Curriculum Units by Fellows of the Yale-New Haven Teachers Institute
1983 Volume IV: America in the Sixties: Culture and Counter-Culture

IBM and the Growth of Computer Technology: Teaching History in Computer Education

Curriculum Unit 83.04.06
by Sheila H. Troppe

Purpose and Strategies

The electronic computer has been in existence for only three decades and in this short time has served to change the course of our generation and of subsequent ones. It is a major tool found in all areas of our society with far-reaching implications. Students must not only be educated in how to use computers, but in dealing with the problems they pose in our daily lives and in our society.

I'm one of a team of four REACH teachers in our middle school. REACH is an acronym for Reinforcing Educational Activities (with) Computer Hardware. Although use of the computer is our primary objective, we also employ other electronic devices to both reinforce and enrich basic academic areas. We service all the students in our urban middle school population and so we see each student a minimum of three times in his middle school career. The program is sequential in nature; each year building and expanding upon knowledge acquired from the year before. The sixth grade program is simply a reinforcement of basic skills using a variety of hardware combined with software programs. It is in the seventh grade that we first introduce computer history and the beginnings of programming. The eighth graders will continue with computer history, literacy, and delve deeper into programming. I designed this unit as supplemental to our eighth grade curriculum. Even though it is our hope that these classes be homogeneously grouped, I have taken into account that we may continue with our heterogeneous groupings with their tremendous range of skills and abilities.

The unit is, therefore, very basic in nature so that a teacher may expand or adapt for individual students. I felt that the books we are using put all of their emphasis on computer literacy and programming to the exclusion of computer history. I wanted our program to include some history of the machine—significant events, people, and companies who, combined through the course of time, contributed to the development of the computer. The unit is meant to be a reference or guide that can easily be adjusted by the user.

After a brief review of the history of the computer, I have introduced the company whose name is synonymous with the word computer, IBM. The driving force behind this incredible colossus was its first president, Thomas J. Watson Sr. Watson's iron-fisted policies shaped "the company" as it is known to its employees. His impact and influence was wide-ranging and may still be felt even today. To attempt to understand IBM and its incredible growth, one must know something of the man who shaped its destiny. This part of the unit

examines the legendary attitudes, policies, and restrictions imposed by Watson and their basis. The unit will attempt to chronicle the emergence and growth of the conglomerate it was in 1914 through the 1960's when it had grown into a powerhouse involved in an anti-trust suit initiated by the Johnson administration. The study of IBM will serve to flesh out an otherwise technically oriented course. Hopefully, students will see the human side of the company and also connect its growth and change to the times in which they occurred. The history and development of IBM is not abstract and I feel that there are political, social, and moral lessons to be learned from a closer look, depending again upon the emphasis and direction of the teacher. I presented the basic facts in as brief and concise a manner as possible. Since the material was compiled from many sources I wanted it to be in an easily usable form.

The unit is intended for use in one of three ways; it can be reproduced for student use, used by the teacher as the basis for lectures and lessons, or a combination of both. I will use the unit as a basis for my lessons and then individualize activities I feel are appropriate to both the student and my objectives. Research, reports, role-playing, games, and dittoed activities can be incorporated into the unit. I have suggested several in my lesson plans at the end of the narrative. I have not suggested any time frames because, again, 1 feel that depends on the teacher and the ability of the class.

Introduction

IBM is a multinational corporate giant—born of a loose conglomerate of manufacturing companies in 1914 and honed into one of the most spectacular success stories of our time by a fanatical, driven supersalesman. Its success can clearly be seen in terms of dollars and cents; in 1958, just before the second generation of computers was introduced, Americans spent less than one billion dollars on data processing. In 1980, they spent more than fifty-five billion dollars. IBM equipment represented more than 69 percent of the dollar value of American-made, general-purpose computers already installed around the world. The rest of this market was evenly divided, principally among seven other corporations; often referred to as "the seven dwarfs". Needless to say IBM is the star of the show. In 1982 it showed profits of 4.4 billion on sales of 34.4 billion making it the most profitable U.S. industrial company. IBM is the leading computer firm in virtually every one of the 130 countries where it does business. If you had been far-sighted enough to have invested approximately twenty thousand dollars for a hundred IBM shares in 1951, two years before the company delivered its first electronic computer, you would have seen the value of your holdings grow to over $1 million by 1980 and received almost half a million dollars in dividends.

