

The Intellectual Development of Modern Schooling: An Epistemological Analysis

Alberto Arenas¹

University of Arizona, USA
alberto.arenas@arizona.edu

Recibido: 17 de abril de 2007
Aceptado: 10 de septiembre de 2007

¹ Profesor Asistente, Facultad de Educación, Universidad de Arizona (Estados Unidos). Ph.D. en Educación de la Universidad de California, Berkeley (Estados Unidos). Este artículo presenta los resultados de una línea de investigación denominada «Educación, Modernidad y Medio Ambiente» que viene desarrollando el autor en la Universidad de Arizona. Esta línea de investigación busca rescatar los bienes comunes materiales e inmateriales de comunidades marginales y hacerlos una parte integral de las instituciones educativas.

El desarrollo intelectual de la escuela moderna: un análisis epistemológico

Resumen

Este artículo presenta un recorrido histórico del desarrollo de la escuela moderna, enfatizando particularmente los cambios epistemológicos que ocurrieron en Europa en los siglos XVII y XVIII. Mientras que historiadores de finales del siglo XIX y principios del siglo XX que exploraron este mismo periodo presentaron un recorrido benévolo de la evolución de la escuela moderna, yo adopto una actitud más crítica. Como demuestro en este artículo, es precisamente a partir del siglo XVII cuando la mayoría de las características que asociamos hoy en día con la escuela moderna encuentran su origen, como son un pénsum curricular fragmentado; el privilegiar un conocimiento racional y objetivo codificado en forma escrita; una visión mecanística del medio ambiente separado y completamente diferente de la naturaleza humana, y una pedagogía totalizante que controla cada momento y movimiento de los alumnos. A través de este artículo busco contribuir a nuestro entendimiento de cómo la escuela como institución se forjó en la psique moderna con tal fuerza que ha menoscabado otras formas de la transmisión intergeneracional de la cultura.

Palabras clave del autor: historia, educación, modernidad.

Palabras Clave descriptores: historia de la educación, Europa, siglos XVII-XVIII, filosofía de la educación.

The Intellectual Development of Modern Schooling: An Epistemological Analysis

Abstract

This article constitutes a historical account of the development of modern schooling, with a prime emphasis on the epistemological changes that took place in Europe in the seventeenth and eighteenth century. While earlier historians who focused on this same period presented a benevolent account of the growth of modern schooling, I adopt a more critical view. As I demonstrate in this article, characteristics such as a fragmented disciplinary curriculum; a privileging of rational and objective knowledge codified in book form; a mechanistic view of the natural environment as detached and wholly different from human nature; and a totalizing pedagogy that controls every moment and movement of students, were all features that emerged during this time frame and became an integral part of the ethos and organization of modern schooling. With this article I hope to contribute to our understanding of how the school as an institution was carved into the modern psyche with such potency that it overshadowed most other forms of the intergenerational transmission of culture.

Key words author: history, education, modernity.

Key Words Plus: educational history, Europa, 17th-18th, educational philosophy.

O desenvolvimento intelectual da escola moderna: uma análise epistemológica

Resumo

Este artigo apresenta um percurso histórico do desenvolvimento da escola moderna, enfatizando particularmente as mudanças epistemológicas que aconteceram na Europa nos séculos XVII e XVIII. Enquanto os historiadores de finais do século XIX e começos do século XX, que exploraram este mesmo período, apresentaram um percurso benévolo da evolução da escola moderna, eu adoto uma atitude mais crítica. Como demonstro neste artigo, é precisamente a partir do século XVII que a maioria das características

que associamos hoje em dia à escola moderna encontram a sua origem: um programa curricular fragmentado; o privilégio de um conhecimento racional e objetivo codificado em forma escrita; uma visão mecanicista do meio ambiente, visto como separado e completamente diferente da natureza humana, e uma pedagogia totalizante que controla cada momento e movimento dos alunos. Por meio deste artigo, busco contribuir para nosso entendimento, mostrando como a escola, como instituição, forjou-se na psique moderna com tal força que tem menosprezado outras formas da transmissão intergeracional da cultura.

Palavras chave: História, educação, modernidade.

“Schools are slaughterhouses of the mind where one spends ten years and sometimes more...being stuffed with information which could be learned in one year”.

—*John Amos Comenius (1632)*

“In the modern world, the celibacy of the mediaeval learned class has been replaced by the celibacy of the intellect”.

—*Alfred North Whitehead (1929)*

The social phenomenon of attending school is ubiquitous around the world. Regardless of socioeconomic level, gender, ethnicity, or geographic location, most children follow the ritual of spending several years of their life in an institution that attempts to mold them into modern citizens. The nation-state legitimizes this ritualized behavior by making schooling compulsory, universal, and lasting an ever-increasing number of years. Throughout the globe, in even the remotest regions, schools sprout with the avowed goal of integrating the population into the rationalistic and totalizing modern project of the nation-state. Children are exposed to modernity not just through an intentional pedagogy in the form of standardized literacy, numeracy and other knowledge forms, but also through a continuity of practices involving discipline, obedience and respect for the teacher and the school (Lave, 1988; Smith, 1992).²

The worldwide expansion of modern education is well documented, along with the remarkable similarities that exist among the different school systems (Benavot & Riddle, 1988; Boli, Ramirez, & Meyer, 1985; Meyer & Hannan, 1979). What is less well documented is the origin of the modern school and the existing critiques of modernity. Many historians have researched the development of the modern school, particularly historians at the end of the nineteenth century and the beginning of the twentieth, but they invariably came from a tradition that viewed mass schooling

² In terms of socializing children to embrace a modern paradigm, Lave assesses even greater importance to the continuity of practices that takes place inside schools than to the actual content itself (1988).

in a positive and optimistic manner (see, for instance, Compayré, 1885; Eby, 1934; Reisner, 1930; Wilds & Lottich, 1936). This positive outlook was picked up by supporters of human capital theory and of modernity in general who saw in mass schooling a vital tool for achieving societal progress (e.g., Inkeles, 1983; Inkeles & Holsinger, 1974). Such optimism contrasted with that of a growing minority of scholars who, starting in the 1960s, criticized schooling for dismally mitigating a series of social, economic and political predicaments affecting countries the world over, and on several counts actually exacerbating these problems.³

Following this latter line of inquiry, this article adopts a more critical view of modernity as it attempts to elucidate certain puzzling aspects related to the modern school. What events occurred from the Renaissance to the Age of the Enlightenment that led to the emergence of the modern school? What is the genesis of educational practices we take today for granted, such as simultaneous instruction, the use of textbooks, a highly disciplined classroom, and a fragmented curriculum? How did modern schooling replace vital forms for the transmission of culture between generations? Why is there an abyss between the school and community? Why did the school enshrine only certain forms of knowledge, particularly intellectual learning, while excluding others? Responses to these questions would allow us to contextualize the literature of modernity on the one institution that has been key in the dissemination of modern values, beliefs and practices. I believe that unless one has some understanding of the epistemological, social, technological, economic, and political forces that undergird the modern school, a compelling alternative to the negative aspects of universal, homogenous schooling cannot be provided.

In this article, I will study in detail the historical evolution of the modern or common school. By focusing selectively on certain European philosophers whose work was pivotal—both in direct and indirect ways—in forging mass schooling, and several key social, technological, economic, and political events in Europe from the Protestant Reformation to the French Revolution, I hope to show how these shaped the modern school's ethos, pedagogy, curriculum, and organization, and how the school, in turn, was a key instrument in promoting modern beliefs and behaviors. As we will see, the main premise underlying the spread of schooling was the belief in progress and modernity—the idea that through rationality, objectivity, the control of nature, and standardization, human societies were resolutely headed in a better direction.

