

## **CHAPTER II – PROLOGUE**

### **EDUCATIONAL PRECEDENTS**

Prior to 1865 employers had turned to education to solve employee problems. During the colonial era and the nineteenth century development, when America first experienced the industry revolution, educational precedents were established in employer-employee relationships. Pioneering entrepreneurs and businesses, including textile mills, armories, and railroads, created educational strategies to manage their new workplaces which, would become models for industrial workplaces in the closing decades of the nineteenth century.

#### **THE FARM AND EARLY WORKSHOPS**

The primarily agricultural economy in the New World resulted in the farm, the workplace for the majority of the early populous, providing the context for training and education. In this rural environment families not only tilled the land but manufactured articles such as candles, farm tools, homespun, and other goods needed for their self-sustaining operation, and in some instances, for nearby neighbors. Training was a natural outcome of rural family living with learning taking place as younger members of the family learned through observing adult members practicing the art and practice of farming and various crafts (Cremin, 1980; Hawkins, Prosser, and Wright, 1951, p. 3).

Employment opportunities outside the home during this period normally consisted of the small handi-craft shops serving local markets, construction, and the processing of natural resources or exploitation of minerals (Cochran, 1981, p. 171; Jacoby, 1985, p. 14). Working conditions were generally informal, determined by the proprietor -- a head of a household or an apprentice master -- with minimal economic, governmental, or societal influence. Up until the nineteenth century, this country's business enterprises, with few exceptions, continued as small, personally managed enterprises where an individual or a small number of owners operated, as they saw fit, a shop, factory, bank, or transportation line out of a single office. These proprietors, who generally had a paternalistic attitude toward their employees, passed on their expertise and knowledge through some form of an apprenticeship arrangement utilizing the catch-as-catch-can or pickup method of training (Cochran, 1981, p. 19).

Administration and organization of early factories were influenced by the agricultural family system. Hours from sunrise to sunset were established in the early mills and factories, even for the children. Many early production systems were, in fact, family affairs with a master workman assisted by his family and a few outsiders. The father, the master craftsman, having absolute power and determining not only working conditions, but the personal and vocational

development of those working for him, became the model upon which much of early American industry was unconsciously organized (Hicks, 1941, pp. 35-36).

### **EARLY APPRENTICESHIP**

Apprenticeship, purported to be the oldest known type of industrial education in the United States, had been brought from England by early craftsmen (Bishop, 1868). Traditional apprenticeship performed multiple educational functions -- training in the trade of the master, a mechanism for moral development and instruction in sound ethics, and education in the common branches of learning (Hawkins, Prosser, and Wright, 1951, p. 335; Rorabaugh, 1986).

The first, instruction in the master's trade, followed the generally accepted principle that only a person who is himself competent in a craft could give effective vocational instruction in that craft. This training was generally carried out with a 'show me' technique; and, as only masters knew the mysteries of the trade, they were the only ones who could show others. For decades the production processes followed tradition and custom; they were not determined by science, discovery, and invention. Crafts of every kind could be learned by the pickup method of observation, imitation, and practice. Under these conditions, the master, or business proprietors and skilled craftsmen, were able to instruct their employees as a part of their daily work routine by giving information needed and developing the skill right on the shop floor (Cochran, 1981, p. 19; Hawkins, Prosser, and Wright, 1951, pp. 4, 7).

The second educational function, instruction in general ethics, took place as a result of expected behavior enforced by the master and through modeling the master. Masters were not only responsible for instruction in their craft, but were also required to provide for the general welfare of the apprentice such as providing adequate food, clothing and lodging, and for providing other common education. An apprentice had his expected behavior defined. In addition to serving faithfully, behavior was defined according to tradition and contemporary mores to include such areas as protecting his master's professional secrets, obeying commands, not wasting the master's good or lending them unlawfully, not playing cards or any unlawful games, not absenting himself from the master's house or service day or night, and not haunting ale houses, taverns, or playhouses. The typical producing unit was a small workshop, commonly on the ground floor of the family home in which any apprentices and journeymen were lodged and boarded; and, business relationships were face-to-face between people who knew each other (Hawkins, Prosser, and Wright, 1951, p. 7). The master consequently had the ability to closely monitor both the personal and professional development of the apprentice.

