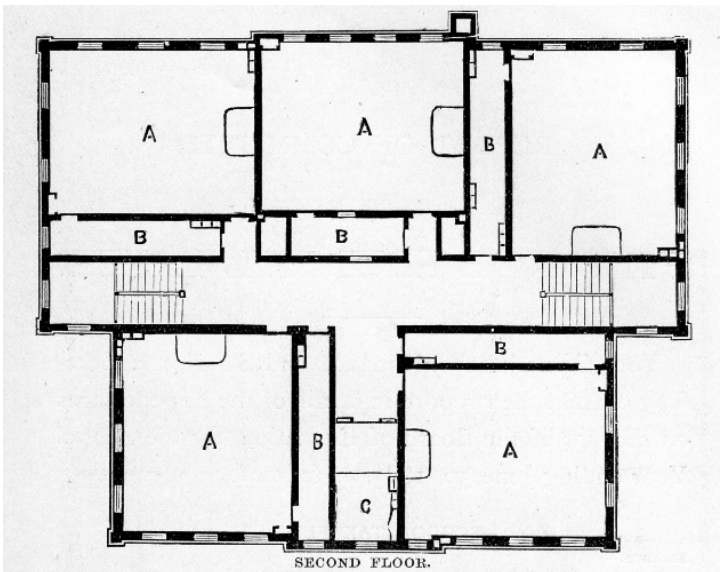


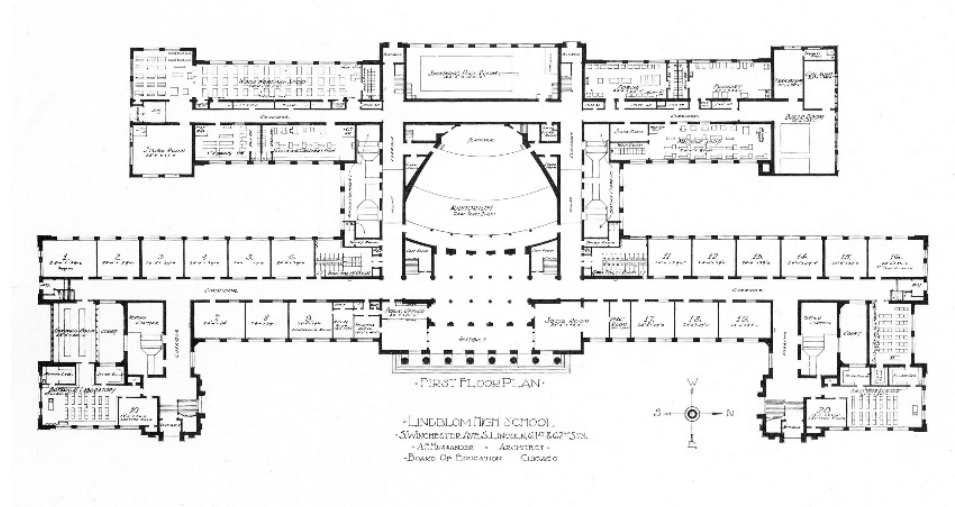
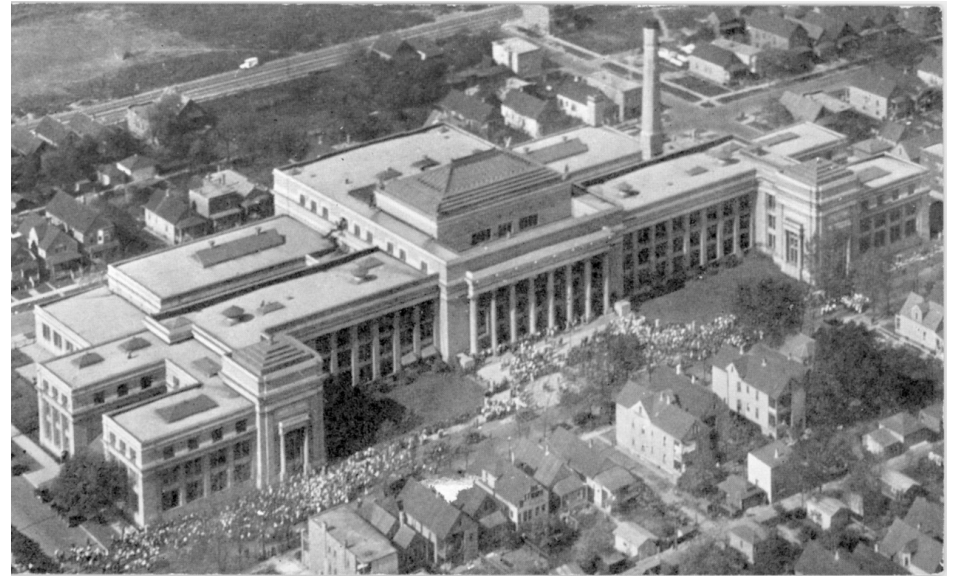
“The Transformation of the Schoolhouse: Modernizing School Architecture in the Nineteenth and Twentieth Centuries”

Abstract: School buildings as a type have been works in progress since the mid-nineteenth century, consistently evolving, through the interaction of educators and architects, in an effort to make structures that not only enclose but also enhance the educational processes occurring between their walls. They have changed from a simple collection of similar rooms with few amenities to complex, differentiated modern school plants wherein almost every design decision is impacted by its effect on pedagogy and learning. This paper will examine on how school buildings were transformed over the nineteenth and early twentieth centuries by organizational and curricular reforms in educational systems, increased societal emphases on the health and hygiene of school-aged children, and education's changing role in modern society. It will discuss how the architecture of secondary education differed from that of primary education and the manner in which transformations in the United States related to parallel currents elsewhere.

