, though, is still influenced with traditional-like conceptions ([16]; [17]). Such changes have been considerably marked with both the evolution of Sciences and new approaches established for Education Sciences, Pedagogy and (particularly) Didactics. Teachers can develop professional expertise by making use of school textbooks [18].

Moreover, school textbooks allow researchers to verify how Botany has been taught at the elementary level – these books are, then, a relevant documental corpus when analysing content and pedagogical methods, and may also reflect educational policies, teaching regimes and programme changes. By analysing school textbooks, one can un-build Botany teaching and rebuild such teaching, and also understand the evolution of several concepts related to Botany. It seems to be important to study school textbooks and their application during classes by considering the following: i) the set of presumptions; ii) the fact that various studies document the significant role played by school textbooks over teachers and pupils ([19]; [20]; [21]; [22]; [23]); and, iii) the fact that one of the factors that condition the use of textbooks certainly resides on the suggested content.

Thus, we would like to address these questions: What relationships have been established between Botany and elementary school textbooks, between Science and Natural Sciences? Which significant events, within educational reforms, have taken place in school textbooks in terms of content, pedagogical approach, and scientific concepts related to Botany? What trends can be seen on content and time levels concerning textbook publications? Is there any specific methodological part on Botany contents in all school textbooks? How are books chosen, and which ideology is behind such choices? Is such approach really representative in the textbook? What relationships are there among daily lives, cultures and school textbooks, mainly what concerns the gap Science fills in both teachers' and pupils' lives? Is that only information, representation, imagination? Is that know-how-to-do? What kind of relationship does the textbook set among past, present and future? How does the textbook represent and structure ages, of relationship does the textbook set among past, present and future? How does the textbook represent and structure ages, cognitive maturity, and action on its target-readers? Finally, what could be the kind of unique approach on Botany teaching if Botany contents are not found in school textbooks in Portugal and Brazil?

We aim to: i) Contribute to the current knowledge on Botany within elementary school textbooks in Portugal and Brazil; ii) Understand the relationships established among the mentioned problem, educational reforms, programmes and school textbooks; iii) Grasp the importance of school textbooks on Botany teaching; iv) Interpret the evolution of Botany concepts, the methodological approaches and contents of school textbooks and the way these influence the teaching of Natural Sciences at the elementary level in Portugal and Brazil.

We chose the document investigation (reference research, legislation and textbook collection) in order to investigate Botany contents in school textbooks and its application during classes in Portuguese and Brazilian elementary schools. Such method also favours the establishment of interdependent relationships between theoretical build-up and empirical data on a constant counterpart basis and mutual support. The document investigation is appropriate for the collection of printed data that do not vary according to human trends (but selective information may also be grasped – such information is tendentious as documents bear only what has been decided to be reported, being inconvenient aspects omitted).

The data analysis method is a core subject in the current research, as it is important to find enough evidence to ease describing and interpreting the studied situation by considering such reality particularities. It is crucial to collect information from both school textbooks and teaching practise through appropriate tools, having in mind the analysis frame, presumptions, objectives and study object. Thus, a set of tools will be used so that the mentioned objectives are met:

a) The content analysis, which essentially consists of a systematization effort, attempts to make contents fully analyzable and involves relatively complex procedures. It is split into various phases that engulf the determination of category and analysis units so that different features on Botany in Portuguese and Brazilian school textbooks are gathered.

b) The 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 intra-variations 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.

c) An extensive analysis implies the collection of oral reports from interviews carried out with key-informants [24].

Thus, we aim to gather opinions and unique reports on either events or cases [25]. Such strategy, on a micro scale basis, allows researchers to collect data that might clarify certain aspects regarding the teaching of Botany, education and teaching practise in Portugal and Brazil.

By considering the nature of the project, some results may be foreseen during its execution: the way scientific knowledge is placed inside schools; how it is translated into school knowledge; how school

textbooks can mirror scientific and technological progress; and the way teachers within classrooms face such situations (or not, in case they are missing).

Regarding the place school textbooks have in the elementary level, we ought to consider the influence of such learning resources and the way they are deeply tied to the decisions taken by teachers during their practises. By doing so, we may verify that school textbooks lead to teaching practices throughout the teaching-learning process.

### 3 FINAL CONSIDERATIONS

The present project has been outlined for a long-term research involving different institutions in Brazil and Portugal. We clearly know that such efforts will need deeply defined methodological approaches and detailed steps so that planned objectives are attained.

Moreover, we also understand that our goals will add useful information regarding school textbooks in both countries, filling up a gap in the comprehension of how Botany is taught at schools.

