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# Anglo-American Influence on the Teaching of the Natural Sciences in Primary Schools of 19th - Century Brazil

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## Anglo-American Influence on the Teaching of the Natural Sciences in Primary Schools of 19th - Century Brazil <sup>1</sup>

2. In nineteenth-century Brazil, one can identify two great movements in which educational theories and practices were transplanted from Europe and the United States to Brazil. The first centered on the secondary school curriculum, and began with the founding of the Imperial College Pedro II in Rio de Janeiro in 1838. The college was created and supported by the imperial government and served as a model for private and public secondary schools in the provinces. Throughout the 1800s, French curriculum theory and organization shaped the debates about the purpose, content and organization of the college, and to a larger extent about secondary education in general.

The second transnational movement centered on the content and teaching methods in the primary school. Ever since the Empire of Brazil was established in 1822, and the Constitution amended by the Additional Act in 1834, the responsibility for primary education fell to the provinces, while that of superior education was the exclusive responsibility of the imperial government.

3. The provincial governments, however, failed to provide adequate primary schooling for its populaces. What typified education in the distressingly small number of primary schools throughout the realm were scant recourses, a dearth of didactic materials, a predominance of rote and verbal methods of instruction, and unprepared and incompetent teachers. Brazilian legislators grappled with the issues of how to expand primary schooling to the masses and modernize the teaching methods used in the classroom. With reference to this latter concern, the authorities looked abroad for innovations that could be adopted and adapted to the Brazilian reality.

### Factors Influencing Brazilian Science Education

4. The imperial government located in Rio de Janeiro, nevertheless, felt it was its responsibility to improve all levels of education in the country -- and the teaching of science in the primary schools. The government's interest in science was influenced by several factors; (1) advances in science and technology; (2) scientists' advocacy for science education; and (3) science education in Europe and the Americas.

5. Developments in technology and science in the 19th century were numerous and impressive. Inventions such as the telegraph, telephone, steamboat, photography and refrigerator influenced daily life. Scientific developments such as vaccines, skin grafting, the seismograph; and the discovery of mitosis, the moons and canals of Mars provided new experiences and opportunities for citizens everywhere. Eminent men of science like Pavlov (conditioning), John

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<sup>1</sup> Numbers preceding paragraphs refer to the PowerPoint slides of the presentation.

Stuart Mill (post hoc analysis), Wilhelm Wundt (psychological research) and Louis Pasteur (isolation of strains of bacteria) also extended the boundaries of their respective areas of knowledge (Ochoa & Corey, pp. 179-198). Technological and scientific developments were also felt in Brazil, especially in the second half of the 19th century

6. Many scientists in the 1800s were active in defining public policy on science education. They defended the introduction of science studies in the curricula of elementary and secondary schools. In some instances, they argued for complimenting classical studies with science disciplines and in other instances for replacing classical studies altogether. Some of the luminaires included the Irish physicist John Tyndall, the French physiologist Claude Bernard, the British physicist Michael Faraday, the German chemist Justus Von Liebig, the British polymath and astronomer John Herschel, the Scottish geologist Charles Lyell, the French microbiologist Louis Pasteur, and the British botanist Joseph Hooker (DeBoer, p. 8).

7. By the 1880s, many countries confirmed the increasing interest in science education in primary schools. For example, the United States, England, Norway, Austria, Japan, Argentina, Prussia, Switzerland, Holland, Belgium and Greece promoted the study of natural history for young students. Even France decreed in 1882 that the teaching of physical and biological sciences in primary schools was compulsory. As observed by the parliamentarian Rui Barbosa, the ubiquity of science education at the primary level in Europe and the Americas was a powerful argument for the inclusion of science in the Brazilian school curriculum (Barbosa, p. 265).

### The Reform of Leôncio da Carvalho

A serious effort to reform primary education – and science education -- was implemented by the Minister of the Empire Carlos Leôncio da Silva Carvalho. He was greatly impressed with education in England and the USA. In 1879 he instituted a sweeping and enduring reform that redefined all levels of Public Instruction (PI). The Minister believed that public instruction, both primary and secondary, was the first condition for any material and moral progress, since all other political and social institutions depend on its effectiveness. Public education creates knowledgeable and free men who contribute to the development of social institutions and the overall progress of the nation. In support of his view, Carvalho cites the orator Daniel Webster, who in a speech to the American Congress stated that the future of the institutions of the country depend upon on the knowledge of the masses (Chizotti, pp. 181-182). Cavalho's sentiments were clearly influenced by the American experience and ideals on public education.