A friend, long in the computer business, is given to head shaking at the mention of IBM. "Their products are good," he laments, "but certainly not the best. They are a triumph in marketing." This explanation for IBM domination may be somewhat simplistic, but nonetheless accurate. IBM's supremacy has been explained through a combination of factors, including historical circumstance, financial acumen, managerial genius, espirit de corps, and brute force. Surprisingly enough, IBM was not the first company to enter the computer business. Remington-Rand entered the marketplace four years earlier with their computer, "Univac". When IBM entered the field, Remington quickly lost their lead and has been relegated to second-class status since.

A digital computer, in its simplest terms, is a device that works by counting. In order to understand how we went from that simple device to a company that turns out a machine that is capable of solving over a million calculations per second, we must go back to the beginning and examine some of the more important contributors and their contributions.

History

One of the most primitive devices used by early civilizations is still in use today. In various forms, the abacus was used by the Egyptians, Greeks, Romans, and Chinese. It can be considered, in light of our earlier definition, as the first digital computer. Combinations of rods and beads often lead to lightning calculations in the hands of advanced students.

In 1642, a Frenchman in his early twenties, Blaise Pascal, invented a machine to aid his father in his work. Pascal's "arithmetic machine" worked very much like today's odometers. The numbers 0 through 9 were printed on the edges of a row of wheels. When a wheel made a complete turn from 0 through 9, a small notch caused the next wheel to the left to move up one number. The machine could only do addition or subtraction operations.

It wasn't until 1694 that a significant improvement was made over Pascal's machine. A German mathematician, Gottfried Wilhelm von Leibniz, built a calculating machine called the "Stepped Reckoner". It used cylinders instead of gears and wheels and could also multiply and divide as well as add and subtract.

In 1801, Joseph Jacquard of France invented a new type of loom for weaving cloth that revolutionized the weaving industry in the early part of the century. Punched cards were used to control the operation of the loom. Yarn was pulled up through the holes in the card to make the pattern. Jacquard's punched cards stored information. This idea was used by a number of inventors in later years. It also served to inspire the next major contribution, Babbage's Analytical Engine.

The Analytical Engine was the first calculating machine that could be called a computer. Babbage devised most of the principles on which modern computers are based. The Analytical Engine had all four parts of a computer system: input, output, memory, and central processing unit. All of the machines Babbage invented were, of course, mechanical; combinations of gears, wheels, and levers to be operated by steam. Unfortunately, a working model could not be built because the tools of that time simply could not accommodate his sophisticated design and Babbage died never knowing that his ideas would be widely acclaimed more than one hundred years later.

During the nineteenth century, the United States government was faced with the cumbersome task of taking the census and tabulating the results. The number of years necessary to compile usable information made the information virtually obsolete by the time it was available. A young army engineer and inventor was assigned the task of making the system more workable and before the 1890 census he built the Tabulating Machine. Herman Hollerith's invention borrowed the idea of punched cards from Jacquard. His machine used cards punched in a special code. Name, address, sex, home state, and more data were punched so the electric circuits would connect where there was a hole. The information was then automatically tabulated and stored. Hollerith's machine completed the census tabulations five years sooner than the last census and proved enormously successful. He improved the machine for commercial use in accounting as well as tabulating, left the census office and founded the Tabulating Machine Company. This company, along with others, formed the conglomerate which later became IBM. Descendants of the Hollerith machines continued to form the basis of IBM's business until the computer era came along.

As technology improves, it builds upon itself and continually grows faster. Machines had to be made to handle greater and greater amounts of data for a wider variety of tasks. The age of modern computers dawned in 1944 when the first real computer was built by an American engineer. As much as any man alive, Howard H. Aiken shares the credit for the first generation of computers. Watson himself was somewhat of a patron saint

and godfather. Apparently Watson and IBM had the only resources readily available to apply to Aiken's project, so he began conferring with their specialists. Watson financed the experiment with an initial gift of one million dollars. The machine was produced according to Aiken's design at IBM's Endicott plant. It was demonstrated in January of 1943, after which a long period of debugging, testing, and experimentation prepared it for shipment to the Harvard physics lab. The calculator was fifty-one feet long and eight feet high. It weighed almost two tons and had 530 miles of wire, 175,000 taper plug connections and 1,210 ball bearings. It contained 765,299 parts. The machine was eventually donated to Harvard. The machine was christened the Mark I.