Dale Allen Gyure



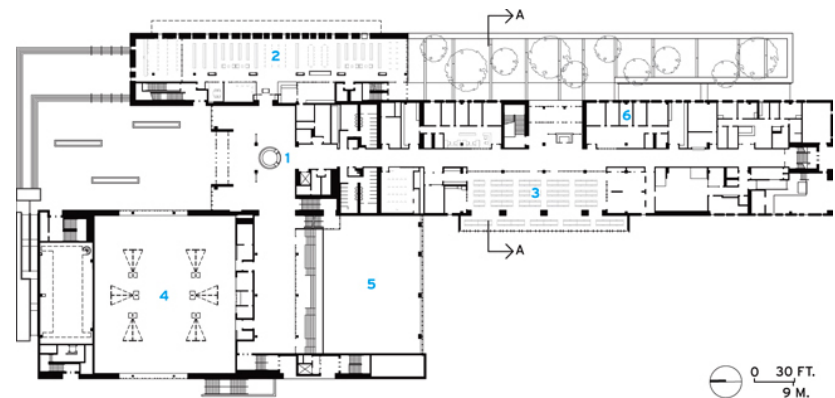
IMAGES * West Division High School (Chicago – Augustus Bauer, 1880)



IMAGES * Lindblom High School (Chicago – A.F. Hussander, 1918)

The modern school building is the product of a relatively brief evolutionary period occurring between the mid-nineteenth and early twentieth centuries in Western Europe and the United States. It developed in response to a variety of factors and influences, including the rise of mass education, beginning in industrialized countries and spreading around the world, that spawned new ideas for educating youngsters and new challenges for the school's physical environment. By the 1920s, the constituent elements of the modern school had been determined, and I would argue that there have been no substantial physical changes since then.

In this paper I'll briefly summarize the transformation of the nineteenth-century schoolhouse into the twentieth-century school building in terms of the architectural changes and the forces that impacted school design. I'll focus my remarks on the United States, not only because it happens to be my personal area of expertise, but also because the USA has been in the vanguard of modern school design for over a century.

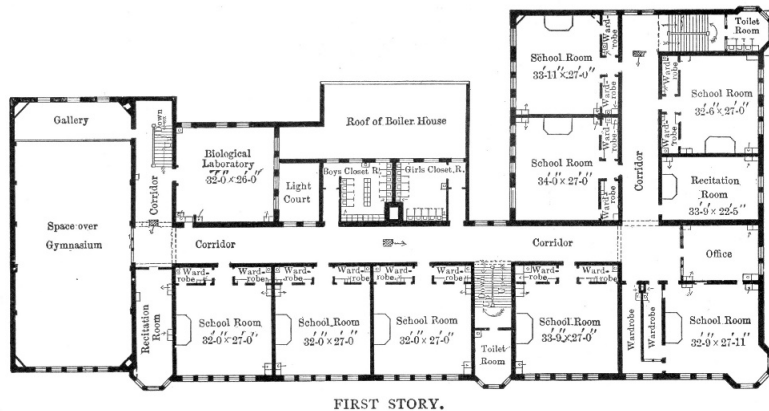


GROUND FLOOR

IMAGES * South Shore Int. College Prep High School
(Chicago – John Ronan Architects, 2011)

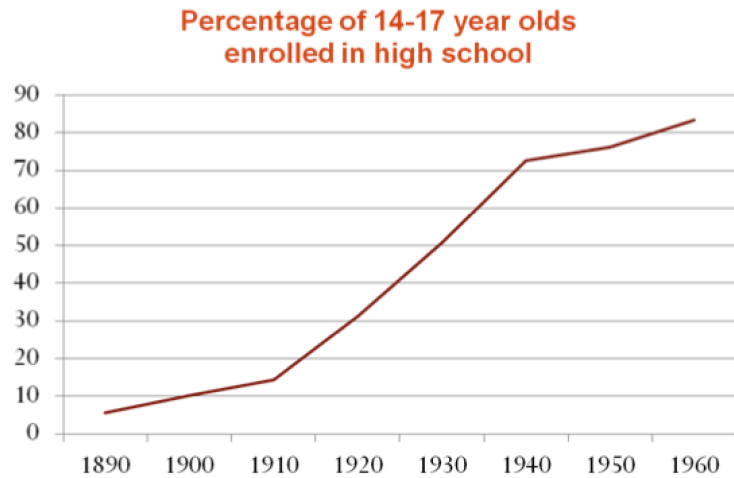


While numerous—and sometimes competing—stimuli helped shape the modern school’s evolution, most of them emerged from the same source: the proliferation of mass public education. Universal education first appeared in the eighteenth century, and by the late nineteenth century, states throughout the Western world implemented and enforced laws that *required* children to attend school up to a certain age. Such compulsory education was fueled by nationalistic yearnings, a desire to oversee the moral upbringing of younger citizens, and the pragmatic recognition that life in the modern industrialized world required certain knowledge, skills, and personal characteristics that were too complex to be transmitted through the family unit, the most traditional site of human learning.



IMAGES * North-West Division High School (Chicago – Charles Rudolph, 1889)

The Pre-Nineteenth Century School Building



Beginning in the nineteenth century, a massive increase in school attendance stressed existing school buildings and revealed inadequacies in pedagogy and curricula. In the United States, for example, in 1890—when compulsory attendance laws were in their nascent stage—5.6% of 14-17 years olds were enrolled in high school; by 1920, the percentage had risen to 35%, and in 1940, on the eve of World War II, 73% of these teenagers attended school on a regular basis. This growth combined with substantial immigration increases to produce an untenable situation, as over 23 million immigrants arrived in America between 1880 and 1920.