The third, general or common education, was accomplished either by the master himself, if he were capable and so inclined, or by his utilizing tutorial or evening school arrangements provided outside the workplace. Evening schools met the needs of many

apprenticeship masters who were traditionally responsible for instructing male apprentices in reading, writing, and ciphering and female apprentices in reading and writing (Hawkins, Prosser, and Wright, 1951, p. 6) Early Massachusetts laws (1642, 1692) had in fact stipulated that apprentices have the privilege of going to an evening school (Long, 1976, p. 36).

Through the early to mid 1800's, or as long as the production process -- hand tools and simple manual procedures -- followed tradition and custom and were not determined by science, discovery, and invention, crafts of every kind continued to be learned through apprenticeship by the pickup method of observation, imitation, and practice. Apprenticeship provided the education used for virtually all occupations including industry, agriculture, shipping, commerce and mercantile, domestic service and the professions of lawyer, physician, and schoolmaster from 1783 to 1850 (Hawkins, Prosser, and Wright, 1951, pp. 6-7).

### **INNOVATIONS IN TEXTILE INDUSTRY**

Textile manufacturing was the first industry in America, as it had been in England, to be affected by the inventions of the industrial revolution (Coolidge, 1942, pp. 9-10; Faulkner, 1951, p. 129; Lapiappe, 1988). There were two patterns of textile manufacturing in the early days of the Industrial Revolution -- Rhode Island, which began on a small scale by men with limited resources, and Massachusetts, which was large scale from the beginning, financed by wealthy Boston investors (Navin, 1950, pp. 7-8). Both required solutions for management and labor problems for their increased scale of operations which placed them on the forefront of innovation (Cochran, 1981, p. 97; Gibb, 1950, p. 104; Ware, 1990, p. 27).

#### **Rhode Island Solution**

A major stimulus to industrialization of the textile process was the first successful and profitable spinning mill set up by Samuel Slater in 1789 when he duplicated the English Arkwright machinery and borrowed from his British past for the direction and overseeing of his own factory (Cameron, 1960, p. ix; Coleman, 1963, p. 77; Copeland, 1917; Gibb, 1950, p. 7; Josephson, 1949, p. 14; Tucker, 1984, p. 15). President Jackson dubbed Slater "The Father of American Manufacturers when he called on him in the spring of 1833 to meet the man to whom he attributed the development of the American textile system (Cameron, 1960, p. x).

The new spinning technology required men as machinists and supervisors, but it required little strength to operate, enabling women and children to tend the machines. Slater's own apprenticeship being a positive experience, he adopted methods he knew, seeking out children for mill hands, many of whom had grown up familiar with home spinning and weaving. Samuel Slater later hired families to control workers by transitioning the family hierarchy from the home to the workplace. Slater's management style was paternalistic, his making the decisions and

having an interest in his workers' family affairs. He is attributed to starting a Sunday school (1792) to teach reading, writing, and arithmetic, in addition to religion. A few years later (1796) Slater began day schools for children in the mills (Cameron, 1960, pp. 58-59, 87, 93-96; Prude, 1983, pp. 36, 43-44; White, p. 107).

Slater's spinning mill was a training school for the developers of future mills. Slater's proteges left his employ in large number, moving to other towns and setting up their own shops or offering their services as free-lance mechanics to other new mills (Navin, 1950, p. 10). Slater initially attempted to stop growth by swearing early employees to secrecy, paying key operatives elevated rates, and being cautious about admitting strangers to view his technology (Prude, 1983, p. 47). Nevertheless, men whom Slater trained were quick to realize the potential for profits and often went elsewhere to start their own mills or build machinery for others (Cameron, 1960, p. 85; Gibb, 1950, p. 7; Navin, 1950, p. 16). By 1810 there were almost 300 little cotton mills in the United States, most of them in New England and virtually all of them imitations of Slater's establishment, whose primary importance was as a training school. (Bishop, 1868, p. 13; Ware, 1990, p. 27).

