

RUI BARBOSA AND ARGUMENT FOR TEACHING THE NATURAL
SCIENCES IN THE
BRAZILIAN PRIMARY SCHOOL OF THE NINETEENTH CENTURY.

Karl M. Lorenz, Ed.D.
Graduate Program in Education
Sacred Heart University
U.S.A.

ABSTRACT:

This paper discusses the ideas of Rui Barbosa about teaching science in the Brazilian primary school. Rui Barbosa was one of the great parliamentarians of his time, and one of Brazil's most articulate advocates of educational reform in the nineteenth century. Lourenço Filho, the eminent Brazilian educator, considered Barbosa one of the great pedagogues of his time, stating that he was the first nationally prominent figure to approach problems of pedagogy and method from a philosophical, social, political and technical perspective (Lourenço Filho, 1966, p.12). Imbued with a brilliant mind, a gift for elocution, and a vast knowledge of educational developments abroad, Barbosa was an avid proponent 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, and resulted in the first official document of the Imperial Government to address the issue of science education in Brazil.

Keywords: ideas of Rui Barbosa about teaching science.

RESUMO:

Este trabalho discute as idéias de Rui Barbosa sobre o ensino de Ciências na Escola Primária Brasileira. Rui Barbosa foi um dos maiores parlamentares de seu tempo, e um dos maiores articuladores do Brasil que advogava a reforma educacional no século dezenove. Lourenço Filho, o eminente educador brasileiro, considerava Barbosa, um dos maiores pedagogos de seu tempo, e a primeira proeminente figura nacional a encarar problemas de pedagogia e método a partir de uma perspectiva filosófica, social, política e técnica (Lourenço Filho, 1966, p. 12). Determinado, com uma mente brilhante, um dom para eloquência, e um vasto conhecimento do desenvolvimento educacional no estrangeiro, Barbosa era um ávido proponente das idéias políticas, sociais e educacionais anglos americanas. Seu conhecimento do desenvolvimento educacional na Europa e nos Estados Unidos ajudaram-no a lapidar a visão de uma Escola Primária Brasileira Moderna, e resultaram no primeiro documento oficial do Governo Imperial a contemplar o assunto da Educação de Ciências no Brasil.

Palavras-chave: ensino de Ciências, idéias educacionais de Rui Barbosa.

Primary Education in XIX Century Brazil

From the proclamation of the Empire in 1822 to the founding of the Republic in 1889, the Constitution of Brazil confirmed the autonomy of the provinces in matters related to primary and secondary education, while relegating to the Imperial Government the responsibility for basic education in the Municipality of the Court, and for higher education throughout the realm. During the empire, however, the provincial governments made little progress towards providing adequate primary and secondary education for its populaces. What passed for secondary education was a conglomerate of independently functioning courses and a small number of private secondary institutions, few of which offered science courses (Lorenz, 2003, p.71-73). As for primary education, there were too few schools in the provinces to accommodate the growing number of children needing instruction. In 1878, it was estimated that less than 2% of the nine million free inhabitants were enrolled in primary schools, which was far less than in major European countries (Lourenço Filho, 1966, p.56). In 1867 and 1875 the Ministry of the Empire conducted surveys of public and private education in the provinces and the Municipality of the Court. A comparison of the data on fourteen provinces investigated in both surveys shows that during the eight-year period, enrollment in the primary schools increased by 68% while the number of public schools tending these students increased by 6%, with private schools accounting for the rest. Clearly, surging enrollments were outpacing the creation of new public schools (Almeida, 167-169).

The inadequate number of schools, however, was one problem; another was the poor quality of instruction. What typified education in the majority of schools of the period were scant recourses, a dearth of didactic materials, a predominance of rote and verbal methods of instruction, unprepared teachers, and an absence of administrative oversight. A large number of the schools were one-teacher enterprises, many conducted in the home of the teacher, or in the estates of wealthy landowners. Some were day schools, others only offered night courses. Students could be both children and adults. Institutions were public and others private, some of which were run by individuals and others by charitable and patriotic societies. Up to the final quarter century, the subjects usually taught included the essentials of reading and writing, some religious instruction, and the four arithmetic operations. Science teaching, even in its most rudimentary form of nature study, was not part of the program. .