³ For an explanation on how schools have contributed to the rural-urban migration, see Blaug (1973); for a critique on the bureaucratization of learning and the muzzling of children's curious and creative nature, see Illich (1971); for an analysis on how formal schooling has contributed to ecological devastation and community deterioration, see Bowers (2001), Orr (1994) and Smith (1992); for an analysis of how national systems of education have contributed to the displacement of minority languages, see Skutnabb-Kangas (2000); for an approach on how modern schooling has displaced indigenous cultures, see Prakash and Esteva (1998).

This article makes no claims of unearthing new historical data. Rather, its main contribution stems from taking a wider and more critical historical lens than the one used by other educational researchers who have made the link between schooling and modernity (e.g., Fuller, 1991; Fuller & Rubinson, 1992; Meyer & Hannan, 1979). To shed light on vital aspects of the modern school, I focus my historical survey mostly on the seventeenth and eighteenth centuries (with passing references to the sixteenth and nineteenth centuries), a period when most of the educational ideas we deem today as modern were conceived, and an epoch that witnessed the emergence of the founding members of the modern school.

Comenius: A Founding Member of the Modern School

The first comprehensive theory of modern schooling is believed to have been articulated by the Czech educator John Amos Comenius in the seventeenth century (Dobinson, 1970; Eby, 1934; Sadler, 1966). Comenius (1592-1671) was perhaps the first one to talk about a true national system of education that was compulsory, universal, used the vernacular as the main communicative tool, and sought to transmit a rational body of knowledge—albeit not a secular education. Comenius was not the first one to uphold schooling for all. Prior to him, Martin Luther (1483-1546) had advocated the founding of compulsory public schooling for poor children, for both boys and girls (albeit differentiated), but his ideas never matched the level of detail or comprehension reached under Comenius.⁴ The Czech scholar, as perhaps no other educator before him, most clearly spelled out an exhaustive pedagogy of teaching methods, an interconnected system of grade levels, and a single form of schooling for all children, regardless of gender or social class differences. Unlike Luther's ideas, Comenius' pedagogy had an unfailing trust in rationality, which was expounded in his well-known work *The Great Didactic* (1628-1632/1896):

We should accustom boys to do everything by reason, and nothing under the guidance of impulse. For man is a rational animal, and should therefore be led by reason, and, before action, ought to deliberate how each operation should be performed, so that he may really be master of his own actions (1628-1632/1896:364).

⁴ Some authors consider Luther as the father of universal education, while others make salient his contradictory attitudes towards vernacular education. While he must be recognized as the first reformer to call for compulsory education, he cannot be considered the father of the modern, common school given that he privileged Latin schools, where the vernacular language was not used, and rationality had no important place in his curriculum. Luther even called for the suppression of vernacular schools in the latter part of his life, probably as a result of the 1524 Peasants' War and the rise of the Anabaptist movement. For a summary of this debate, see Eby (1934: 67-79). For a thorough discussion of Luther's educational contributions, see Luke (1989).

Comenius set himself to the task of using scientific principles to provide a veritable science of education. He carefully divided the life span of an individual in developmental stages or “schools of life”, and designed a different type of education for each stage, starting as early as the prenatal period. He then adapted his theory of development to the ancient Greco-Roman system of education (1628-1632/1896):

1. A Mother-School, from birth to six years of age. Comenius subdivided this nursing period between children under three, and children from three to six years old. The main purpose of this stage would be to foster the child’s senses.
2. A Vernacular-School, from seven to 12 years of age. This elementary or common school would be open to all boys and girls, and during the daily four hours of teaching children would develop their intelligence and memory. It would also include plenty of manual and physical activities. Comenius was the first to provide a definite conception of what the elementary school should be.
3. A Latin-School or *Gymnasium*, from 13-18 years of age. It would teach academically-gifted children six daily classes, and it would emphasize intellectual training. At the end of the period, an examination would determine which students could continue onto higher education.
4. A University and travel, for students 18-24 years of age. It would last for six years, and it would end with a rigorous academic examination. From the university, future leaders of the state and administrators would be chosen.

Despite the structural similarities between the Greco-Roman educational system and that of Comenius, along with similarities in terms of cultivating rationality (particularly in the Athenian version of education), there were stark differences between the two systems. The system that existed in the Roman Empire, a more efficient version of the one found in Ancient Greece, was voluntary, private, gender differentiated (girls generally received fewer years of schooling and for different purposes), accessible mostly to the children of the wealthy, and each level was separate from the previous one (Compayré, 1885). In contrast, Comenius’ model of schooling was intended to be mandatory, free, publicly-run, abolished differential treatment based on gender or social class, replaced an aristocracy of wealth for one of academic talent, and established a complete interdependence between the different grade levels. Other differences included Comenius’ usage of scientific knowledge to prepare a curriculum from the time the child was born all the way to age 24, a teacher training program to achieve a standardized form of instruction, and the belief that formal education was the surest means for improving the socioeconomic condition of the masses and for bettering society in general.

Comenius was greatly concerned with the transmission of knowledge in efficient ways. He was appalled by the habitual practice in schools of teaching children individually and not as a whole group. At the time, teachers commonly summoned a student at their desk to read or recite while the rest of the class continued with separate learning assignments. Silence and order were *not* the norm in schools. To remedy this situation, Comenius proposed the simultaneous teaching of groups of students. He believed that this pedagogical technique would expedite the conveyance of learning material, large groups of students could be controlled at once, and it would guarantee that all pupils learned the same material at the same pace. With his proposal for simultaneous instruction, Comenius foreshadowed the practice employed by the Brothers of the Christian Schools by 50 years—which was the first group within the Catholic Church to provide a common school for all children—and by almost two centuries the ideas of Johann Heinrich Pestalozzi, who was instrumental in making simultaneous instruction a permanent fixture of schools in the nineteenth century.

From where did Comenius derive his most important educational ideas? First, he inherited the fervor that Luther and other Reformation leaders had for mass schooling. As mentioned previously, Lutheranism had stressed the mass transmission of literacy and a standardized curriculum for all schools. Luke (1989) ascribed to the sixteenth-century Protestant school many of the characteristics that will gain strength under Comenius: A disciplinary apparatus; a fragmented curriculum; classrooms divided by age level; and even an incipient bureaucratic system that included student-teacher recruitment, examinations, school finances and some teacher training.

Second, Comenius was greatly inspired by the popular utopian books at the time, but especially by *Christianopolis*, published by the German Johann Valentin Andreaë in 1619. This utopia, written in the first half of the seventeenth century, considered education of the utmost importance. In the ideal city described in the book, education was compulsory, carried out in public schools, and it was the same for both sexes. Since aristocracy and private property did not exist, social classes were absent. For the schools, Andrea proposed the teaching of a vast array of knowledge, which included the most recent scientific discoveries in astronomy, physics and mathematics, but all under the aegis of honouring God. *Christianopolis* was not atypical for its period. Even though it was probably the work of fiction that most strongly defended the healing potential of education, other utopian schemes of the period professed a similar faith (Ozmon, 1969).

The proliferation of utopian books during the Renaissance and post-Renaissance periods marked a widespread optimism among the European intelligentsia. The voyages around the globe, the conquest and colonization of civilizations in the Americas, and the portentous

discoveries in the fields of astronomy, physics and mathematics all brought about a bursting of confidence in the sense of adventure and rational genius of human beings. A new era of certainty and universal scientific laws were leaving behind a medieval era characterized by doubts, diffidence, and religious determination. Humans were no longer subject to the capriciousness of God's will; rather, they were the product of rational forces that needed to be discovered and tested. Nature, hitherto seen as a mysterious living being that was revered with religious awe, came to be viewed a machine to be analyzed, manipulated and forced to yield to human needs. The new epistemological changes were reflected in the works of utopian writers who, armed with this new knowledge and zeal, created worlds in which poverty and other forms of social injustice were eliminated. Comenius was one among many who was swayed by these idealistic visions.