Meanwhile at the Moore School of the University of Pennsylvania, two men and their associates were at work on a machine that made the Mark I virtually obsolete. Dr. J. Prosper Eckert, an electrical engineer and Dr. John Mauchly, a physicist, were building a computer far better than the IBM machine. The moving parts inside the computer were replaced by electrical circuits. This computer, bigger even than Mark I, was 300 times faster. It conducted electricity through vacuum tubes and was named Eniac.

Soon after Eniac was built, Jon von Neuman, a Budapest-born mathematician and physicist with a reputation for brilliance had the idea of storing a computer program in the computer's memory. This enabled people to build computers that worked faster than Eniac. Today's computers are based on von Neuman's idea of storing programs in the computer's memory.

A few years later, in 1951, Eckert and Mauchly (the Eniac designers) built another computer called Univac. The builders went to the Watson labs at IBM to discuss the possibilities of joining forces to put the new computer on the commercial market. Watson was so sure that nobody had gained on IBM technologically, he turned down the pair. Subsequently, the two went to Remington-Rand who signed a contract with them and then produced the revolutionary Univac, the first commercial computer. This highly touted machine caused tremendous television publicity and badly shook Watson and the IBM organization. Over and over again Remington-Rand had the opportunity in Univac to take the lead in the world's newest and most promising industry, but refused to commit the capital essential to the development and marketing of the machine. Many would later comment that Remington-Rand had snatched defeat from the jaws of victory.

While most experts were conceding that electronic computers were indeed the machines of the future, they felt that a commercial market for them was small and for a large company such as IBM the amount of money to be made from processing data electronically was considered negligible. This viewpoint soon changed with an unexpected spurt of orders flowing into Remington-Rand headquarters. IBM was not caught completely off guard in spite of the fact that the competition had now installed five machines while they had none. At the beginning of the Korean conflict, Watson Sr. put the resources of IBM at President Truman's disposal. A team of IBM scientists evaluated government needs and concluded that current computers were unequal to the task, but that IBM had the know-how to assemble an electronic computer that could perform the high-speed calculations necessary for research in weaponry, aircraft, and missile designs. The new computer was designated the "701". IBM had been charging $300-$400 per month in rental to its customers for the use of their tabulating equipment. The estimated rental for the new machines was first estimated at $13,000 per month and was finally increased to $20,000 per month. The first "701" off the production line was shipped to the government's atomic research development center at Los Alamos, New Mexico in March, 1953. The "701" was formally introduced to the public in the following month. This meant that Remington-Rand was no longer the sole producer of commercial computers. In the eight years since the end of World War II, IBM's revenues quadrupled while those of Remington-Rand had only doubled. Soon after the "701" came a new machine-the "702". The race had just begun and the winner was already assured:.

The Watsons and IBM

Thomas J. Watson did not create IBM. It was fashioned from a consolidation of small, unrelated companies by a financier named Charles Flint. Watson took command of the company in its infancy and nurtured it into the giant it would become. With a straight-laced code of personal conduct and a style that incorporated courtliness, conservative dress, a consuming drive for power, and an insatiable thirst for praise, Watson left the imprint of his resolute will on corporate life at IBM and on a whole new breed of men fashioned in his image. Watson, in turn, was extremely influenced by two forceful men he met early in his career as a salesman.

Watson began his sales career as a country peddler, but soon outgrew the narrow confines of upstate New York. He came to Buffalo where he encountered the first man in whose likeness he would, in part, mold himself. John Range, the Buffalo manager of the National Cash Register Company, was a critical factor in Watson's development. In convention centers around the world, Watson would repeat his technique of how Range demonstrated by example, the art of turning a man into a dedicated, demon salesman. There is no doubt that Watson learned how to play the role of father-figure boss of salesmen by first being a willing target of the technique himself. In October of 1895, Watson persuaded Range to hire him for a probationary period. The National Cash Register Company was a famous, even slightly infamous company that had nearly monopolized the manufacture and distribution of the cash register. Range told Watson to study the company manual, a gospel of company policies and prescribed sales techniques. Unfortunately, the manual, not withstanding, Watson's first efforts were a dismal failure and he was promptly called into Range's office where he received a first-hand demonstration of the technique Range was famous for. Range proceeded with a tirade calculated to take the hide off a man, cut it to ribbons, and then piece it back together again leaving the salesman shaken, but grateful for the advice and counsel.