In 1878 Leôncio de Carvalho was appointed Minister of the Empire, and immediately set out to make basic education more accessible. Carvalho adhered to the Liberal Party position that the insufficient number of schools was due to restrictions placed on the founding of private schools. Hence, in April 1879, he decreed a reform of primary and secondary education in the Municipality of the Court, and of superior education throughout the empire. The reform is best known for advocating “freedom of education,” which created the conditions for individuals and entities to establish private primary and secondary schools with limited oversight by the government.

Carvalho also sought to broaden the primary curriculum to include the study of history and geography of Brazil, more extensive study of the Portuguese language, and an extended mathematics program, that also included the study of the metric system which had been adopted in Brazil in 1863 (Faria Filho, 2000, p.139). While the reform was restricted to the Municipality of Rio de Janeiro, it emanated from the imperial Government and was therefore a de facto model for the provinces.

Parliamentary procedure dictated that the Minister’s reform be approved by Chamber of Deputies and the Senate, after it was examined by the Commission of Public Instruction which was established in 1880. Rui Barbosa was asked to head the commission and write up its findings. Barbosa was a lawyer and journalist who in 1879 was elected to the Chamber of Deputies as a representative from tropical northeastern state of Bahia. In writing up the report, Barbosa presented his own ideas on a national educational reform, which he believed would more effectively modernize the current system of education. He presented two documents to the Chamber of Deputies, one in 1881, on higher education, and another in 1882, on primary and secondary education (Lourenço Filho, 1966, p.45). His proposal for reform of primary education was part of the 1882 document, which was published the following year. Because of new issues that immediately took precedence after Barbosa submitted the report to the Chamber, his reform failed to receive proper attention from the legislature.

The Intellectual Heritage of Rui Barbosa

Rui Barbosa is acknowledged as one of the most important public figures of late nineteenth and early twentieth-century Brazil. Numerous biographies, hundreds of

monographs, newspaper and journal articles, and countless volumes of documented materials comment on his unique and elevated position amongst his contemporaries during the final years of the Empire and the first decades of the Republic. His admirers have variously characterized him as a voice of the liberal tradition, a defender of civil rights, and an abolitionist. Indeed, he was a linguist, a jurist, a parliamentarian, a framer of the Constitution, a Minister of Finances, and a candidate for the presidency of the Republic (Johnson, 1977, p.15).

From his earliest days Rui Barbosa had come to appreciate the customs, traditions and institutions of England and the United States. He was not shy about exhibiting his Anglo-American affinities, as when he declared from the floor of the Senate, “I was born to esteem the English and the Americans as well as my own people, and I grew to admire with the same affection and the same veneration these two nations, from whose respective histories modern constitutions evolve. I studied their examples and institutions, each with the same interest” (Pires, 1949, p.24). Being a “spiritual child of the Anglo-Saxons, and the most outstanding example of their personality,” (Pires, 1949, p.19) Barbosa was a voracious reader of British literature, and this led him to once proudly proclaim that no one in Brazil had a bigger library or had studied English things more than he (Pires, 1949, p.55). Indeed, his readings had immersed him in the intellectual ferment of his day, and had made him conversant with the ideas of Stuart Mill, Darwin, Spencer, Huxley, Dickens, Thackeray, George Elliot, Tennyson, Robert Browning, and many others.

In March 1882, in the midst of a debate on the parliamentary system of governance, Barbosa stunned his colleagues, who for decades had looked to France for guidance in social and political affairs, when he boldly asserted that “in matters of freedom, in political liberty, in the knowledge and experience of constitutional guarantees, England is entitled to teach France and the French liberals” (Pires, 1949, p.31-32). Barbosa rejected France’s structuralist approach to governance, which reverberated in its classical educational system that he found too organized, formalistic, and inflexible. For a free and democratic Brazil, education would be universal, and it would advocate individual liberty, develop the creative faculties, and enrich the spirit of its future citizens.

The Importance of Science Education

In the 1882 report, Barbosa addresses numerous issues, one of them being the teaching of science at the primary level. Barbosa felt compelled to convince his readers of the importance of primary science education, and the manner in which the sciences should be taught. After all, at that time, most politicians and educational authorities favored the classical-humanistic tradition in education, and accepted, as uncontested, its supremacy over the utilitarian scientific enterprise. Barbosa was faced with the challenge of changing their minds on this issue and of redirecting their priorities.