Third, Comenius followed the ideas of Francis Bacon (1561-1626), also a utopian writer. Although not himself a scientist, Bacon's influence stemmed from being the most eloquent defender of the empirical method of science, and particularly of the inductive method—universal conclusions are drawn from particular understandings. Bacon was one of the first to put induction to a test as rigorous as the one employed by ancient Greeks in the deductive method. Bacon believed that deduction could not advance knowledge in the field that occupied the minds of scholars at the time, the realm of nature; only scientific experimentation, he believed, could unlock the mysteries of the universe and lead to social and political progress. Bacon's clearest ideas of education were expressed in his utopia *New Atlantis* in which knowledge was subdivided into several disciplines, including mathematics, biology, chemistry, hydrology and mechanics.⁵ He wanted to use his method of inquiry to reach a mechanical and reliable formula for the orderly acquisition of knowledge, which would be all-comprehensive and encyclopedic in scope. His ultimate purpose was to use scientific knowledge to control the whole of nature to benefit human kind (Bowen, 1981:43). A far less benevolent analysis was presented by Carolyn Merchant (1980). She argued that Bacon's writings were exemplary for showing the influence of patriarchal attitudes on scientific thought. According to Merchant, he used metaphors that equated nature with women in crude and brutal ways. Bacon considered that the role of the scientist was to "torture nature's secrets from her" and nature had to be "hounded in her wanderings" and made into a "slave" (Merchant, 1980:169). As we will see later, the use of the scientific gaze to dissect nature would later on have nefarious consequences for the well being of the environment and of human's interaction with it.

⁵ Some believe that Comenius never knew about Bacon's *New Atlantis* but that he was nevertheless influenced by Bacon's other writings and certainly by other utopian writers (Sadler, 1966: 71).

Comenius was a devout Protestant who, like Bacon himself, had been deeply influenced by the Reformation movement. One of the main consequences of the split of Christendom was to desanctify the monopoly that the Catholic church had over Truth, permitting the upsurge of alternative paradigms to explain the world. Thanks to Protestantism, each individual could communicate with God directly without a church or pope mediating the contact. In essence, the rise of Protestantism informed individuals that they could be popes in their own right, granting individuals a power they had been previously denied. In order to establish a personal relationship with God, proselytes needed to learn well the word of God, and thus literacy became essential. This precondition was possible to fulfill thanks to the refining of the printing press in Europe in the fifteenth century.⁶

The Printing Press and the Written Word

The printing press allowed, for the first time in history, the reduction in costs necessary for people other than the elites to acquire written material. In the sixteenth century, “books became part of household acquisitions for many families” (Luke, 1989: 51). And it was not just about religious matters, but secular ones as well—law, agriculture, politics, culinary, and good manners were all fair topics for printed material. Just as important, the new books were printed in the vernacular language and not in Latin. The explosion of information was such that 50 years after the printing of Gutenberg’s Bible, 35,000 different titles had been released, and copies counted more than 15 million (Luke, 1989: 58). Protestants seized this opportunity to start their own schools, inculcating the religious and secular knowledge they considered appropriate. A case in point was England where, in 1480, before printed books were widespread, 34 schools existed; by 1660, the number had gone up to 444 (Postman, 1992: 63).

In describing this educational boom, some scholars have keenly argued that the school was “a daughter of the printing press and of the Reformation”, both of which were instrumental in bringing about the modern period (Gaulupeau, 1992: 14). Comenius himself was a great admirer of the printing press, that “marvelous device for multiplying the number of books infinitely and with amazing speed”, he wrote (in Dobinson, 1970: 64). Thanks to the printing press, in the sixteenth and seventeenth centuries radical ideas were propagated (e.g., Luther’s 95 theses; Copernicus’ heliocentric theory; Galileo’s defense of Copernicus) that granted individuals the necessary intellectual space to question

⁶ It should be mentioned that the printing press with movable clay type was probably first invented in China in the 11th century, but the printing press with replaceable wooden or metal letters was first developed in Europe four centuries later (Fontaine, 1999).

the two reigning paradigms, the Greek deduction approach based on universal truths and Roman Catholic theology. In this context, schools and universities became the main sites for the selection and spread of the new revolutionary ideas.

Regarding printed materials, Comenius was perhaps the first one to introduce in schools non-religious books appropriate for each grade level (Eby, 1934: 185).⁷ The custom at the time was to use in schools books written for adults, and usually only the teacher and a few students had copies. Comenius remedied this situation by publishing his own textbook in 1658, *Orbis Sensualium Pictus* (The Visible World in Pictures), for elementary-school age children. This book, composed by 150 short sections, is considered the first secular children's book with pictures, and it covered all sorts of subjects, including biology, history of wars, stages of development and religious life. Thanks to the establishment of printing presses throughout Europe, the possibility of reproducing books had increased tremendously by the 1650s, and thus Comenius was able to provide one copy *per* pupil, something unheard of at the time.

Textbooks changed radically the character of education. The homogenizing process that started with simultaneous instruction was greatly aided by textbooks, for they restricted the type of content and the amount that was taught in an academic year, and ensured that year after year the same identical knowledge would be transmitted. Over time, textbooks gradually displaced oral tradition and other forms of knowing and feeling that were not susceptible to be codified in book form. The printed document came to signify the reliable representation of observable events, and it replaced in importance the changing and undependable spoken word. Virtually the entire intellectual content that was transmitted in schools from one generation to the next became enshrined in books and textbooks. A new hierarchy of knowledge was thus gradually established. Prior to the rise of the printing press and the reformation, only religious knowledge mattered; afterwards, secular and rational content encoded in textbooks competed for hegemony in schools alongside religious texts. Gradually, both secular and religious texts were the only sources of knowledge considered to be legitimate and truthful; everything outside of them, particularly oral tradition at the vernacular level, was susceptible to be deemed insignificant, picayune, or worse, false.

Centuries later, when national systems of education were established, book content tended to be standardized and made the same for all children. Thus, it is not far fetched to state that without the invention of

⁷ It appears that the first authors of *religious* textbooks for children were Luther and Calvin. Luther wrote a primer, *Kindesbuchlein*, which sought to make children familiar with the Lutheran doctrine and important biblical facts (Reisner, 1930: 28). Calvin published in 1541, *The Way of Instructing Children into Christianity*. He employed the vernacular language to pose a system of questions and answers susceptible to be memorized by children (Gaulupeau, 1992: 14).

the printing press, the common school as we know it would simply not have developed. As Edward Reisner said, “possibly the most important single factor connected with the rise of the common school [was] the invention and spread of printing” (1930: 19).

Comenius never saw in his lifetime the creation of the common school. His attempts to found schools ended up in failure, mostly because of the religious persecution that took place during the Thirty Year War between Protestants and Catholics. Being a prominent Protestant educator, he was often fleeing from one country to another to avoid capture by Catholics, and consequently was never in a place long enough to put his ideas into practice. It would be up to future generations of educators to do this task for him.

Descartes and Newton: The Crowning of the Modern Paradigm

The philosophical and scientific revolution, which started with Copernicus and Kepler, found its highest and most complete expression in the works of Descartes and Newton. Even though they did not write about educational issues, their ideas did have an important impact on the beliefs and practices of the time, and inevitably, on those of educators as well.