9. The Carvalho reform introduced changes in all levels of education. He opened schools to private initiatives, much as in the US. With respect to primary education, he divided the elementary curriculum into a lower and an upper cycle. He gave great importance to the Intuitive Method, that is, the Teaching of Objects method. He included this study in the lower grades of the primary school and required teacher normals to train prospective teachers in the method. In the upper grades, he introduced the study of basic notions of the natural sciences: chemistry, physics, geology and biology (Almeida, p. 179). Carvalho also supported efforts to develop student compendiums and teacher manuals on Object Teaching and in the traditional areas of science.

10. With respect to the reform of 1879, Carvalho advocated the adoption of manuals on progressive methodologies for use in teacher normals. Several French manuals on the Intuitive Method were available but considered inadequate. Carvalho, however, was helped in this effort by Rui Barbosa (1849-1923), one of the great parliamentarians of his time and one of the defenders of educational reform in Brazil in the 19th Century. Lourenço Filho, the eminent Brazilian educator, considered Barbosa one of the great pedagogues of his time (Lourenço Filho, p. 12). Barbosa was imbued with a brilliant mind and possessed a vast knowledge of educational developments abroad. He was an avid defender of Anglo-American political, social and educational ideas. His knowledge of educational developments in Europe and the United States helped shape his vision of a modern Brazilian primary school.

Rui Barbosa had a particular interest in the advances in science teaching in England. As a voracious reader of foreign literature, especially British literature, Barbosa had extensive knowledge of debates and theorizing in England about the relationship between science, society, and education. His curiosity introduced him to the ideas of Stuart Mill, Darwin, Spencer, Huxley, Thackeray, George Elliot, Tennyson, Robert Browning, and others (Pires, p.16).

### Rui Barbosa and *Licoes de Coisas*.

11. In his 1879 reform, Carvalho argued for the adoption of manuals on progressive methodologies for use in the teacher normals. Several French manuals on the Intuitive Method were circulating in Brazil at the time, but their content did not correspond to what their titles suggested. In 1881, Rui Barbosa, an influential Brazilian statesman and parliamentarian wrote a manual on Object Teaching that was titled *Licoes de Coisas*. In 1882, the new Minister of the Empire, Felipe Franco de Sá, approved Barbosa's text for use in the schools of the Municipality of Rio de Janeiro and after some delay 1500 copies were printed in 1886. The *Lições de Coisas* enjoyed considerable success in Brazil. It was most widely disseminated teacher's manual in Brazil (Johnson, 11-12). Barbosa's work passed through various editions, and during the final years of the empire (1886-1889) and the greater part of the Old Republic (1889-2930), it was the only officially sanctioned teachers manual in Brazil (Johnson, 42-43).

#### 12. *Picture of Barbosa's Manual.*

13. The text of Rui Barbosa proposed three principles that should guide teachers when educating children. The students should: (1) have contact with objects, natural phenomena, and industry during the lessons; (2) use their five senses to learn about the characteristics of objects and phenomena; and (3) relate their observations about characteristics to the words that represent them.

## Normal Calkins and *Primary Object Lessons*<sup>2</sup>

14. Barbosa's *Lições de Coisas* was a translation of a very popular work written by Norman Calkins and published in the United States in 1870 under the title *Primary Object Lessons*.

15. Norman Calkins was an important figure in American Education during the second half of the 19th Century. He began his career as a primary school teacher, and later became headmaster of the Central High School in Gainesville, New York. In 1845, he was named County Superintendent of Education, and the following year he moved to New York City where, among his different activities, he was editor of the educational magazine, *Student*. Immediately before and during the Civil War Calkins taught at Oswego College, in New York State, which was one of the first institutions in the country to explore Pestalozzi's ideas on teaching children. Calkins was elected as Assistant Superintendent of Primary Schools of New York City in 1862, at which time he also taught a course, Principles and Methods, in the Saturday Normal School. Also, during his career he played a central role in the founding of the National Education Association, whose presidency he assumed in 1886 (Johnson, pp. 19-20).