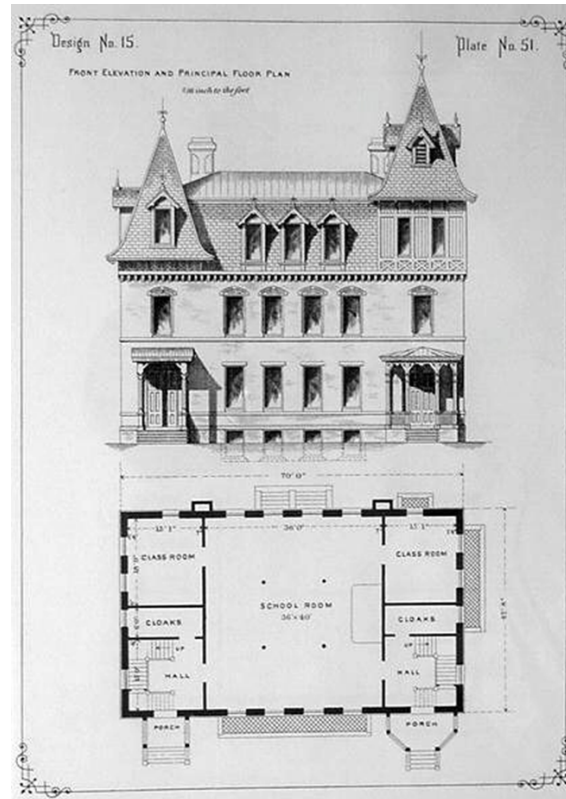




THE ICHABOD CRANE SCHOOL HOUSE, KINDERHOOK, N. Y.



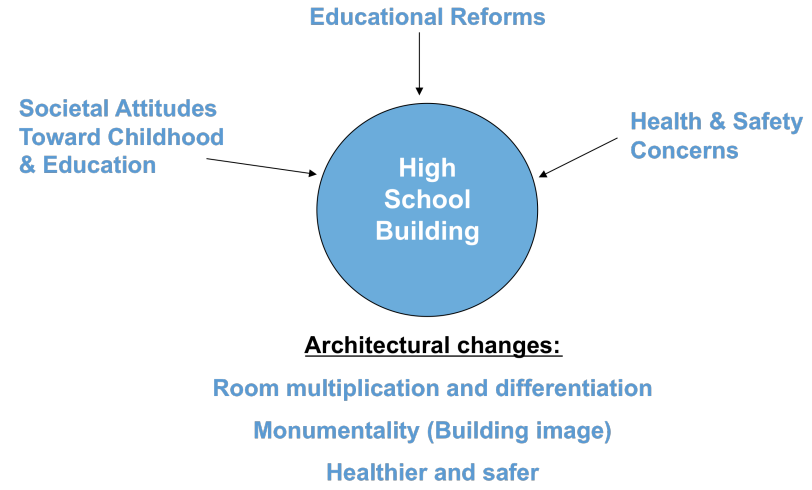
Throughout most of the nineteenth century, however, children who attended school did so in circumstances and built environments that differed little from previous generations. From the beginnings of human education until the 1800s, few of the buildings housing the education of children were purposefully designed. Most school buildings were converted—or appropriated without alteration—from other uses. Because traditional learning methods placed few demands on the educational process, any shelter from the elements large enough to hold the desired number of pupils sufficed. Up to that time most pedagogies involved some version of the “mental discipline” approach whereby students were expected to memorize large amounts of material and recite it upon command. Curricula were narrow: for younger children, a focus on reading, writing, and mathematics; for teenagers, the addition of classical languages, history and geography, science, and moral philosophy. None of these subjects demanded any special accommodations beyond a meeting space that allowed the teacher to maintain physical and psychological control over the students. Because physical education and vocational training were nonexistent, and schools didn’t offer meals to their students, school buildings could be relatively simple.



Since the beginnings of mass education there have evolved three levels of schooling in most Western countries: pre-school or nursery; grammar or primary; and secondary. The complexities of education and pedagogy increased with each grade, but until the late nineteenth century the school buildings for these three levels had more similarities than differences. The prototypical pre-modern urban school building was a unitary, often cube-shaped form of varying height. Its basic components, at all levels of education, were few: a series of cellular classrooms and some type of gathering hall; for the youngest children, a play area outside was standard. Most nineteenth-century schools contained identical floor layouts composed of repeated classrooms of a standard size. The only real challenge in their design was how to circulate students vertically if the school was to be taller than one story; common solutions were matching, symmetrical stairways at the ends of a rectangular box or a central open stairway/atrium. As mentioned, no specialized places were required other than a separate room for the headmaster, perhaps bathrooms (depending on the time period), and often an assembly hall for gathering all of the students—and sometimes the public—together in one space. In most cases the assembly room was placed at the top of the building for structural reasons, and it was common for it to be created simply by removing the wall between two classrooms; a centralized form that was widespread used the atrium for such events. In terms of its exterior appearance, the premodern school tended to be visually unimpressive, or at best a competent rendering of a

traditional style. Classical symmetry was prevalent on the façade and in the floorplan.

Factors Influencing the Development of the Modern School Building



Beginning in the 1870s, new developments began to alter the American schoolhouse. In addition to the sheer increase in students due to the implementation of compulsory education laws and foreign immigration, there were three main areas of influence that I will outline: organizational and curricular reforms in educational systems; evolving attitudes toward education in society; and a greater concern for students' health and safety. These three concerns combined to make the modern school building.

Organizational and Curricular Reforms

NATIONAL EDUCATION ASSOCIATION
DEPARTMENT OF SCHOOL ADMINISTRATION

LESS WASTE GREATER EFFICIENCY

WALLS & PARTITIONS NOT OVER	10 %
FLUES NOT OVER	5 %
STAIRS & GORRIDORS NOT OVER	20 %
ACCESSORIES NOT OVER	3 %
INSTRUCTION NOT LESS THAN	50 %
ADMINISTRATION NOT OVER	12 %