René Descartes (1596-1650), perhaps the first modern philosopher, used the language of mathematics to demonstrate the existence of God and to show the orderly nature of the world. By using radical doubt, he determined that only knowledge that was perfectly known could be trusted, and that mathematics was the sole field where there was no dispute, no uncertainty, no fogginess. He thus became immersed in the gigantic effort of explaining the whole universe in terms of mathematics. His ultimate conclusion was that only scientific knowledge could provide an individual with absolute reliability and truth.

His studies at the Jesuit College of La Flèche, which led him to a profound sense of disillusionment with his own educational experience, sparked a concern for certainty and confidence (Descartes, 1637/1901: 151-153). “As soon as I had finished the entire course of study,” he wrote in his most celebrated work, *Discourse on Method*, “I found myself involved in so many doubts and errors, that I was convinced I had advanced no farther in all my attempts at learning, than the discovery at every turn of my own ignorance. And I was studying in one of the most celebrated Schools in Europe.” Specifically, he disliked not being allowed to know “the true sense of mathematics” since he had only been shown their application to the mechanical arts, and the fact that he was forced to spend an undue amount of time reading ancient books instead of studying contemporary authors. Descartes’ opinions about

the curricula are not as important to future educational development as was his whole method of research as described in the *Discourse on Method*. Without intending it, he complemented Comenius' ideas in devising some of the most important principles of modern education. As Compayré said of Descartes, "there is no thinker who has exercised a more decisive influence on the destinies of education" (1885: 188). Descartes' contributions to the field of education are seen in three main areas.

First, Descartes' analytic method. He would take a segment of reality and break it apart until he reached its most basic components. His advice was to go from the simple to the complex, from the known to the unknown. This strategy has become essential in modern science, and has made it possible to advance most scientific theories. Taken to an extreme, however, Cartesianism leads to a fragmented and reductionist view of reality; it compartmentalizes knowledge by focusing on the particular, while preventing the individual from perceiving the whole picture. The current fragmentation of the curricula and the lack of communication between the different disciplines came partly as a result of an exaggerated emphasis on Descartes' analytical method.

Second, his mechanistic view of nature. Greatly influenced by Bacon, Descartes considered that nature behaved as a soulless, perfect machine, governed by exact mathematical laws. He extended his mechanistic view to all living matter, including plants, animals and humans. A logical consequence of referring about nature and humans as machines was that both could be manipulated, controlled and exploited at will. The impact of these ideas on education was twofold. At the curricular level, it greatly influenced the development of the physical sciences in the eighteenth century and of the social sciences in the nineteenth century, both of which viewed nature as an entity separate from human communities that needed to be exploited under the magnifying glass of science. At the organizational level, it led to a view of schools and students as machines that needed to be regimented and subdued.

Third, Descartes' dualistic assumptions. In his manicheistic beliefs, he was much more categorical and explicit than Bacon. In his well known dictum *cogito ergo sum* Descartes affirmed the independence and the preeminence of the mind. Embodied in that phrase is the assumption of mind existing prior to, and autonomous from, matter. The mind, enjoying greater import than the body, contained all the operations of sensation, intuition, and feeling that allowed humans to reach knowledge. His separation and irreconcilability between mind and body led to a "bifurcation of nature", as Whitehead wrote, and with it nefarious dualisms that included the severance of humans from nature, science from spirituality, and facts from values. In education, Cartesianism provided scientific legitimacy to a practice and belief that was already common in schools and universities, that is, the superiority of mental work over manual activities.

Descartes presented a picture of the universe as a perfect machine governed by exact mathematical laws, but this picture was only a sketch that he was never able to complete. Despite the mathematical progress made during his lifetime, his early death prevented him from engaging in careful experimentation that he had recognized as necessary to test his grand hypothesis. The man who brought that dream into completion and gave full body to the mechanical science was Isaac Newton (1642-1727).

It was Newton who gave completion to the Copernican and Cartesian revolutions. He composed in mathematical form what he conceived as the entire mechanical behavior of nature, discovering a natural order that was simple, predictable and universal. During Descartes' time, the idea of combining mathematics with experimentation was still in its infancy, and it was only until the second half of the seventeenth century that both fields truly began to merge, particularly in the areas of fluids, gases and light. Pascal's law of pressure in liquids, Torricelli's barometer, Boyle's law of pressure in gases, and Roemer's measurement of the speed of light were all examples of the successful alliance between mathematics and experimentation.

With Newton, this alliance reached its highest point. In his famous *Mathematical Principles of Natural Philosophy* (1687/1999), known as the *Principia*, he provided a synthesis between the Cartesian view (truth can be deduced from ideas) and the Baconian view (truth can be arrived at through observation and experimentation). When direct experience was impossible, as in the case of celestial calculations, he favored the method of analogy, using, for instance, the movement of a pebble to calculate planetary orbits. It was in the area of curves where Newtonian science did what no science had been able to do before: predict motion in mathematical terms. As was written of this episode,

Descartes had shown how to find the equation that would represent any curve, and thus conveniently and accurately measure it and enable calculated prediction to be applied to all figures; but the science of mechanics, and with it any measurement of the processes of change in the world, demands a form for the law of growth or falling-off of a curve, that is, the direction of its movement at any point. Such a method of measuring movement and continuous growth Newton discovered; he had arrived at the most potent instrument yet found to bringing into subjection the world to man (Randall, 1976: 258).

Contained in Newton's totalizing explanation for all bodies in motion was an answer to a question that had puzzled philosophers for ages. What is reality composed of? Put differently, what is the "stuff" that

makes up the universe? Twenty centuries earlier, Democritus had answered that question by saying that everything in nature was comprised of material particles that were disconnected, invisible, and unalterable. He called these particles *atomos*. During the Middle Ages and the Renaissance this idea cropped up in several occasions, but it was only with Newton's mechanical science that philosophical atomism became physical atomism. Swayed by Descartes' ideas that reality could only be understood by breaking it up into the smallest fractions possible, Newton argued that all matter was made of small, indestructible, solid particles. As we will see later on, these atomic laws greatly influenced the principles and conduct of social institutions, including that of schools.

Just as with Descartes, Newton's influence on education was indirect. He culminated the establishment of the mechanistic worldview, which was totalizing, reductionistic, and universal. It was so convincing and all-encompassing that its followers prevented alternative world views from having a rightful place, and everything that could not be quantified lost validity and importance. The fanatical pursuit of correct and objective answers, and the prevention of paradoxes, contradictions, and ambiguities from entering the classroom owe much to this mechanistic paradigm. Similarly, myths, legends, and oral folk stories lost all scientific credence, and only knowledge that could be tested and verified was granted legitimacy. Myths and folk knowledge became a part of the humanities but were seen as lacking any scientific validity for explaining the principles of the cosmos. The importance and prestige that the mechanical sciences with their proclivity for universal answers were to acquire over the decades served as the foundation for the standardization and homogenization of social institutions that started to occur centuries later.

Along with the scientific discoveries, Descartes and Newton gave humans formidable powers. Through observation, experimentation and mathematics, humans could reveal the secrets of the planet. Nature finally ceased to be a living entity that was full of mystery and enchantment, and instead became a lifeless machine that could be dissected, manipulated and exploited at will. Individuals started to have enormous faith in their ability to control their destinies. No longer were they subject to the whims of nature or the arbitrariness of religious interpretation. Humans were finally placed at the center of the universe. The modern school's historic silence regarding environment protection or the need to view nature as a being that is alive finds legitimacy in these writings. While nature does have a predominant role in the sciences, the inevitable morality of viewing nature as an entity deserving of respect, nurture, and love simply finds no space in a fragmented curriculum that supports knowledge only according to scientific reason.