While he was at Oswego College, Calkins published his first pedagogical work, titled *Primary Object Lessons for a Graduated Course of Development* (1861). The text provided suggestions on teaching different school subjects by exposing children to common objects according to an approach suggested by Pestalozzi. Nine years later, the manual was republished under the abbreviated title of *Primary Object Lessons*. It was this 1870 edition that became Calkins' signature work and established his reputation as one of the most influential proponents of Object Teaching and of Pestalozzian-based pedagogy in the United States (Lourenço Filho, pp. 75-76).

16. The psychological principles supporting Calkins text adhered to Pestalozzi's ideas on pedagogy. The principles were: (1) the "habit of attention" develops when curiosity is stimulated and the love of physical activity is sated; (2) knowledge of the world is obtained through the senses; (3) developmentally, sensation, perception, comparison, simple memory and imagination appear in this order; and (4) learning is achieved from the simple to the complex, from the unknown to the known, from things before their ideas represented by words.

17. Calkins' *Primary Object Lessons* was an immediate success. For decades it enjoyed an enduring popularity with educators, both in the United States and abroad. By 1898 it had passed through 40 editions in the United States and was translated into Japanese and Spanish. It was also praised and recommended by Buisson, the French Minister of Instruction (Valdemarin, p. 118). In sum, Calkins' manual, through the translation of Rui Barbosa, made a significant contribution to Brazilian education reform in the 1880s, 1890s and early 1900s.

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<sup>2</sup> The information on Calkins and the *Primary Object Lessons* was originally published in the 2005 article by Lorenz and Vechia.

### Science Primers<sup>3</sup>

18. The reform of primary education implemented by Leoncio da Carvalho and the publication of Rui Barbosa's *Lições de Coisas* contributed to the creation of an environment of receptivity to innovations in the teaching of science. These innovations included the production of science textbooks intended for young audiences in Brazil.

19. As part of this editorial phenomenon, the Imperial Government, together with the publisher Laemmert, introduced science textbooks in the Municipality of the Court. On August 22, 1882 the Council of Public Instruction approved for the second cycle of primary schools a collection of seven science textbooks from abroad. The collection was titled *Science Primers*. In Brazil it was known as the *Library of Intuitive Teaching: Natural Sciences*.

20. The collection consisted of the following volumes: *Physical Geography*, *Geology*, *Astronomy*, *Chemistry*, *Physics*, *Botany* and an *Introduction* to the collection. The texts were written by eminent professors e men of science of Great Britain. Archibald Geikie (1835-1924), author of the geography and geology texts, was Director of the Geological Survey of Scotland. Norman Lockyer (1836-1920), an astronomer, was a member of the Royal Society of London. Henry Enfield Roscoe (1833-1915) was professor of chemistry at Owens College in Manchester, England. Balfour Stewart (1828-1887) taught physics at Queens College in Manchester, and the University of Edinburgh. Joseph Hooker (1817-1911) was Director of the Royal Botanical Garden, and Thomas Huxley (1825-1895), who wrote the introductory text, was a physiologist and defender of the evolutionary theory of Charles Darwin.

21. The Science Primers were initially published by the Macmillan Company in London and later by the Appleton and the American Book Company, both based in New York. The Appleton publishing house, the more predominant of the two companies, specialized in the publication of textbooks for children. The science primer collection was very popular in the United States and abroad. The texts were translated into German and adopted in Scandinavia and countries such as Spain and Italy.

22. What characterizes the collection is that it considered contact with nature as the primordial activity of science teaching; it gave young students opportunities to participate more actively in their learning. According to advertisements, the aim of the primers was to transmit scientific information in a comprehensible and interesting way for young students, and to discipline their thinking in preparation for further systematic studies. Thus, one finds in the texts simple experiences and engravings that are intended to stimulate the curiosity of the child and facilitate the memorization of concepts.

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<sup>3</sup> The information on the *Science Primers* was originally published in the 2007 article by Lorenz.

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