THIS CANDLE IS TO SHOW THE DIVISIONS INTO WHICH THE TOTAL FLOOR AREA OF A SCHOOL BUILDING IS DIVIDED

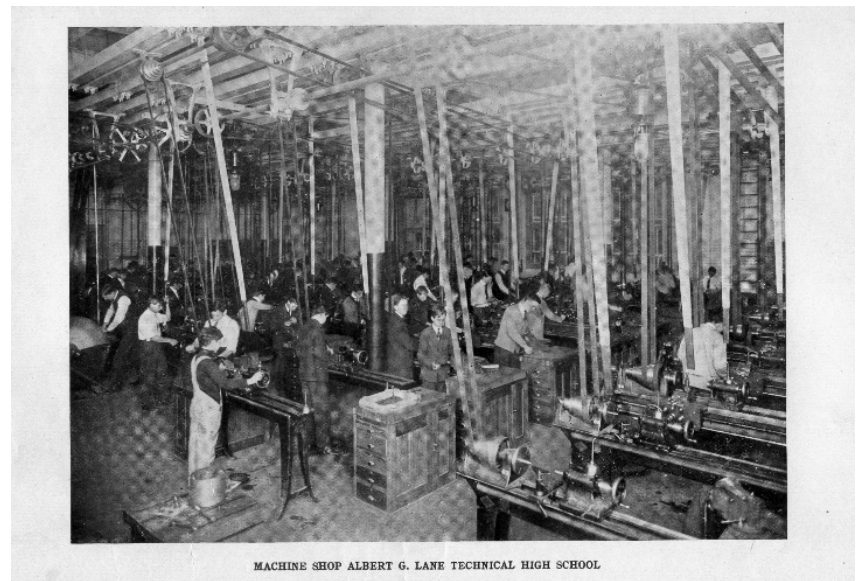
THE TOTAL FLOOR AREA IS TAKEN AS 100 PER CENT

THE CANDLE OF EFFICIENCY
IN SCHOOLHOUSE PLANNING

TRY THIS MEASURE
ON YOUR SCHOOL BUILDING
THEN SEND THE RESULTS TO
COMMITTEE ON STANDARDIZATION OF SCHOOL BUILDINGS
FRANK IRVING COOPER
CHAIRMAN • 35 CORNHILL • BOSTON

NOTE: TABULATIONS SHOW MANY SCHOOL BUILDINGS WITH ADMINISTRATION 10% STAIRS AND GORRIDORS 17% FLUES 3% AND INSTRUCTION 37 PER-CENT -

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MACHINE SHOP ALBERT G. LANE TECHNICAL HIGH SCHOOL



Photo by Dale Allen Gyure

Average number of school board members in America's 28 largest cities

1893 = 21.5

1913 = 10.2

1923 = 7.0

Starting from the top, Western educational systems, no matter whom they answered to, began to reorganize in the latter nineteenth century. Urban school systems in the United States adopted the “corporate-bureaucratic model,” which consisted of a small, centralized school board, a superintendent to oversee operations, and a professional staff to execute policies. When considering this centralization of authority together with the widespread move toward state training of teachers (followed by regulation of the teaching profession) we can begin to see the outlines of a modern educational system.

This reform was very much a symptom of a developing cultural fascination with efficiency in the initial decades of the new century, inspired as much by the machines which spurred this obsession as the pace and complexity of life seemed to increase exponentially. In this “Search for Order,” to borrow the title of a famous book on Progressive-Era America, the drive for efficiency in all regards led American schools to become as regimented as factories.

The efficiency mania can be seen in the books and articles that taught techniques for achieving “personal efficiency” or “scientifically” managing the household. “At the turn-of-the-century, the efficient corporation had become the model for social institutions, and education was no exception.

Eager educators turned their eyes to successful American businesses for guidance in organizing and operating their school systems and began analogize schools with businesses or machines, or to conceptualize schools in business terms.

The architectural complement to the efficiency movement was a quest to design buildings that best fit the curriculum and protected the health of the students for the least cost. So the development of different-sized rooms to house different subjects and floor plans intended to maximize light and improve replaced the dark, stuffy nineteenth century schoolhouse with its stacks of identical rooms and poor circulation; the old buildings were considered inefficient and unsafe.

A further attraction of the corporate-bureaucratic organizational model was its correspondence with the by-then ubiquitous graded schools. From English Lancasterian beginnings characterized by extraordinary numbers of pupils of different ages and talents undergoing lessons in one space, American schools began to adopt the Prussian model of graded schools, beginning with Boston in the 1840s, which partitioned children according to their age and standardized curricula by grade throughout the system. This approach was based on efficiency as much as developmental concerns, and in that way meshed perfectly with the corporate mindset.

Chicago High School Curriculum – Courses of Study:

1856 → **Classical (3 yrs), English (3), Classical & English (4), Normal (2)**

1880 → **English (2), College Prep (3), Comprehensive (4)**

1915 → **11 four-year and 11 two-year courses**

Four Year: *General, Science, Normal preparatory, Commercial, Office preparatory, Technical, General trades, Household arts, Arts, Architectural, and Pharmacy.*

Two Year: *Accounting, Shorthand, Mechanical drawing, Designing, Carpentry, Pattern making, Machine shop, Electricity, Household arts, Printing, and Horticulture*

Educational reforms didn't end with organizational changes. Beginning in the late nineteenth century school administrators began to rethink their institution's basic orientation given the effects of rapid industrialization and population increases. More emphasis began to be placed on secondary education, which to that point had been somewhat of a luxury for the children of middle class parents. With increasing acceptance of the importance of public education as a national imperative, educators introduced alternatives to the prevalent college preparatory or general curricula, expanding into manual training and vocational education. As the country adjusted to the notion of universal schooling and public school enrollments rose dramatically, it was vital that school systems develop courses of study and non-academic classes tailored to the greater masses. This approach was codified in 1917 through federal legislation that provided government matching funds to

secondary schools offering agriculture, trade and industrial education and home economics.

The architectural impact of these organizational and curricular reforms can be seen in the development of the comprehensive high school plan. The traditional schoolhouse, with its boxy form and its duplicated, stacked classrooms, underwent a shift from unity to differentiation in terms of its interior spaces—which echoed the transition that took place in curricula and overall administrative organization. From its roots in ungraded schools utilizing single rooms, American education had evolved into a system segmented by age/grade levels occurring in multi-room buildings with specialized spaces under the pressures of efficiency minded reformers and the necessity of absorbing scores of new students in a short period of time. School architects could no longer stack duplicate four- or six-room floor plans on top of each other to create a secondary school; now, in addition to normal classrooms, they needed to design spaces for laboratories, domestic sciences, art and mechanical drawing, workshops, and other rooms necessary for preparing teenagers for their future roles as working citizens.