The Appeal to Reason in Education

The power and simplicity of the new mechanical view of the universe drew many social, political and economic thinkers of the eighteenth and nineteenth centuries to use it as a model. Of these, John Locke (1632-1704) stood out as one of the earliest and most important of the philosophers who applied the modern view to society in general, and to education in particular.

Locke was a convinced Newtonian who believed in applying the methods of scientific rationalism and the mechanistic model of the universe to the behavior of societies. Just as Newton reduced the composition of nature to basic building blocks, Locke saw societies as composed by single individuals, independent, isolated and irreducible. In his view, the behavior of each person was controlled by the same natural laws that determined the course of the physical universe. Thus the role of every government was to discover and put in practice the natural laws that existed even prior to the existence of large political bodies, instead of choosing autocratically a set of rules. His atomistic view of society led him to champion a representative government whose role was to defend private property and the fruit of every person's labor.

Locke witnessed during his lifetime the beginning of radical economic transformations that would intensify the process of individuation. European societies started to experience the passage from a labor-extensive, agrarian and handicraft economy to an urbanized economy that used steam-powered machines. The new capital-intensive productive relations were accompanied by legal and institutional changes, including the sanctioning of usury, the development of contract law, taxation of commercial transactions, and the advent of an intra-European market economy. More and more, individuals were bestowed with the responsibility of financing state expenses and the freedom of performing their own economic transactions.

With regard to Locke's views on education, these were spelled out in *Some Thoughts Concerning Education* (1693/1996), which became extremely popular in the following two centuries. By the end of the nineteenth century, it had gone through 12 editions in English, 7 in German, 6 in Italian, and an outstanding 21 editions in French (Bowen, 1981: 172-173). His book, a manual for mothers on how to educate their children, was in many ways the application in the realm of education of Descartes' and Newton's ideas on the preeminent position of reason, and a compilation of the most advanced ideas on educational reform at the time. Locke believed that through education one could shape the mind of children as one pleased. He rejected the doctrine of innate knowledge and instead followed Aristotle and Bacon in favoring the *tabula rasa* theory of the mind. He wrote, "Let us suppose the mind to

be, as we say, white paper, void of all characters, without any ideas; how can it be furnished?...To this I answer, in one word, from experience” (in Bowen, 1981: 174). Experience, gathered through the senses, was the starting point in the learning process. The second step was memorization, necessary to retain the raw sensations and knowledge derived from experience. And the third step was reasoning, which was the most important mental process and the pinnacle of human behavior. It was reason that organized and gave meaning to experience.

For instance, he advocated the teaching of mathematics because it was the best means for training children to reason. As he wrote in his *Of the Conduct of the Understanding* (which focused on the self-education of adults):

[To] have a man reason well, you must...exercise his mind. Nothing does this better than mathematics, which, therefore, I think should be taught to all those who have the time and opportunity; not that I think it necessary that all men should be mathematicians, but that having got the way of reasoning, which that study necessarily brings to mind to, they might be able to transfer it to other parts of knowledge as they shall have occasion (1693/1996: 178-180).

In his defense of mathematics, he employed the same argument as the one used by the upholders of teaching classical languages in schools, that is, the skills and logic learned by studying Greek and Latin were transferable to other disciplines and domains of life. This is ironic given that Locke saw as a waste of time the tradition at the time of forcing children to master classical languages.

Providing ample time to teach mathematics and using the vernacular were two of the many educational ideas suggested by Locke that would later become part and parcel of schools. Other ideas included avoiding corporal punishment in schools; treating children as rational beings with whom to reason; providing manual trades for poor children (a form of proto-vocational education); believing in the Greek principle “A sound mind in a sound body”, which was the opening line of his celebrated educational manual; and adopting a non-religious civic program to instill morality (which later became the secular public education). With the exception of a secular orientation to education, one may recall that some of these ideas had already been espoused by Comenius several decades earlier. Indeed, Locke had been influenced by Comenius through Samuel Hartlib’s utopia *A Description of the Famous Kingdom of Macaria*, published in 1641, which included many of Comenius’ ideas. Hartlib’s book was one of the sources that influenced Locke to believe in the transformative power of education. As Locke wrote, “Of all the men we meet with, nine parts of ten are what they are, good or evil, useful or not by their education” (in Bowen 1981: 176).

Despite Comenius' indirect influence on Locke, they differed in one important respect: the value of universal and standardized education. Locke, who came from a well-off English family, rejected the idea of education for all, and instead argued that the upper classes were the ones who needed to be educated. He believed that only the children of the rich were capable of reasoning, favoring for them a rigid academic program that included the study of mathematics, science, geography and English. For the lower classes he supported instead an apprenticeship program in which they could learn simple handicrafts and the importance of frugality and hard work. It should be mentioned that although Locke disdained bookish knowledge and stressed the importance of rigorous physical activity, his followers ended up supporting mostly the training of the mind and minimized the importance of physical exercise. This is not surprising given that high social status and pecuniary benefits were accorded to those who went through an academic program that stressed intellectual training, whereas those who went through a vocational program remained in an inferior social status.

Locke's aristocratic views—and his renown as a political thinker—may explain why he became so popular while Comenius' writings received so little attention at the time (Wilds & Lottich, 1936: 235). While Comenius was too radical, or perhaps too modern, Locke provided the right mixture of progress and conservatism for the eighteenth-century European. On the one hand, Locke opposed the arbitrary and despotic authority of the church and the state—he spoke in favor of equality and against slavery—but on the other hand, he neglected the needs of the masses and took for granted the vast economic and social disparities of his epoch. In this sense, Locke was perhaps the best exponent of the rationalist movement that was highly elitist but also rejected the belief of divine authority, either vested in the clergy or nobility, as the source of personal enlightenment and of all morality. In this manner, rationalists advocated the replacement of the old aristocracy of religion and family name with a new aristocracy of talent, of intelligence. It was in France where rationalism developed most profusely and where the worship of reason reached its zenith. Voltaire, Diderot, Montesquieu, Helvetius, Condillac and others spearheaded the rationalist movement that wanted to free the human mind from the control of religious zealots and absolutists tyrants. The individual, the “free man”, gained a position of privilege never before enjoyed.

Rationalists also sought to develop individuals who could control all aspects of their lives by means of critical analysis and suppression of spontaneous enthusiasm and feeling. They wanted to teach young aristocrats to control their passions, to avoid any display of vulgarity, to be emotionless. A general statement at the time summarized the rationalist view in the following way:

We know truth only through reason. That reason is enlightened only by our senses. What they do not tell us we cannot know, and it is mere folly to waste time conjecturing. Imagination and feeling are blind leaders of the blind. All men who pretend to supernatural revelation or inspiration are swindlers, and those who believe them are dupes (in Eby, 1934: 305).

Although most rationalists did not offer any prescriptions for schools—they actually considered them destructive to children because it forced them to submit to authority—their work does reveal certain inclinations that later on proved influential. Such was the case of the famous *Encyclopédie* (1751-1772), directed by Denis Diderot and Jean Le Rond d'Alembert, which in 33 volumes professed to include all the knowledge of science, technology and art acquired by humans until that moment. This work served as proof of the monumental progress that societies had made in their philosophical quests and conquest of nature. One important contribution of the *Encyclopédie* was to give stature and independence to new fields of science. Botany, geology, biology and chemistry became fashionable disciplines among the intelligentsia, and they started to share the glory of physics and mathematics. What was loosely called “natural history” became so popular that it was common among encyclopedists to be avid collectors of different specimens of plants, fossils, birds and insects. In general, the *Encyclopédie* represented not only the importance of acquiring information and facts, but also the necessity of detailed observation and thorough experimentation in all aspects of life.