Barbosa firmly believed in the proposition that the sciences and social and national development were inextricably related. He writes that, “The entire future of our species, all the governments in our societies, all of the moral and material prosperity of the nations depends on science, just as the life of man depends on air.” He viewed science as a liberating force that would lead men from the shades of ignorance to the light of freedom. If, as he states, “science and freedom are brothers,” then science has the potential of freeing men from their social and political bonds, and education was the medium by which this could be accomplished (Ribeiro, 1967. p.44).

Barbosa was aware of developments abroad. In the decades preceding his published report, he and the rest of the world were witness to countless contributions in the technology and the sciences. Regarding technology, there was the invention of the telegraph and telephone, photography, the refrigerator, the phonograph, dynamite, the dry cell battery, the light bulb, and a host of other marvels. For the sciences, there appeared the periodic table, vaccines, skin grafting, the seismograph, the photometer; the discovery of mitosis, cathode rays, and the moons and canals of mars. Pavlov began his work on conditioning, Wilhelm Wundt founded a psychological research laboratory at the University of Leipzig, John Stuart Mill proposed post hoc analysis, and Louis Pasteur isolated the streptococcus, staphylococcus and pneumococcus bacteria, to name just a few individual accomplishments (Ochoa and Corey, 1995, p.175-198).

In concert with these advances, many scientists had or were actively campaigning to make science part of the school curriculum. Among these were John Tyndall, Claude Bernard, Michael Faraday, Justus Von Liebig, John Herschel, Charles Lyell, Louis Pasteur, Joseph Hooker, Herbert Spencer and Thomas Huxley. In the second half of the nineteenth

century this chorus of voices called for the replacement of the study of the classical languages in the curriculum with science courses (DeBoer, 1991, p.8).

Barbosa's appreciation of the sciences can be traced to his familiarity with the writings of this group of luminaries. He was particularly affected by Spencer's ideas on the role that science played in the evolution of social institutions, especially his insight that the inclusion of the sciences in the curriculum is part of an evolutionary process. Barbosa embraced Spencer's belief that any study of science "represented a natural movement away from authority, formality, and dogmatism and toward understanding, meaning, and freedom" (DeBoer, 1991, p.15).

Spencer made this clear when he noted that the study of physics, chemistry and biology was important because it provided the student with the vital knowledge that creates and sustains the great industrial nations. Physics had given us the lever, wheel and axle, the steam engine and the smelting furnace. To Chemistry we owe the manufacture of gunpowder, sugar refining, bleaching and dyeing. Through Biology we understand agricultural production, and through Physiology, the life-saving issues of health (DeBoer, 1991, p.13). An educational system that did not recognize these advances and inform its students about the contributions of science and technology to human and social progress and well-being was not worthy of its name.

The State, Barbosa argued, is duty-bound to propagate the sciences, and this must be undertaken as an obligation of the highest order. It should include the study of the sciences in all "circles of public instruction." He cautioned, however, that it should not be science that mixes the real with ideology, the supernatural and arbitrary abstractions; but rather the true science that relies on demonstrable facts, investigation, classification and explanation.

Barbosa bolsters his argument by referring to what he calls the "universal authority of the facts." One need only look to the Prussian primary schools that promote the study of natural history, and the elementary schools in Saxony and the dukedom of Baden, which include the study of basic notions of physics and the life sciences, often applied to the rural economy. Similar developments could be seen in Sweden, Norway, Holland, Belgium, Greece, Austria, Japan, Argentina, and France, which in March 1882, decreed that the teaching of the physical and life sciences be mandatory in the elementary school. Barbosa also examined science education in the United States, singling out for particular attention developments in the states of Ohio and Illinois. He even notes that in the Philadelphia

exposition of 1876, the state of New Jersey exhibited more than 15,000 compositions of students, an exceptionally large number of which had scientific themes (Barbosa, 1947, p.261-265).

As further evidence of the increasing importance given to science instruction in England, Barbosa recounts the findings of various commissions convened to examine the matter. Most notable was the 1864 commission comprised of Lord Lyttelton, Lord Derby, and Sir Stafford Northcote, among others, which argued that the primary school curriculum was not complete if science instruction was omitted. The members concluded that the mental faculties of the child could be trained through a variety of scientific activities: “the study of the natural sciences develops, better than any other studies, the observing faculties; disciplines the intellect, by teaching induction, as well as deduction; supplies a useful balance to the studies of language and mathematics and provides much instruction of great value for the occupations of after life” (Barbosa, 1947, p.258).