School and Society

<u>High School Attendance of 14-17 yr. olds</u>		<u>Public High Schools</u>
1890	3.7%	2,526
1920	28.4%	14,326

Total American High School Students

1890	203,000
1920	2,200,000

Chicago High School Enrollments:

1856 = 114
1870 = 600
1880 = 1,043
1890 = 1,701
1900 = 10,201
1910 = 17,781
1920 = 36,483

By 1920, school was no longer for the privileged elite in America – it was becoming part of every child’s life. Compulsory attendance and child labor laws combined to increase enrollments, and secondary schools also gained popularity because they were more responsive to adolescents’ practical needs. There was a distinct change in education’s purpose. As educators became more concerned with training students for life, the school became a central social agency in American society. In the process, the schoolhouse began to represent more than just a place to learn, and its architecture reflected this institutional evolution. The secondary school in particular occupied an especially important place in the educational hierarchy as the capstone of the public education

system and the institution which taught adolescents the most important skills they would need for later life.

Health and Safety



In the late nineteenth century Americans became more aware of their bodies and physical health, partially as a factor of increased advertising of consumer products aimed at cleanliness and personal hygiene and partially due to popular scientific theories. In the educational world, the new body and health awareness centered on three main areas pertaining to the schoolhouse: lighting, heating and ventilation, and fire safety. This awareness led to attempts to create healthier and safer school buildings.

Lighting was deemed the most important health consideration. Beginning in the 1870s, the adequate lighting of the

schoolroom became one of the most important topics in school architecture design. Before artificial lighting became widely-used in urban schoolhouses in the 1920s, architects literally reshaped and reoriented school buildings in an effort to control the amount and direction of natural light entering the classroom. Light was considered essential for maintaining students' eyesight; it was also prized for its supposed germicidal qualities. Efforts to control light's proper distribution were based on alleged scientific "evidence" that poor lighting damaged students' eyesight. Such studies—whether legitimate or not—influenced the rapid evolution of lighting standards during this period. These standards would affect school architecture by changing the typical classroom's size and shape and the school building's overall layout.

Large windows (up to 5' wide and 8' tall) and high ceilings allow daylight to penetrate the room. Due to the angle of the sun, classrooms were less than 30' wide so that no child would have to sit at a desk without sunlight. American classrooms tended to standardize around the turn of the century at 24' wide and 32' long. Additionally, the direction of the light was very significant and helped shape classroom design across the Western world for decades. Schoolrooms typically included a bank of large windows to the left of the student desks as they faced the teacher, and, ideally, direct light entered from no other exterior wall. Clearstories and transom windows helped reflected light enter the room from the hallway. On schoolhouses from this era one often sees distinct blank walls

that interrupt the window rhythm, obviously a consequence of following the unilateral lighting rule.

Architects further calculated the schoolroom's proper dimensions based on the amount and source of light, configuring its size to allow light to properly penetrate all parts of the room from a bank of windows along the left hand/exterior wall. Ideally, such windows would begin at a height three feet above the floor and extend to within six feet of the ceiling. The commonly accepted rule by the turn-of-the-century called for a window area equal to one-fourth the amount of total floor space, although this was often adjusted for school buildings in different regions of the country.



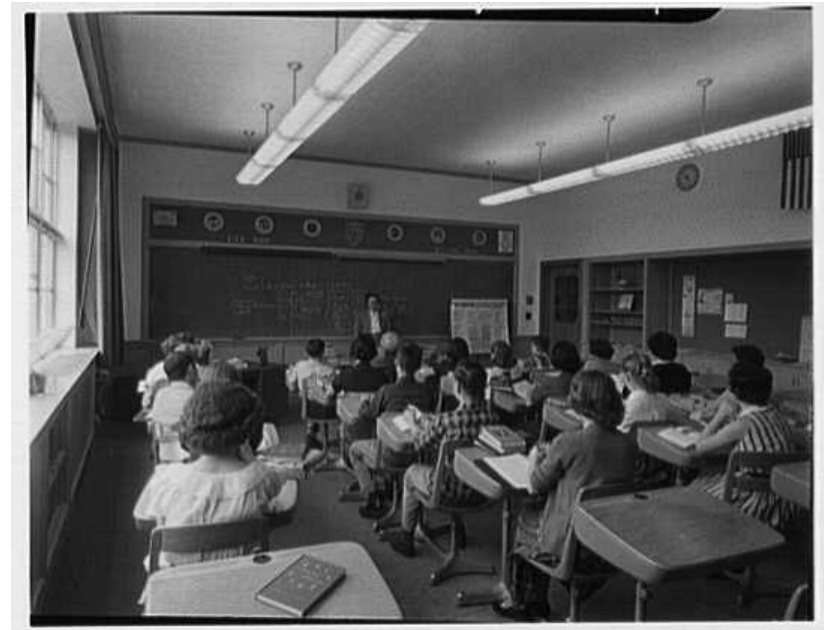
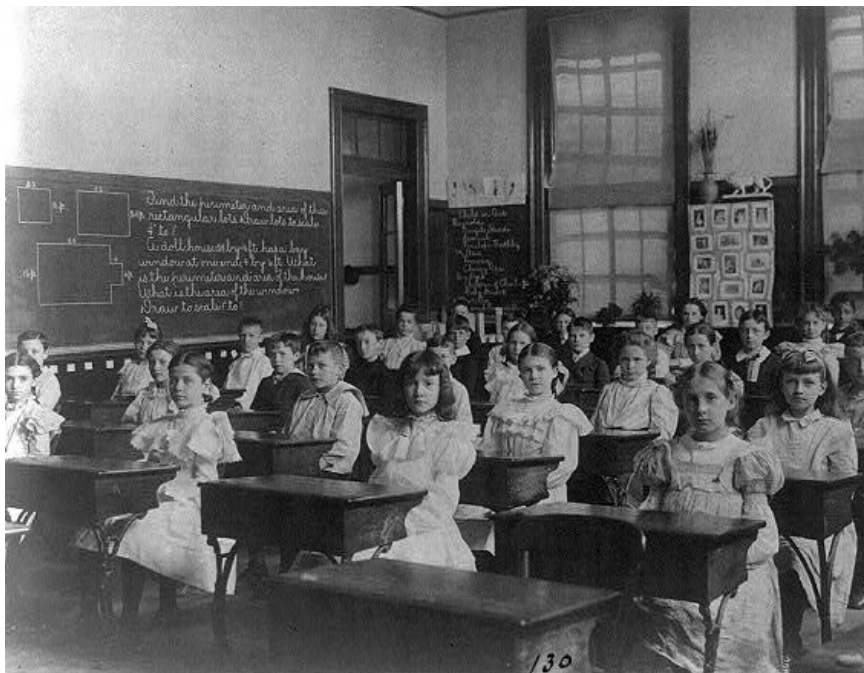
Architects' interest in adequate ventilation went hand-in-hand with proper lighting issues, and the two combined to significantly influence the schoolhouse's transformation.