By the end of the eighteenth century, secondary schools already reflected many of the elements embraced by the rationalist movement. The curriculum was expanded to include the new subjects from the natural sciences; the knowledge contained in the *Encyclopédie* was transmitted in a simplified form to students, and paradoxically, schools adhered more than before to memorization, something that Locke and the rationalists abhorred; knowledge that could not be measured in objective terms was cast out and the few exceptions (e.g., arts and classical languages) were transformed to meet the rigid paradigm of rationalism; and finally, imagination and feeling were scoffed at and prevented from having a rightful place in the educational system. Any human behavior (including expressive emotions) that was considered antagonistic to clear and logical thinking was deemed unreliable. Reason became the new master and emotion its servant.

Pedagogy as a Totalizing Experience

Despite the theoretical advances made in the seventeenth and eighteenth centuries in terms of pedagogical and curricular reform, in actual practice most schools retained the antiquated forms of the Reformation period. The elementary school had changed little in terms

of curriculum, methods of teaching and forms of control. Using a repressive and harsh discipline, the curriculum of the vernacular school up until the eighteenth century in Europe consisted of reading, writing, and some elementary arithmetic (Reisner, 1930: 84). Moreover, schools were not spaces concerned with time or with closely monitoring every moment of a student's life. The school day and courses did not start and end at definite times, teachers did not teach the whole class but only individually, and there was no strict pedagogy to which teachers had to adhere. With the exception of the student who was called upon by the teacher, the other students were free to do as they wished: some spoke to each other, some played, some read, some just sat there. Students had not interiorized a set of rules concerning the administration of time and space, nor did teachers attempt to impose it on them. Gradually, the emergence of a well-regimented education machine changed all this so that children lives' inside schools became completely structured, standardized and controlled.

As mentioned earlier, perhaps the first modern pedagogue was Comenius. In his writings and practice, he tried to provide a comprehensive picture of everything that took place inside schools. No moment was to be left unattended, every schooling hour needed to have a specific purpose, even leisure was carefully programmed. Within each class period, the curricular content was meticulously planned. "The subjects of instruction be so divided that each year, each month, each week, each day, and even each hour may have a definite task appointed to it" (Comenius, 1628-1632/1896: 326). The Moravian scholar, who greatly admired the technological innovations of his time, was perhaps the first educator to start applying machine-related metaphors to schools.

The art of teaching demands nothing more than the skillful arrangement of time, of the subjects taught, and of the method...The whole process will be as free from friction as is the movement of a clock whose motive power is supplied by the weights. It will be as pleasant...as to look at an automatic machine of this kind, and the process will be as free from failure as are these mechanical contrivances, when skilfully made (Comenius, 1628-1632/1896: 248-249).

Not surprisingly, Comenius' metaphors were a reaction to the era of the machine, which Europe had entered in the seventeenth century. The most important scientists geared their intellectual efforts to building machines (Mousnier, 1967). Pascal made the first calculating machine, Huygens improved the telescope and pendulum clocks, Papin made the first steam-machine using pistons and Savery perfected the steam-pump. Moreover, there were also processes and artifacts that were not necessarily new but that became refined and then popularized throughout Europe. The

paving and lighting of streets, the use of forks at the table, the artificial cooling of drinks, and the stopping of bottles with corks were just a few examples. Science and technology became synonymous with goodness, and material progress with moral progress.

Just as a machine is carefully designed and fabricated, Comenius also wanted to methodically plan all areas of a child's life, starting as early as the prenatal period (Dobinson, 1970: 25-27). He provided detailed information for the mother, including how to exercise the body, the need to maintain a careful diet—specially avoiding spicy food, in following with northern European tastes—and the need to avoid extremes in movement, temperature and even sleeping. For pre-school age children, Comenius advocated that parents systematically introduce to them the knowledge of the world. For example, to get to know the sky, young children should be trained to differentiate between the stars, the moon and the sun; later on, they needed to learn when the sun and moon rise and set, and even the fact that depending on the season the day was shorter or longer. Although Comenius did not establish explicit learning goals for all age levels, he did insist that education was a life-long process and part of the challenge consisted in selecting the knowledge and behaviors associated with each level.

These ideas were taken by Locke one step further. In *Some Thoughts Concerning Education*, Locke provided a blueprint on how to raise children and make them good students. The book, which covered more than 100 topics through short vignettes, expounded on a tremendous variety of issues, both profound and pedestrian, such as the qualities of a virtuous person, the right clothes to wear, the correct fruits to eat and how to hold the pen properly.⁸ For the correct manner of writing, he wrote, “I think the Italian way of holding the pen between the thumb and the forefinger alone may be the best” (1693/1996: 119). All his suggestions, shrouded by the need to cultivate children's rational faculties, constituted an important first attempt in providing a totalizing pedagogy that covered aspects both inside and outside the schooling experience.

Despite the meticulousness of his book, Locke himself felt that he had not studied as many areas as needed. In the conclusion of *Thoughts* he said, “There are a thousand other things that may need consideration, specially if one should take in the various tempers, different inclinations, and particular defaults that are to be found in children and prescribe proper remedies” (1693/1996: 161). Thus one can see the almost obsession that philosophers and educators at the time had with formulating and controlling ‘correct’ behavior and thinking.

⁸ Regarding the correct type of fruits to eat, Locke wrote «melons, peaches, most sort of plums, and all sort of grapes in England, I think children should be wholly kept from» because their juices are unhealthy, but «strawberries, cherries, gooseberries, or currants, when thoroughly ripe» are safe to eat and may even be conducive to good health (Locke, 1693/1996: 20).

Although Comenius and Locke provided the epistemological and intellectual basis for many modern educational activities, the actual translation of their ideas into practice in a massive scale started with Catholic orders. One of these was led by Jean-Baptiste de La Salle (1651-1719), who undertook the first systematic attempt by the Catholic church to provide popular, elementary schooling.⁹ The Institute of the Brothers of the Christian Schools, founded by La Salle in 1684, sought to provide free elementary and religious instruction in the vernacular to the children of the working classes. By 1700 the Christian Brothers managed 18 houses or schools that taught 5,000 pupils; by 1792, when the French Revolutionary Assembly decided to proscribe the order, it had grown to 127 houses teaching 36,000 students (Reisner, 1930: 108). When Napoleon reestablished the order in 1803, these schools served as a model for public elementary education in France, in other Catholic countries, and even in some Protestant nations.

What made the Christian Brothers' method so modern? La Salle's pedagogy, which was contained in the manual *Conduct of Christian Schools*, published in 1720, sought to organize public instruction in a methodical and efficient way. In seeking to standardize schools, activities were regulated with remarkable precision. As La Salle wrote in the preface of *Conduct*:

It has been necessary to [this] end that there may be uniformity in all the schools... and that the methods employed may always be the same. Man is subject to slackness, and even to changeableness, that there must be written rules for him, in order to keep him within the bounds of his duty (in Compayré, 1885: 264-265).

Given that the average classroom held 100 students to one teacher, the whole manual was a manuscript on classroom management with a main emphasis on the establishment of order and respect for authority. This was achieved by teaching children simultaneously and by allowing them to speak only in certain instances and in a low tone. Further, a whole system of signs substituted speech for most commands. To repeat the prayer, the master would fold his hands; to repeat the catechism, he would make the sign of the cross or strike his breast; to begin or end an exercise, the master would lower or raise an iron instrument. According to the *Conduct*, everything had to follow precise specifications, even the ferule (which could only be applied on the left hand so as not to prevent the child from writing): "an instrument formed of two pieces of leather

⁹ Prior to the Christian Brothers, vernacular education had been greatly neglected by the Catholic Church. The Society of Jesus, which had been the most prestigious order at the educational level, was concerned only with Latin schools (equivalent to the secondary level) and universities. There were other Christian orders that did provide some elementary education, but it was never systematic or long-lasting (Reisner, 1930: 51-60).

sewed together; it should be from 10 to 12 inches long, including the handle; the palm shall be oval, and two inches in diameter; the palm shall be lined on the inside so as not to be wholly flat, but rounded to fit the hand” (in Compayré, 1885: 272).