### **Boston Company**

In 1814 Francis Cabot Lowell and his associates, the Boston Company, established the first complete factory in the textile industry when they integrated spinning and weaving within a single mill on the Charles River at Waltham, Massachusetts (Gibb, 1950, p. 24; Hicks, 1941, p. 3). This innovation being a success, the Boston Company proceeded to expand their business venture by building another mill, this time surrounded by a company-built town which they named for Lowell (Tullos, 1989, p. 25). The technology revolutionized the organization of the process (Gregory, 1975, pp. 8-11), allowing the manufacturer to use unskilled labor throughout the production process.

### **Semi-Skilled Labor – Operatives in the Mills**

The Boston Company had to solve two problems -- that of supplying labor and solving public relations problems. Not only was there a scarcity of labor, but Americans, as a result of English industrial slums, viewed manufacturing as a tainted pursuit and were opposed to the development of industry on a large scale (Coolidge, 1942, pp. 12-13).

The Boston Associates' innovative solution resulted in a labor force intended to be a shining example of the ideals of profit and virtue, doing good and doing well. They developed a means to attract the daughters of Puritan Yankee farmers which would not corrupt them nor debase them socially. The paternalistic policy of the mill owners supported two factors – the strongly held belief that idle young women were particularly prone to depravity, making

employment itself a contribution to public morality, and the shared class and Puritan religious origins of labor and management. Lowell, the first planned industrial community in the United States, provided responsible stewardship -- boardinghouses which gave ultimate moral sanction to the entire enterprise. The corporation established a set of rules, enforced by housemothers, which controlled every aspect of the operatives' lives. The boardinghouse also functioned as an instrument for surveillance and moral policing, turning out anyone who in any way protested or acted against any work or boardinghouse rule (Eisler, 1977, pp. 19, 22, 24).

The training of new operatives, which extended over a course of several months, was accomplished by the show-me method. New operatives were not expected to immediately fit into the mill's regular work routine, but rather were assigned work as spare hands and earned daily wages which were independent of the quantity of work turned out. A spare hand, a newcomer, worked with an experienced operator who instructed her on the job, the new operative learning by observing and imitating the more experienced operator. After weeks or months, when the new operative could handle the normal complement of machinery, either two looms for weavers or one side of 128 spindles for spinners, she would move into a regular position when an opening was created by a regular operative departing (Dublin, 1993, p. 127; Dublin, 1979, p. 47; Eisler, 1977, pp. 43-44). As wages were based on piece work, it took a new worker a month or two to determine exactly what wage she would earn (Dublin, 1993, p. 132).

Little emphasis was placed on the actual training of the skill, but rather on the other 'educational' amenities offered workers. Many of the young women recruited to work in the textile mills used the experience as an opportunity for educating themselves and for expanding their horizons. They read books they purchased or borrowed from libraries and attended lectures and evening classes (Larcom, 1890, pp. 222-223). They organized improvement circles and frequently published literary works (Dublin, 1979, p. 99; Larcom, 1890, pp. 174-175). Benefits for the workers included upright pianos, literary evenings, newspapers, magazines, and lectures. The price for these amenities, considered by the mill owners to be civilizing and enriching, was required church attendance and conducting oneself in a manner approved by the mill owners including such stipulations as no immodesty, profanity, or dancing (Ware, 1990, p. 72).

Welfare work at Lowell seems not to have been the result so much as a way to improve production or to provide for the development of the operatives, but rather of the necessity of attracting workers. Lowell employers seem to have shown no significant measures to retain workers after securing them. The Lowell operatives held positions requiring minimal training, positions of considerable economic and social subservience which held little bargaining power. These semi-skilled could not fail to follow the paternalistic policies of management, including obeying the rules and following the political and social lead of management (Gibb, 1950, p. 89).

### **Skilled Labor – Mechanics in the Machine Shop**

The labor force at Lowell was not only made up of the mill operatives but also skilled artisans in the machine shops. As there were no textile-machinery shops of any consequence in this country and it was the custom of textile mills to build most of their own machinery, the Boston Manufacturing, which had the rights to manufacture textile machinery, set up a machine shop at the mill in 1914 (Gregory, 1975, pp. 183-184; Navin, 1950, p. 8).