This conclusion, Barbosa notes, agrees with Huxley’s thesis that science can effect the direction of one’s intellectual development. The emphasis on direct contact with nature and systematic observation and the drawing of appropriate conclusions is nowhere evidenced in the curriculum, except in science courses (DeBoer, 1991, p.11). For the biological sciences, the first habits of observing; for physics, the faculties of experimenting and demonstrating; for mathematics, those of precision and of deduction. Science also cultivates sound judgment and an independence of spirit. To be successful in achieving these ends, method needs to rely upon experimental teaching, which stands in opposition to method that relies upon student memorization.

In summary, there were compelling reasons for teaching science in the Brazilian primary school. Science instruction was widely acknowledged as a necessity by modern nations because it develops the child’s mental facilities; it renders the child knowledgeable about the scientific and technological wonders around him; and finally, it eventually contributes to national development.

Method and the Teaching of Science

If the sciences should be taught in the primary school, at what age should children begin their study? Barbosa answers by reiterating Huxley’s position that science should be

taught at the earliest age possible, or as he unequivocally states, “From the first steps in the school” (Barbosa, 1947, p.265). He relates the conclusions of the representatives of English schools of Clifton, Malvern, and Taunton, who collectively agreed that science could be taught as soon as a child enters the school. Barbosa later stipulates that science content could be introduced to the child as early as nine or ten years of age. This would be achieved if a child’s first venture into the sciences focused on a general experience of nature, and answers to a young mind’s questions about the sky, the sea, animals, plants, and the human body. Later, once the child matures, he could embark upon a more systematic study of the biological and the physical sciences.

How should science be taught to these young children? Barbosa's answer follows the logic presented in Thomas Huxley’s discourse on science education in his work, *Lay Sermons*. Huxley believed that a child seeks information about matters of natural science as soon as he begins to speak. The child’s first learning events center on objects, or of this or that phenomenon of nature. Hence, “as soon as it is fit for systematic instruction of any kind, it is fit for a modicum of science.” What are these natural objects of interest? They are “the common facts of biology,” which begin with the parts of the body, the names and habits of living beings that surround the child (Barbosa, 1947, p.268). Barbosa relates the opinion of the French delegates at the 1876 Exposition in Philadelphia on the manner of teaching botany, physics, and physiology in the primary school. For the delegates these subjects can be taught by selecting objects, phenomena and experiences that are easy to explain and useful to those who understand them, rather than as memorized rules and definitions that contribute little except as practices in grammar (Barbosa, 1947, p.265). This is possible because there exists in children of any age a natural interest in botany and geology.

If interest in the things and natural phenomena is innate, then “Teach science with things, and not with books, that is, teach the natural sciences with the personal observations of the student, teach the physical sciences, uniting the student and the teacher in practice of the experimental methods” (Barbosa, 1947, p.288). Clearly this concept of science teaching derives from Barbosa’s familiarity with Object Teaching, which he fully embraced. So enamored was he with this methodology, that he devoted a section to it in the 1882 report, and published an adaptation and translation of Norman Calkins’ popular teaching manual, *Primary Object Lessons*, in 1886.

Calkins' approach to teaching, based on Object Lessons, permeates Barbosa's thinking on the method of teaching science. The Object Teaching methodology appealed to Barbosa because it resonated with the ideas of other notables, such as Spencer who provided a similar interpretation of the best method to teach children, when he stated: "To tell a child this and show it the other, is not teach it how to observe, but to make it a mere recipient of other's observation – a proceeding which weakens rather than strengthens its powers of self-instruction, which deprives it of the pleasure resulting from successful activity... Children should be led to make their own investigations and to draw their own inferences. They should be told as little as possible and induced to discover as much as possible" (Quoted in Lourenço Filho, 1966, p.85).

Final Considerations

The 1882 report presented Rui Barbosa's ideas on the purpose and method of science teaching in the primary school. He wrote a masterly proposal, drawing upon the observations and reflections of some of the most eminent scientists, philosophers, educators, social commentators, and statesman of his time. His arguments were orchestrated to demonstrate that the best minds in Europe and the United States considered science education essential, and natural, for young children.

In enunciating the best thoughts of his time, Barbosa joined a select coterie of intellectuals who were responsible for ushering in modern ideas of science education during the final quarter century. Barbosa was Brazil's most erudite spokesman for modernity in education, and while he may not have achieved his goal to reshape primary education as he envisioned, he did provide a wealth of insights that future reformers could consult when exploring change in basic education.

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