### References

- [1] Carvalho, G.S., & Silva, R. (2005). First images in primary school textbooks as didactical obstacles in the construction of science concepts: the example of digestion. ESERA Conference.
- [2] Guimarães, F. (2007). *A Botânica nos manuais escolares dos Ensinos Primário e Básico (1.º Ciclo) no século XX em Portugal*. Braga: Universidade do Minho/Instituto de Estudos da Criança. [PhD Thesis].
- [3] Santos, F. S. (2009). *A construção de material didático contextualizado como subsídio para as aulas de Ciências do Ensino Fundamental-II: uma experiência colaborativa em Cubatão*. São Paulo: Universidade de São Paulo. [PhD Thesis (submitted)].
- [4] Guimarães, F., (2008). Saberes escolares de Botânica nos Livros Didáticos de Ciências da Natureza dos Ensinos Primário e Básico (1.º Ciclo). Análise ao seu estatuto curricular no último século em Portugal. *Plures – Humanidades*, 10, pp. 27-45.
- [5] Magalhães, J., (2006). O Manual Escolar no Quadro da História Cultural. Para uma historiografia do manual escolar em Portugal. *Sísifo. Revista de Ciências da Educação*, 1, 5-14. Consultado em Março, 2007, em <http://sisifo.fpce.ul.pt>
- [6] Cavadas, B. F. B. P., (2008). *A evolução dos manuais escolares de Ciências Naturais do ensino secundário em Portugal 1836 – 2005*. Salamanca: Universidad de Salamanca/Facultad de Educación. [Tesis Doctoral].
- [7] Cabral, M., (2005). *Como analisar manuais escolares*. Lisboa: Texto Editora.
- [8] Molina, O. (1987). *Quem engana quem: professor x livro didático*. Campinas, SP: Papirus.
- [9] Carvalho, G. S., Silva, R., & Clément, P., (2007). Historical analysis of Portuguese primary school textbooks (1920-2005) on the topic of Digestion. *International Journal of Science Education*, 29, 2, February, 173-193.
- [10] Guimarães, F., (2007). *A Botânica nos manuais escolares dos Ensinos Primário e Básico (1.º Ciclo) no século XX em Portugal*. Braga: Universidade do Minho/Instituto de Estudos da Criança. [Tese de Doutoramento].
- [11] Guimarães, F., Lima, N., & Magalhães, J., (2007). Conteúdos que privilegiam diferentes dimensões do ensino da Botânica. Análise de manuais escolares dos Ensinos Primário e Básico (1.º Ciclo). In J. M. Sousa (Pres.) et al. (Orgs.), *Educação para o sucesso: Políticas e Actores. Vol. 2. Livro de Actas do IX Congresso da SPCE*, pp. 1397-1408. Funchal: Sociedade Portuguesa de Ciências da Educação. (CD-ROM).
- [12] Santos, F. S., (2006). A Botânica no Ensino Médio: Será que é preciso apenas memorizar nomes de plantas? In C. C. Silva, (Org.), *Estudos de história e filosofia das ciências: Subsídios para aplicação no ensino*, pp. 223-243. São Paulo: Editora Livraria da Física.
- [13] Guba, E., & Lincoln, Y., (1994). Competing Paradigms in Qualitative Research. In N. K. Denzin, & Y. S. Lincoln, *Handboock of Qualitative Research*, pp. 105-117. Thousand Oaks: Sage.
- [14] Giddens, A., (1996). *Novas regras do método sociológico*. Lisboa: Gradiva.
- [15] Giordan, A., (1999). *Une didactique pour les sciences expérimentales*. Paris: Éditions Belin.

- [16] Mélcón Beltrán, J., (2000). Currículo escolar y lecciones de cosas. In A. T. Ferrer, (Edit.), *El libro escolar, reflejo de intenciones políticas e influencias pedagógicas*, pp. 135-160. Madrid: UNED.
- [17] Gómez Rodríguez de Castro, F., Somoza Rodríguez, J. M., & Badanelli Rubio, A. M., (2003). Los manuales de Lecciones de cosas. In A. J. Eguizábal, et al., (Coords.), *XII Colóquio Nacional de Historia de la Educación – Etnohistoria de la Escuela*, pp. 377-388. Burgos: Universidad de Burgos/Sociedad Española de H.<sup>a</sup> de la Educación.
- [18] Tormenta, J. R., (1996). *Manuais escolares: Inovação ou tradição?* Lisboa: Instituto de Inovação Educacional.
- [19] Castro, R. V., (1999). Já agora, não se pode exterminá-los? Sobre a representação dos professores em manuais escolares de Português. In R. V. Castro, A. Rodrigues, J. L. Silva, & M. L. D. Sousa, (Orgs.), *Manuais escolares – estatuto, funções, história. I encontro internacional sobre manuais escolares*, pp. 189-196. Universidade do Minho/Instituto de Educação e Psicologia.
- [20] Martínez Losada, C., Vega, P., & García Barros, S., (1999). Qué procedimientos utiliza el profesorado de Educación Primaria cuando enseña y cuáles tienen mayor presencia en los textos de este nivel. In R. V. Castro, A. Rodrigues, J. L. Silva, & M. L. D. Sousa, (Orgs.), *Manuais escolares – estatuto, funções, história. I encontro internacional sobre manuais escolares*, pp. 325-336. Universidade do Minho/Instituto de Educação e Psicologia.
- [21] Sá, J., Varela, P., Carvalho, G., & Guimarães, F., (1999). Manual do professor para o ensino experimental no 1.<sup>o</sup> Ciclo – um projecto de investigação-acção centrado na escola. In R. V. Castro, A. Rodrigues, J. L. Silva, & M. L. D. Sousa, (Orgs.), *Manuais escolares – estatuto, funções, história. I encontro internacional sobre manuais escolares*, pp. 441-458. Universidade do Minho/Instituto de Educação e Psicologia.
- [22] Proença, M., C., (2000). Los manuales escolares: Reflejo de influencias pedagógicas e intenciones políticas. Una reflexión desde la experiencia portuguesa. In A. T. Ferrer, (Edit.), *El libro escolar, reflejo de intenciones políticas e influencias pedagógicas*, pp. 319-326. Madrid: UNED.
- [23] Colon Cañellas, A. J., (2003). La materialidad trascendente. Del objeto libro a la cultura ideológica de la escuela. In A. J. Eguizábal, et al., (Coords.), *XII Colóquio Nacional de Historia de la Educación – Etnohistoria de la Escuela*, pp. 917-926. Burgos: Universidad de Burgos/Sociedad Española de H.<sup>a</sup> de la Educación.
- [24] Crabtree, B. & Miller, W. L. (1992). *Doing Qualitative Research*. Newbury Park: Sage.
- [25] Almeida, J. F., & Pinto, J. M., (1982). *A Investigação nas Ciências Sociais: Estudo Elaborado no Gabinete de Investigações Sociais*. Lisboa: Editorial Presença.