Schoolrooms in the nineteenth century were not only designed with natural lighting in mind, but also with an eye toward proper ventilation and heating. The room's form, height, and window size had important consequences for the manner in which air could be circulated. Three major considerations shaped their activities: the amount of cubic feet of air space needed for each student; the amount of cubic feet of fresh air required per minute per student; and the air temperature. A desire to avoid the debilitating effects of vitiated air in the classroom prompted the first two considerations. Temperature regulation was also linked to bad experiences in poorly heated and ventilated buildings.

Schoolhouse ventilation improved by the 1910s, mainly due to the application of the new mechanical systems. While the changes in heating and ventilation did not affect the school building as visibly as the changes in lighting, there were nonetheless repercussions for the entire modern school building. Early twentieth-century schools were intricate machines with huge mechanical instruments and many miles of hidden ducts, flues, and pipes. The fact that all of this attention was paid to the heating and ventilation of school buildings demonstrates a change in society's priorities. Children were becoming more valued as future societal resources whose health was worth protecting. While much was written at the turn of the century about the heating and ventilation of all types of American buildings, in no other area was adequate ventilation considered such a *necessity* and advocated with such enthusiasm.

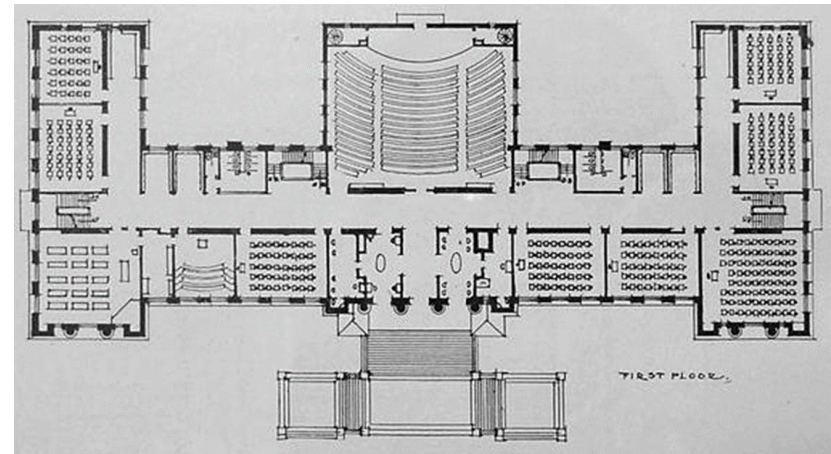
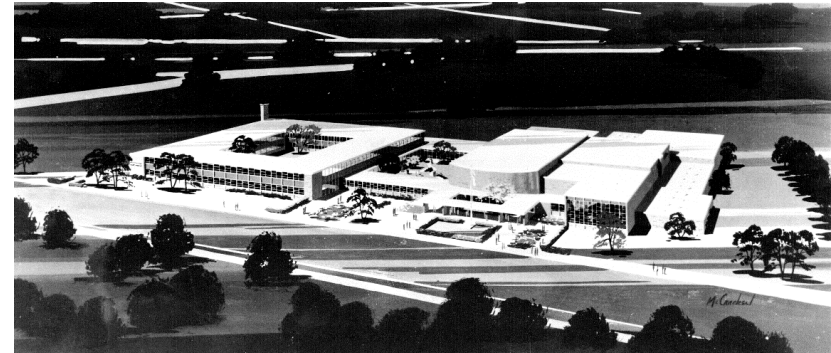
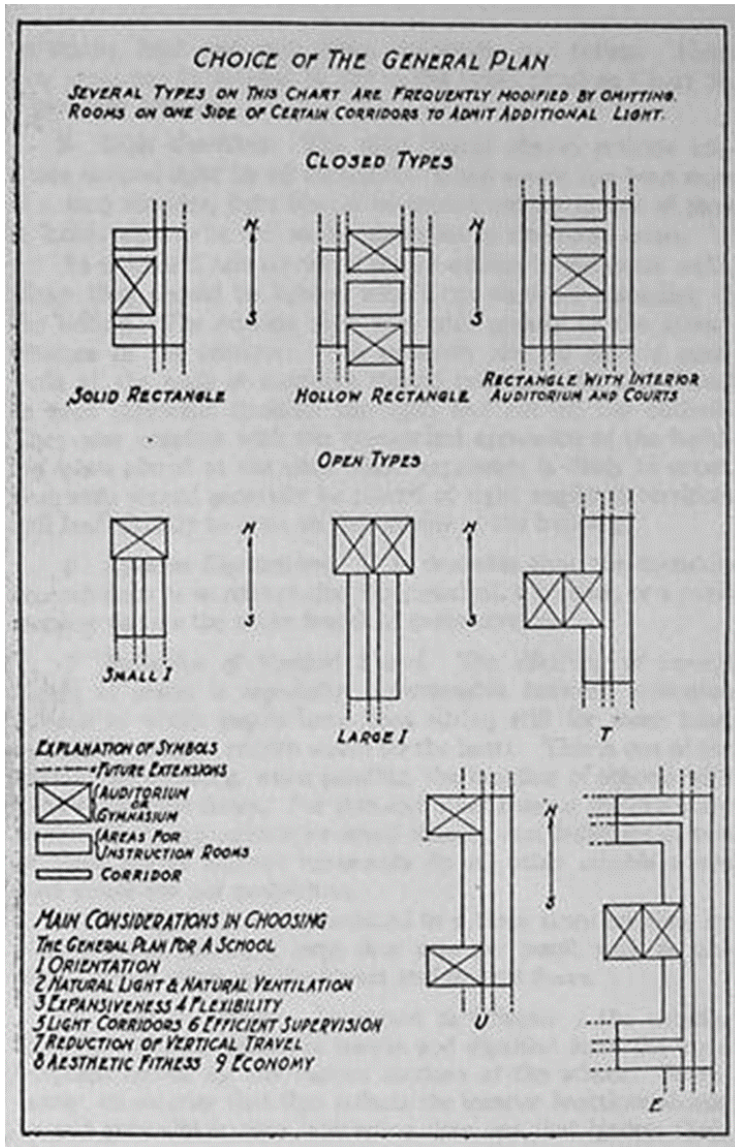