To homogenize the operations in schools, La Salle established in 1684 what could be considered the first normal school for the training of teachers (Eby, 1934: 223).¹⁰ Using experienced teachers, La Salle trained novices to be able to lead large groups of students in a simultaneous and systematic fashion. Undoubtedly, with La Salle’s techniques we find the first true practice of mechanizing education to a high degree.

Concomitant with the rising level of standardization in educational practices, European societies were developing in the seventeenth century a new relationship towards the notion of time. Previously, the activities of agricultural populations did not demand exact temporary units, such as hours and minutes, but rather loose, ill-defined chunks of time such as dawn and dusk, or the time needed to perform a habitual task, such as a ‘cow milking time’. Then a new consciousness of time arose in the mind of Europeans, caused by the convergence of scientific discoveries and technological inventions, a nascent industrialization, and a growing urbanization. Clocks also became popular and ceased to be luxury items. Huygens invented the balance-spring, making possible the usage of efficient pocket-watches by the end of the 17th century. New metaphors also came to the fore—signaling the rise of the new epistemology—like the ones used by Descartes and Newton in which they compared nature and the whole universe to a giant clock and God to the consummate clock-maker.

In schools, the strict adherence to time only came into effect at the end of the eighteenth century and beginnings of the nineteenth. In one school in France, the following was the daily schedule:

8:45 the monitor enters the classroom, 8:52 organization, 8:56 pupils enter the classroom and the prayer starts, 9:00 pupils sit down, 9:04 first dictation, 9:08 end of dictation, 9:12 second dictation, etc. (Foucault, 1991: 137).

In sum, by the end of the eighteenth century schools had become teaching machines in which every single aspect was closely monitored and controlled. Pedagogy became the systematic means of distributing individuals in a physical and temporal space. Just as educators became obsessed in accounting for every moment in school, the student’s

¹⁰There is some dispute regarding if La Salle’s normal school was the first or second ever founded. In 1672, Father D emia, a Catholic priest of Lyon, established a seminary for the training of teachers, but it appeared to have lacked the efficiency and punctiliousness that was La Salle’s hallmark (Eby, 1934: 223).

body also became an important source of control. It became crucial to “discipline the body” to reach the highest level of efficiency. The new pedagogy did away with the traditional system in which the teacher worked for a few minutes with a student while the rest waited without supervision. It opened up the possibility of controlling each student and the simultaneous work of the whole class. It organized a new economy of learning time that helped to normatize, discipline and replicate schooling behavior. While schools today do not follow this extremely regimented behavior, the practice of highly disciplined and structured classrooms is very much in place, which has restrained spontaneity and the free display of emotions; consolidated a social distance between teachers and students, and among students, making learning an individualized rather than a collective experience; and limited extemporaneous learning opportunities for students, such as those found in hands-on forms of learning inside and outside of the school. Ultimately, these problems alongside those mentioned in previous pages—intellectual and rational development viewed as the pinnacle of learning, mathematics and science viewed as more important than other disciplines, a fragmented understanding of reality, and an appreciation of nature as an inanimate entity, all coalesced to foster an educational experience that may stunt the normal psychosocial growth of educators and students. The final touches for creating the modern school occurred with the rise of the national school systems and their penchant for consolidating a single national body politic, which brought about the marginalization of non-hegemonic knowledges and practices (including the use of regional and less powerful languages).

The Advent of National Systems of Education

Two historical events precipitated the changes in European society that finally cleared the path for the transformation of schools and the establishment of mass educational systems. First, the expulsion of the Jesuit Order from Portugal in 1759, followed by its banishment from other European countries and Latin America in the following decade. Given that in southern Europe schooling was conducted almost entirely by the Jesuits, and other religious orders that the Jesuits dominated, their absence left an educational vacuum that was profited by supporters of modern practices who advocated the secularization of schools. Second, the 1789 French Revolution with its emancipatory call away from religious dogmatism and social and economic thralldom. The quest for equality and inalienable individual rights resounded everywhere, and formal education became one of those rights. From the outset, revolutionary leaders were intent in providing mass schooling to disseminate the patriotic, republican values of the new regime. Jean-Jacques Rousseau (1712-1778) was one of the first

to propose a national system of education in his *Considerations on the Government of Poland*, completed in 1772, in which he stressed that properly organized systems of education could promote social change and the common good. In contradiction with some of the principles set forth in the *Émile*, published 10 years earlier—specially his stress to respect the natural propensities of each child—Rousseau proposed a system that would mold every child according to a single national standard. He wrote:

When he [a Polish child] is learning to read, I want him to read about his own country. At ten, he should be acquainted with all its provinces, highways and towns. At fifteen, he should know all its history; at sixteen, all its laws... At twenty years of age, a Pole ought to be a Pole and nothing but a Pole (in Eby 1934: 344).

Rousseau was certainly not the only one who prior to the French Revolution called for national educational systems. Diderot, Mirabeau, Talleyrand, Condorcet and others presented similar plans, which called for the centralization of all culture and education under public control. What the Revolution did was to finally open up the possibility to concretize these plans. But despite the passage of laws by the French revolutionary leaders, it was not until Napoleon's arrival when an efficient system of secondary and higher education was established in France. Elementary education, for which Napoleon had no interest whatsoever, had to wait almost a century for it to be disseminated throughout France.

The first actual implementation of an efficient, universal, free, mandatory schooling system took place in Prussia in the first three decades of the nineteenth century (Reisner 1930: 218-219). After Prussia was defeated by France in 1806, and a set of humiliating demands were forced upon Prussia, the philosopher Johann Fichte blamed the defeat on the lack of love for the motherland. In a series of presentations in Berlin entitled "Addresses to the German Nation", published in 1807-1808, Fichte aroused Germans to have a larger self, one to which they would owe full loyalty and devotion. He called for nothing less than the subordination of the will of the individual to that of the nation. Fichte believed that only a national system of education could save the German nation. As a result of Fichte's influence, by the 1830s the first veritable national educational bureaucracy was established, headed by the Ministry of Religion, Education and Public Health. It established teacher training schools throughout Prussia, school inspectors for each county, and at least one school per community.

The modern curriculum that resulted from the nineteenth-century spurt of nationalist sentiment, which has remained virtually identical up to the present, has three inter-locking dimensions (Meyer *et al.*, 1992: 173-74). First, a rationalist component that emphasizes universal

truths and objectivity as its main elements; today, they are manifested in the form of Math and the Natural Sciences. Second, the heritage from pre-modern schooling, the subjects centering around Ancient Greece and Rome, including philosophy and classic languages; given that these have importance over time, they have been replaced by language arts and literacy in the national language. And third, the nationalist influence, which adds to the curriculum a national tongue and history that excludes regional languages and histories.