Although the management philosophy and industrial relations – paternalistic labor policies in the Lowell Mills – were attracting wide attention in both America and England, little is known about the managerial policy in the machine shop (Gibb, 1950, pp. 52, 87, 145, 177). Mechanics had a much stronger bargaining position with management because of the lack of skilled mechanics and the time required to train them. As opposed to the operatives in Lowell, the skilled mechanics had much more freedom (Gibb, 1950, p. 89).

Mechanics contracted with the company for the performance of specific jobs and enjoyed considerable freedom in the fulfillment of their contracts including hiring and discharging their own help and training their own apprentices and making rules among themselves to protect the apprenticeship system from future abuses. In 1825 these men formed the Middlesex Mechanics Association, a trade guild to encourage good craftsmanship and invention and to control apprentices (Gibb, 1950, p. 89). Innovations and improvements which occurred were not the work of scientists but of practical mechanics working by trial-and-error methods (Gibb, 1950, p. 173).

Mechanical shops originally dedicated to the building of machinery for the textile mills frequently became involved in building locomotives. The machine shop at the Waltham textile mills began building locomotives in 1834, after obtaining George Whistler, an American engineer possessing the required specialized skills (Gibb, 1950, p. 84).

From the 1820s on, records indicate that most of the skilled mechanics in American textile-machine shops were native trained. Both Slater (1790) and Lowell (1813) were able to find skilled native workmen. The numerous and diversified manufacturing enterprises of America's eighteenth-century mercantile-agricultural economy had resulted in American craftsmen of many skills full of portent for future industrial development (Gibb, 1950, p. 10). Although the supply of skilled native mechanics was small, they were frequently preferred to imported mechanics. Contemporaries suggested that English-trained mechanics, with highly specialized skills did not readily fit into the pattern of the average American machine shop. There was a definite prejudice against foreign-born mechanics, the English mechanic being accused of being unimaginative and suspicious of change (Gibb, 1950, p. 177).

## **ARMORIES PRECURSORS OF SCIENTIFIC MANAGEMENT**

Before the mid 1830s the armories were the only industrial enterprises in the United States having extensive internal subdivision (Chandler, 1977, p. 72). This came about from their development of what was to become known as the American system -- interchangeable parts mechanically produced. To produce these standard parts, required a rigid bureaucratic environment, which was to become the primary model for many other manufacturers and work environments.

The United States Armory at Springfield Massachusetts began making muskets in 1794 using the handicraft techniques developed through generation after generation of gunsmiths. Training was accomplished through the apprenticeship system. In the early 1800's, unable to produce a satisfactory number of muskets through this system, the superintendent of the armory, split workers into four main divisions. After instituting these divisions of labor, he introduced new managerial procedures and moved toward eliminating the apprenticeship system. Discord consequently resulted between superintendents and the workers, and production declined. Consequently a piece-rate system of wages was introduced, further displeasing the workers who had already been stripped of much of their craftsmanship through the division of labor (Hounshell, 1984, p. 32).

In 1815, when Colonel Roswell Lee arrived at the armory, armsmaking was transformed from a craft pursuit into an industrial discipline and the weapon from a shop creation into a factory product. The Ordnance Department at that time gave Lee of Springfield and Stubblefield of the Harpers Ferry Armory responsibility for developing a new model musket with standard, interchangeable parts. It was eventually Lee who developed the models as well as inspection gauges to be used in production at both national armories and later for private armories contracting with the War Department (Hounshell, 1984, p. 33). The Harpers Ferry armory lagged behind, clinging to craft production.

By mid-century, the Springfield armory not only integrated the production process but was also the first works in the country to develop extensive internal specialization of jobs. Control and authority of the operation was centralized, and accounting and inspection controls were used to monitor and evaluate the performance of foremen and workers. Colonel Roswell Lee, the superintendent, used practices and procedures that would be taken up and perfected by practitioners of modern scientific management (Chandler, 1977, p. 73).

## **TECHNOLOGICAL CONVERGENCE**

A new phenomenon labeled technological convergence occurred when learning and production technologies developed in the armories spread to private armsmakers and then to other manufacturers, the first a new consumer durable, the sewing machine. Although the armories sold

their product to the government and the sewing machine producers marketed their product among private consumers, these products were nevertheless technologically related because their manufacture depended upon similar metalworking techniques (Hounshell, 1984, p. 4).