Range was a salesman of long experience and as easily as he turned on his rage, he turned it off and comforted Watson. With a suggestion that they take a register with them, Range climbed into a buggy with Watsoh to visit a more promising prospect. Range's confidence was soon justified, when, with Watson as a keen observer, he promptly sold the cash register and then proceeded on three more occasions to repeat his crack sales performance.

Range believed in teaching by example and Watson absorbed this experience into his whole being. He was enormously impressed with the Range style of dealing with a customer by making him feel confident and persuading him that a cash register would save money and guard against losses. Watson was so apt a pupil that within the year, he became one of the most successful cash register salesmen in the East. He eventually became the top salesman in Buffalo surpassing even Range himself and was tapped by John Patterson, the president of NCR to go to Rochester as agent in a branch office. Rochester was not considered desirable territory and the branch was near the bottom in sales. Given Watson's total involvement and competitive nature, there was no way to go but up. Watson succeeded in pulling the branch into sixth place among 160 branch offices where it hung for two years. Sales eventually fell off, due in part to a temporary near saturation of the market. More specifically, Rochester was one of the few cities where competitors had not succumbed to NCR's sales methods and were still thriving. Watson was told to get the business; from Patterson this meant no equivocation and little concern about means and methods. He had no compunction about the rights of the competitor. Watson may have had some reluctance about methods, but he nonetheless went out and got the business. One of NCR's methods was intimidation and threat of ruin, which Patterson's agents were compelled and trained to carry out. Men especially trained in persuasion and tactics of intimidation would swoop down on the prospective purchaser of a competitive cash register and warn the customer that the machine was no

good, that it infringed NCR patents and that the manufacturer was being sued and so likewise would be anyone that bought the machine. In those days, Watson was not restrained by the golden rule of business to which he would later ascribe. With the assistance of the main office; Watson made NCR the monopoly register company in Rochester and secured for himself a place beside Patterson.

In October of 1903, at 29 years of age, Watson stepped into the office of the second man who would serve to further mold and influence him. John Patterson, with enormous drive, mastery, and occasional sadism, dominated Watson's life for the next eleven years and in some ways for the remainder of his life. Men who came under the influence of Patterson, the men who could endure the tension, total dominance, and subjugation of personality always carried with them the mark of Patterson's volcanic personality.

Patterson acquired the National Cash Register Company and turned over the production and engineering to experts. He then turned his full attention to selling and establishing a sales training program and force of total effectiveness. Much of Patterson's philosophies and ideas would later be incorporated into Watson's style and IBM. Patterson believed that man responded bast to a fear of punishment and the promise of money. He established the quota system and the guaranteed territory; altering the time-honored and previously held concept of pitting salesman against salesman in the same area. Patterson told the men how to dress and how to act. He made them memorize sales talks and threatened dismissal if they deviated. He called the men to group meetings; made them cheer each other and stand and make public confessions of failures and successes. He offered generous commissions, prizes, and conventions. Patterson built the newest in facilities. His factories were monuments of cheerfulness; bright and clean, with swimming pools, lunch rooms with free hot meals and medical care and counseling. In return for this generosity, Patterson demanded enthusiastic employees who were loyal, obedient, and conformed to all rules.

There was a dark side to Patterson's personality. Not content with monopolizing the new cash register market, Patterson was intent on removing all competition in the second hand cash register business. He enlisted Watson in a clearly illegal campaign. Watson would establish a store under his own name, near the competition, and proceed to undercut the competition by selling machines at a price that couldn't be matched. When his competitor was clearly in trouble and floundering, Watson would then offer to buy him out at a suitable price. Watson's operation was clearly a restraint of trade operation in the service of NCR. It was only a matter of time before everyone in the business knew of the operation, but by then the competition had been handily taken care of. At the same time, NCR was also attacking competition through litigation-as many as 75 patent-infringement suits were filed against competitive companies; and with the NCR competition department. The competition department was an early form of industrial espionage engaged in attacking and destroying all foes. Eventually his outrageous tactics caught up with Patterson. Suit was filed in Michigan to oust NCR from the state on the grounds that it was organized to maintain a monopoly. While this case pended for several years, depositions were gathered around the country for the anti-trust suit that was soon to come.