One final important aspect of the schoolhouse's transformation was the movement toward fire safety. The ever-present risk of fire haunted architects and educators in the late nineteenth and early twentieth centuries. School building fires were a fact of life in turn-of-the-century America. After several highly publicized disasters, legislative reforms were implemented throughout the United States, while advances in technology and innovations in planning led to the creation of a safer school building. As a result of these efforts, school buildings were designed with more exits, more vertical circulation, more fireproof materials in stairways, corridors, and doorways, and—eventually—fewer stories.



Where was pedagogy in this stew of influences? The fact is that pedagogical methods remained virtually unchanged during the transition from the old-fashioned schoolhouse to the modern school building. The schools were instruments of social order, and the classroom was its nucleus. Teachers acted as drill-masters, in absolute control, often running their classrooms with military precision. This practice reigned from the oldest secondary school teenagers to the youngest primary school first-graders. Not until the mid-century period did progressive techniques such as team-teaching, small group learning, and guided exploration begin to make headway in the public schools.

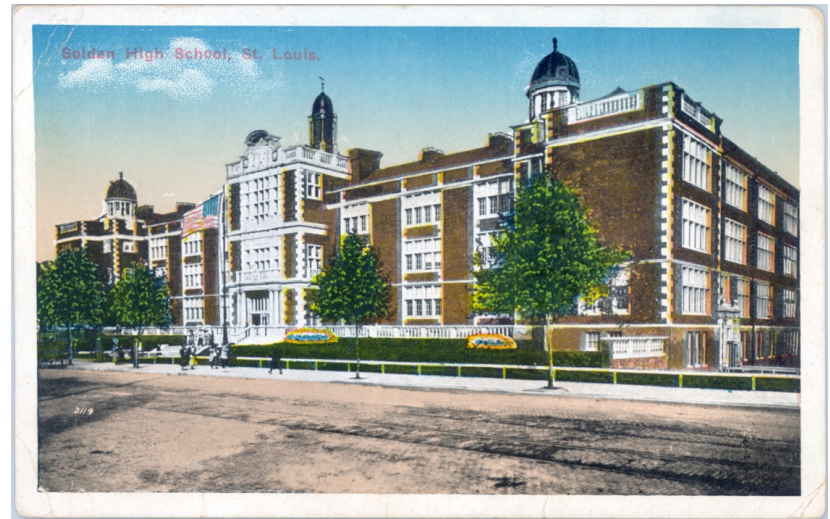
The Modern School Building



By the 1920s, then, the traditional schoolhouse had evolved into the modern school building. What specifically did this mean, in architectural terms?

First, and most significant, the school building was segregated/differentiated through the widespread use of area zoning and specialized spaces. From a unitary building of identical classrooms stacked on top of each other and maybe a larger assembly, the typical secondary school began to be

broken down into classrooms, administrative offices, work rooms (shops), art rooms, a library and a gymnasium, all in order to adjust to changes in curricular offerings. No longer would one size fit all, either in terms of courses of study or educational spaces. In the United States, middle and secondary schools increasingly took “E,” “U,” or “H” floorplans, which allowed noisier spaces, like mechanical shops or music practice rooms, to be placed at some distance from the rooms that required quiet. Also, by distending the building’s form beyond the cube or rectangle, natural light could be admitted in more various ways. As a result, American school buildings were dominated by corridors.