Individual mechanics played an important role in diffusing know-how as they moved from firearms to the sewing machine manufacture and so on. For example, Henry Leland, who had worked at the Springfield Armory, carried his knowledge to the Brown & Sharpe Manufacturing Company which manufactured both machine tools and sewing machines. Wheeler and Wilson an early sewing machine manufacturer based its production on what contemporaries called the 'armory practice', its manufacturing system established by three former armsmaking machinists (Hounshell, 1984, p. 5).

### **RAILWAYS, FIRST BUREAUCRASIES**

Railroads, which began operating in the East in the early 1830s (Overton, 1965, p. 5), and by 1860 had created longer railroad mileage in the United States than in any country in the world, were the pioneers in the management of modern business enterprise (Chandler, 1977, p. 80). They were the first industry to develop synchronized operations and standardized technologies, becoming a model for the large centralized corporations on the horizon. As a result of the rapid growth and expansion, the railroads, which were responsible for relatively large number of employees scattered across the country, were as innovative in their approach to worker education as to their other operations.

By the mid 1800s railroads had created hierarchical business organizations and coordinated activities in various departments. The Illinois Central Railroad (1857) had legal, financial, and operative departments, the operative department being further divided into engineering and transportation areas. Each department and area had defined responsibilities and hierarchies of authority. An 1856 operations report laid out the system to designate responsibility and authority. It listed general principles necessary for operations such as the proper division of responsibilities, conferring sufficient power to carry out responsibilities, the means of knowing when responsibilities were executed, and emphasis upon the great necessity for promptness in reporting derelictions of duty in order that they would be immediately corrected (Chandler, pp. 67-69).

### **Discipline as Education**

Railroads had a great need to control their workers because even the responsibilities of the lowliest worker were awesome -- trains not only ran on fixed schedules, but a careless brakeman or maintenance worker could wreck a train. Consequently, rules and procedures were extremely important. The Pennsylvania Railroad Company adopted, *Organization for Conducting the*

*Business of the Road* (1857), in which they detailed the responsibilities of the transportation, accounting, treasury and legal departments. This included a description of the powers of the division superintendents, that of having charge of all employees, seeing that employees perform the duties assigned them, and furnishing them with copies of all rules and regulations (Chandler, p. 7). The railroads believed that enforcing a rigid system of discipline was critical to their success. They described discipline, not as punitive, but rather as a form of education. Methods of discipline for education began with issuing laws and regulations and exercising control in the form of reprimands, fines, suspensions, and dismissal.

### **Promotion and Apprenticeship on the Railroads**

Seniority became a sacred rule of railroads. Promotion from track worker to brakeman to fireman to engineer amounted to a school in which a green hand could learn a skilled and, in his community, prestigious trade at good pay. And, as railroads expanded, he could take his training and skill to another railroad (Martin, p. 309).

Most nineteenth century rail lines instituted formal apprenticeship programs in the shops and depots. Depot programs were reported as less formal, teenage boys paying for their education and after a fixed period of time being hired as a depot assistant. More formal systems prevailed in shops where teenage boys signed, with their parent's consent, legal indentures of apprenticeship binding them to a term of usually four to six years. The railways, unlike some other organizations at that time, expected the apprentices to serve the full term of their agreements, resorting to legal action to return runaways. The indenture agreements usually had provision for room and board and a set minimum daily rates, along with the promise of instruction in the trade and business (Licht, 1983).

### **GROUND LAID FOR DEVELOPMENT OF FUTURE WORKPLACE EDUCATION**

As the application of technology changed manufacturing and the nation was pulled together by new transportation and communication methods, the physical conditions were set in place for an industrial economy. Changing work, changing workers, and an increasing need for industrial inventiveness created new forms of education. The early entrepreneurs, the innovative Slater, textile factories, armories, railroads, and others which experimented with education to manage their new workplaces, had planted the seeds for the evolution and development of future workplace education. Future employers would turn to the prior experiences and knowledge base created by their predecessors to solve employee problems presented to them by industrializing workplaces following the Civil War.