On February 22, 1912, John Patterson, Tom Watson, and twenty-eight other NCR men were indicted on three counts of criminal conspiracy in restraint of trade and maintaining a monopoly. The trial opened in Cincinnati in November and ran for three months. The men were convicted on February 13, 1913. Patterson, Watson, and one other NCR man got the maximum sentence of one year in the Miami County jail and fines of $5000 each. The others got similar sentences, but with reduced jail sentences. Patterson was released on $10,000 bail; Watson and the others on $5000. Watson maintained his innocence, yet retained a lawyer as an individual defense counsel. While awaiting the Court of Appeals verdict, Watson was fired by Patterson. Watson's emergence from his position of apprentice and subordinate had apparently provoked Patterson's giant ego and wrath. Watson would turn this association into a personal fortune by building a company and

emulating his teacher in many respects including some glaring personal shortcomings.

Watson, nearing forty, having recently been married and about to become a father for the first time, now found himself unemployed. He was approached by Charles Flint, one of the foremost entrepreneurs of his time, to head a loose conglomerate of companies called The Computer-Tabulating-Recording Company. All the companies manufactured something that measured or counted. One of them was the Tabulating Machine Company who had, earlier, developed a system of recording statistics for the United States Census Bureau back in 1890. The directors of the company balked at making Watson president, fearful that a conviction in the anti-trust case would haunt them all. He went to work for the company as general manager. There he worked in relative obscurity, in charge of sales operations while deferring on other matters to Flint and the other directors. The main offices of C-T-R were across the street from Flint's headquarters in Manhattan's financial district, but the problems of Watson's job extended outward to a score of cities, to 1200 employees and more specifically to about 400 demoralized and poorly supervised salesmen.

Watson had been on the job a little less then eleven months when the Federal Appeals Court, in a decision involving a single issue, granted the defendants, Watson among them, a new trial and set aside the earlier conviction. Within forty-eight hours, the board of directors of C-T-R elevated Watson to the presidency. The court decision meant a new trial would have to be held, but none ever materialized. Instead, the case was closed by a consent decree which Watson declined to sign because he felt it was an admission of guilt. Since he was no longer connected with the company, the government simply let him go.

Watson may have moved slowly at the beginning, but he moved surely as well. In 1923, the company's name was changed to International Business Machines Corporation largely for its dignity, public relations worth, and ability to open the doors of prospective customers. At this point in time, IBM was neither international or a manufacturer of true business machines, yet Watson seemed to have a vision of IBM's future. Virtually heedless of grousing directors he set about creating IBM in his own image. Eventually Watson's position as chief executive was secured by his indispensability-Watson was IBM.

The IBM man was not a visible part of the roaring twenties; first of all, because he was a serious fellow, intent on making something of himself, but also because Mr. Watson would fire him if word of excessive frivolity, any drinking whatsoever, or any unacceptable incidents or boisterous or embarrassing conduct got back to the leader.

Watson's thoughts on company matters, patriotism, public issues, morals, the way things were, the way things ought to be began to appear in company publications. Each IBM installation of any size had its own publication. *Business Machines* itself was aimed at the whole IBM family and stuck strictly to IBM affairs. *Think* was inaugurated in the 1930's and was the company's prestige publication incorporating many of Watson's messages, as well as inspiring words from non-company contributors.

There were no specific rules about decorum, grooming, and apparel but a certain style was expected because Mr. Watson felt that dressing well opened more doors and elevated the prestige of both the salesmen and the company. That a salesman's clothes should not distract the customer from his presentation and that it is difficult to demonstrate a complex piece of equipment after a three-martini lunch are sensible business practices. Later on when the work force expanded beyond the range of Watson's ability to involve himself so deeply in the affairs of IBM people, a variation of the practice continued. It was not necessary to put into writing the rules for grooming; a clean white shirt, necktie, and conservative attire. It was said that Watson himself communicated his insistence on dark suits and white shirts by example and by pointedly complimenting executives and salesmen who conformed. The others quickly got the point.

By the same indirect method that made white shirts standard dress, modes of conduct were established. An IBM household was quite simply expected to be at least moderately religious, choice of church was of no particular consequence. Drinking was frowned upon and drinking on the job, either at a company function or while dining with a prospective customer was grounds for instant dismissal.