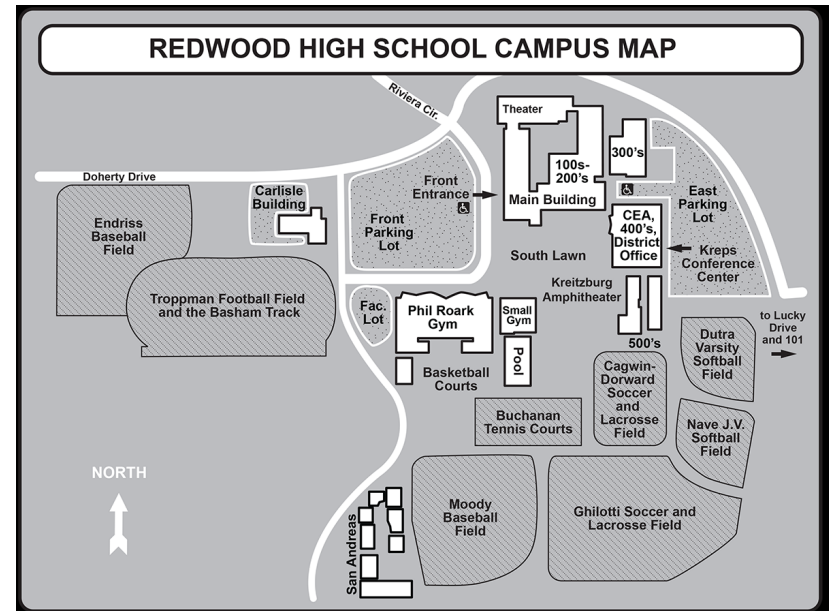
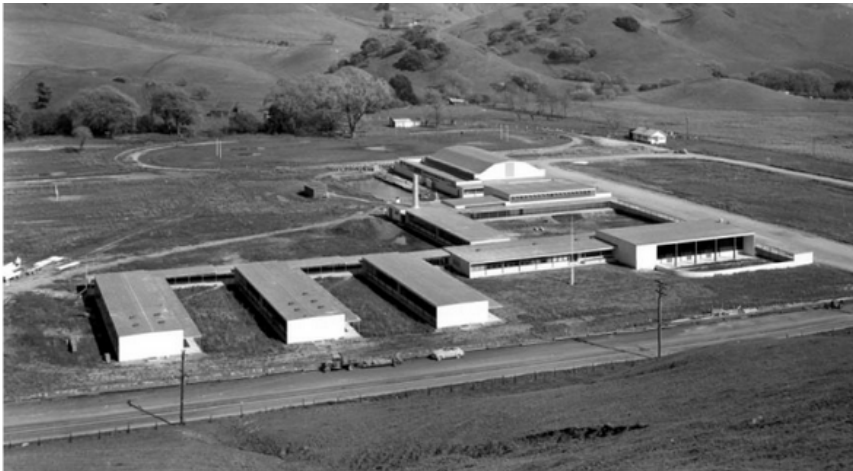


Second, the school’s appearance changed. School buildings, which for most of the nineteenth century and before had been indistinguishable from commercial structures (or even large

houses), became prominent landmarks or civic icons—symbols of America’s faith in public education. Architects increasingly used monumentality and historical architectural styles to convey the civic importance of their schools, while educators wrote about the necessity for visually significant buildings.

Third, the school building became healthier. The increased understanding of voluminous literature of the period devoted to lighting and ventilation concerns both reflected and stimulated educators and architects to aim for the healthiest possible structures in terms of foot candles of natural light and fresh air per student per minute; meanwhile, fireproof materials, wider stairways, more entries/exits were implemented to promote fire safety.

Postwar Adjustments



As the century progressed, these three developments continued to impact the design of school buildings. But from the 1940s on there were adjustments to the school building formula, although none altered the basic concept of the differentiated school. Regarding the school's interior spaces, the differentiation of rooms became a true fragmentation in some places, evolving into the "campus plan," which removed facilities like gymnasias, auditoria, and machine shops into separate and distinct structures, often connected by outdoor covered walkways.



The most important development of the postwar period was the emphasis on flexibility. School systems struggling to keep up with growing numbers of students needed to be able to adapt their buildings to rising enrollments and curricular changes, and school architects responded by devising buildings with non-load-bearing partitions, easily expandable one-story structures, and lightweight, moveable furniture. Rooms which could satisfy multiple uses became prevalent. And quick, easy, and inexpensive materials and methods were employed. The emphasis shifted in most American communities from intense investment in a few notable school buildings to a desperate attempt to build fast enough to house every student.



Also, school buildings became less vertical and more horizontal as the inadequacies of multi-story buildings in terms of fire safety were recognized. The goal for most administrators across the country was to produce one-story school buildings. This shift also was influenced by evacuation concerns fed by the atomic bomb anxiety surrounding the Cold War, as well as a practical consideration: a one-story building was easier to expand in the face of rising enrollments. This trend affected the monumentality of earlier century schools, producing less visually conspicuous buildings that were often located on larger lots in the suburbs rather than restricted urban sites.

Third, the influence of modernism could be seen in the drift away from historical styles and the increasing use of steel or concrete frames, infill walls dominated by glass, flat roofs, and other International Style characteristics. This new generation of buildings needed to be less expensive to construct as the country underwent an unprecedented population surge. The “Baby Boom” produced 76 million American babies between 1946 and 1964, which meant that public schools across the country were forced to meet the challenge of increased enrollment. Educators built as rapidly and as cheaply as possible, and flexibility of use and expandability became the most important goals for school designers at the level of the individual space and the overall school, respectively.



The school-building frenzy waned in the 1970s as population growth slowed. As alternative pedagogical techniques like team teaching and guided self-learning, and school-within-a-school organizations appeared, some systems experimented with open plans. The concept of classrooms without walls

aimed to provide educators more freedom in their pedagogical methods. The acoustical challenges of the open plan, however, led to its demise. A concurrent trend toward more freedom for students sometimes led to the provision of more relaxed spaces within the school that allowed children private time; similarly, classroom designs that encouraged less structured interactions between teachers and students appeared. In secondary schools, which were larger and more complex buildings by nature, spaces for student gathering became popular.



While the constituent parts of the modern school building remained in place from its earlier-century evolution, architects and educators experimented with the organization of those parts. A popular trend in primary schools to eliminate circulation corridors led to compact floor plans; at the secondary level, the opposite often occurred, as corridors

expanded to become “Main Streets” – multipurpose spines connecting the individual rooms. In addition to circulation, these Main Streets might be used for group activities, or could include casual areas for students to relax during down time or between classes. By the end of the century the Main Street concept had trickled down to some primary schools as well.



As the new century dawned computers became more vital to the education process. But their incorporation has had a negligible effect on school design. Beyond the transition from traditional libraries to digital commons areas, the information age has wrought few changes on the modern school building. Two other factors appear to have had more influence: a trend toward reuniting the differentiated spaces of the school into a more singular, compact form; and the desire for greater security measures.

Conclusion

Today’s school building is a direct descendant of its counterpart of a century ago. It was formed during the revolutionary period between 1880 and 1920, shaped by organizational and curricular reforms intended to make schools operate more efficiently and better prepare students for adult life; by an expanded conception of education’s role in society; and by concerns for improving students’ health and safety. Just as these concerns remain in place in the twenty-first century, so do present-day school buildings reflect a lasting solution to educational design going back over 100 years.