This rational-classical-nationalist triad was closely imitated by other European countries, the United States, and Latin America so that by the beginning of the twentieth century many had a thoroughly standardized and bureaucratized educational system. Among its main features were compulsory attendance and free tuition; lay and highly trained teachers; a secular and fragmented curriculum that focused on abstract knowledge with little or no relevance to children's immediate lives; a concentration on patriotic symbols and national culture (and a consequent disregard for local values and histories); a hierarchical educational pyramid with standard elementary schools in all communities, secondary education in towns, and tertiary education in only the larger cities; and a stress on the national language at the expense of regional ones. At the level of classroom organization, many of the elements seemed to have been borrowed directly from Comenius' *The Great Didactic*: The constitution of a true class taught simultaneously by a single teacher; the usage of identical textbooks, one for each student; a reverential discipline with sound signals commanding the beginning and the end of each class; and the surveillance of each moment in the classroom with a subtle system of rewards and punishments.

By the nineteenth century it had become clear that the state had taken over the education of children, and families had relinquished their role of being the main educators. Schools trained children to become members of a new community: the large, impersonal and bureaucratic family of the nation-state (Levinson *et al.*, 1996). Children had been given the role of 'students' and had to learn the necessary skills and behaviors to become honorable citizens and, eventually, also effective workers in the emerging industrial-bureaucratic world. Modern education had finally been born in a massive, national scale, and the belief that all children should go to school would become deeply ingrained in nations around the world.

Conclusion

In this article I explained the rise of the constitutive elements of modern schooling by exploring key epistemological changes that occurred mostly during the seventeenth and eighteenth century in Europe. While my main focus was the intellectual development of modern schooling, I

also showed how social, technological, economic, and political forces influenced the evolution of schools. Understanding the genesis of these elements is vital for transforming the negative aspects of modern schools (e.g., an artificial and ritualistic nature of classroom learning coupled by a virtual monopoly of book and abstract/fragmented knowledge) while still retaining its more positive ones (e.g., a defense for human rights).

Clearly, the modern school was a direct response to an era characterized by religious fundamentalism, monarchical despotism, and a vilification of individual rights. But in their zeal to right wrongs, supporters of modern schooling replaced one form of dogmatism for another, so much so that one critic argued that “school has become the world religion of a modernized proletariat” (Illich, 1971: 15). This dogmatism was evident in Comenius himself, who wanted to concretize his educational model not just for Europe but for *all* nations in the world. As he wrote in his *Pampaedia*, originally published in 1650, “It is essential that we should wish that even the utterly barbarous peoples should be enlightened and liberated from the darkness due to lack of knowledge, for they are a part of the human race” (in Dobinson 1970: 55). This patronizing attitude of illuminating the “barbarous peoples” has, unfortunately, been a constant in modern education. Thus, understanding how modern schools came to be, is a part of a much larger answer towards educational reform.

Bibliografía

- Benavot, A. and P. Riddle 1988. “The expansion of primary education, 1870-1940: Trends and issues”. *Sociology of Education*. 61 (3): 191-210.
- Blaug, M. 1973. *Education and the employment problem in developing countries*. Geneva, International Labor Office.
- Boli, J., F. O. Ramirez, and J. W. Meyer, 1985. “Explaining the origins and expansion of mass education”. *Comparative Education Review*. 29 (2): 145-170.
- Bowen, J. 1981. “The modern West, Europe and the New World”. In *A history of Western education, Vol. III*. New York, St. Martin’s Press.
- Bowers, C. A. 2001. *Educating for eco-justice and community*. Athens, GA, University of Georgia Press.
- Comenius, J. A. 1896. *The great didactic*. With Introduction, Biography and History by M. W. Keatinge. London, Adam and Charles Black. Originally published 1628-1632.
- Compayré, G. 1885. *The history of pedagogy*. Translated and with an Introduction by W. H. Payne. Boston, D. C. Heath & Company.
- Descartes, R. 1901. *Discourse on method*. Trans. J. Veitch. New York: Tudor Publishing Co. Originally published 1637.

- Dobinson, C. H. 1970. *Comenius and contemporary education*. Hamburg, Unesco, Institute for Education.
- Eby, F. 1934. *The development of modern education*. New York, Prentice-Hall, Inc.
- Fontaine, J. P. 1999. *L'aventure du livre: Du manuscrit medieval à nos jours*. Paris, Bibliotheque de l'image.
- Foucault, M. 1991. *Vigiar e punir: História da violência nas prisões*. Translation by Ligia M. Pondé Vasallo. Petrópolis, Brazil, Editora Vozes.
- Fuller, B. and R. Rubinson (eds.). 1992. *The political construction of education: The state, school expansion and economic change*. New York, Praeger.
- Fuller, B. 1991. *Growing-up modern: The Western state builds third world schools*. New York and London, Routledge.
- Gaulupeau, I. 1992. *La France à l'école*. Paris, Découvertes Gallimard.
- Illich, I. 1971. *Deschooling society*. New York, Harper Colophon Books.
- Inkeles, A. and D. B. Holsinger (eds.). 1974. *Education and individual modernity in developing countries*. Leiden, Brill.
- Inkeles, A. 1983. *Exploring individual modernity*. New York, Columbia University Press.
- Lave, J. 1988. *Cognition in practice: Mind, mathematics, and culture in everyday life*. Cambridge, England, Cambridge University Press.
- Levinson, B., A., D. E. Foley and D. C. Holland. 1996. *The cultural production of the educated person: Critical ethnographies of schooling and practice*. Albany, State University of New York Press.
- Locke, J. 1996. *Some thoughts concerning education and of the conduct of the understanding*. Edited, with an Introduction by Ruth W. Grant and Nathan Tarcov. Indianapolis and Cambridge, Hackett Publishing Company, Inc. Originally published 1693.
- Luke, C. 1989. *Pedagogy, printing, and Protestantism: The discourse on childhood*. Albany, State University of New York Press.
- Merchant, C. 1980. *The death of nature*. New York, Harper & Row.
- Meyer, J. W., D. H. Kamens, A. Benavot, Y.-K. Cha and S.-Y. Wong. 1992. *School knowledge for the masses: World models and national primary curricular categories in the twentieth century*. Washington, D.C., The Falmer Press.
- Meyer, J. W. and M. T. Hannan. 1979. *National development and the world system*. Chicago, Illinois, University of Chicago Press.
- Mousnier, R. 1967. *Les XVIe et XVIIe siècles, Tome IV, Histoire générale des civilisations*. Paris, Presses Universitaires de France.
- Newton, I. 1999. *The principia: Mathematical principles of natural philosophy*. Edited by B. Cohen & A. M. Whitman. Berkeley, University of California Press. Originally published 1687.

- Orr, D. W. 1994. *Earth in mind: On education, environment and the human prospect*. Washington, D.C., Island Press.
- Ozmon, H. 1969. *Utopias and education*. Minneapolis, MN, Burgess Publishing Company.
- Postman, N. 1992. *Technopoly: The surrender of culture to technology*. New York, Vintage Books.
- Prakash, M. S. and G. Esteva. 1998. *Escaping education: Living as learning within grassroots cultures*. New York, Peter Lang.
- Randall, J. H. Jr. 1976. *The making of the modern mind: A survey of the intellectual background of the present age*. New York, Columbia University Press.
- Reisner, E. H. 1930. *The evolution of the common school*. New York, The MacMillan Company.
- Sadler, J. E. 1966. *J. A. Comenius and the concept of universal education*. London, George Allen and Unwin Ltd.
- Skutnabb-Kangas, T. 2000. *Linguistic genocide in education—or worldwide diversity and human rights?* Mahwah, NJ, Lawrence Erlbaum Associates.
- Smith, G. A. 1992. *Education and the environment: Learning to live with limits*. Albany, State University of New York Press.
- Whitehead, A. N. 1929. *The aims of education and other essays*. New York, Mentor Books, first published by the MacMillan Company.
- Wilds, E. H. and K. V. Lottich. 1936. *The foundations of modern education, Third edition*. New York, Holt, Rinehart and Winston.