Prior to World War II, IBM was almost exclusively a male, Protestant-dominated world. Departure from this policy, which was practiced in much of the country both by intention and oversight, came during World War II when women entered the work force by the millions. When scientific and technological breakthroughs occurred, Jewish scientists broke through the barriers in large numbers. As for Blacks, there was little chance of employment except in menial tasks until the civil rights outbreaks brought concern about discrimination, and Blacks were given training and employment.

If it was possible to sum up Watson's philosophy in just two words, they would be loyalty and that would be second to the never-ending company emphasis on THINK. THINK was what they all were required to do; loyalty was the inevitable result of thought, if it was correctly undertaken. Every office had a THINK sign and every desk was supposed to hold one. If Watson missed seeing the presence of the all-encompassing word, he was quick to notice and his reaction was explosive. The word was reproduced in the lobby of IBM headquarters and it was spelled out, fifteen feet long, in flowers on company grounds in Endicott.

Watson spoke of the virtue of loyalty often and defined it repeatedly, especially when addressing company recruits. He felt that employment at IBM was not just a job, but a life commitment. The absolutes of the IBM faith were firmly established in those fifteen years or so.

To IBM, men yielded their right to be different or to question the system. IBM engulfed them until they became nearly identical faces in an IBM sea-merging their individual identities in a collective society-for the good of the whole. The search for success and securities was a goal itself.

The corporation grew and prospered as the Watson personality and the well-behaved organization over which he presided extended across the country and into other nations.

Salesmen were dismissed, when flawed in character or manner, they did not meet quotas. By the time the depression eased off in Roosevelt's second term, Watson was training salesmen in lots of fifty at Endicott. Screened for appearance and manners, the fledgling salesmen stayed at the Homestead, the company's spacious hotel adjoining the IBM Country Club and attended class.

With the stiff doses of character building that were injected into the curriculum, the men would relieve the monotony with fifteen minute songfests. In school and out, at meetings, conventions, company ceremonies and banquets, the men sang songs about the glory of IBM. The songs were incorporated into songbooks that were printed by the thousands. When Tom Watson Jr. assumed the presidency of the company, songfests were phased out and the songbooks virtually disappeared.

Watson was a great believer in awards, presentations, and banquets. There were many dinners; some combining fireworks, the IBM orchestra, and oratory honoring differing categories of workers. The company maintained accounts at Tiffany's and Georg Jensen's to supply the gold watches, jewelry, and other awards given to various recipients. The One Hundred Percent Award Dinners were the most significant events. Membership in the club was held as a mark of status and accomplishment. Members were compelled to attend the banquet and no non-members were allowed except for spouses and various dignitaries. The privileged enjoyed a trek to a resort where they participated, sometimes for a week, in dinners, pep sessions, and award

ceremonies. The last night of the convention was a lavish affair filled with speeches and presentations. Those salesmen whose records were most heroic became officers and directors of the club and saw huge pictures of themselves displayed on the dais. Watson sought honors, along with any other form of recognition zealously and received a good many without having to bid for them, however discreetly, that he very possibly stands as the all-time record holder for a non-academic, non-royal personage. Only the U.S. Armed Forces, the International Rotary Clubs, and the United Nations are represented in more countries than IBM and only IBM had a well-oiled, pretested plan for bringing the honors and decoration grantors of so many countries into conjunction with its leader.

Watson was a true believer in the importance of education and continuous learning for his employees and instituted formal education programs in the company. The educational opportunities were not limited to upper level employees. All employees were afforded the opportunity for learning, but as they took on more responsibility, certain types of education became required. Watson also manifested a genuine, fatherly concern for his employees. In the 1930's he implemented a policy of protecting IBM employee's job security. Developed during the depression years, Watson's vow to maintain employment was in direct response to the fears of the employees. This policy forced IBM to pursue different markets for its products and to develop new Products. It also emphasized the contribution of each individual employee to the goals and well-being of the company. Workers realized, as a result of the policy, that their productivity directly affected the profitability and survival of the company. Watson was able to maintain constant levels of employment by opening new markets and increasing the levels of product inventories.

Watson, in 1936, abolished the practice of basing production worker salaries on base wages plus premium pay for output above a norm. Instead, each worker was paid a straight salary plus overtime and vacation pay. Each worker was also expected to meet a production goal. That goal however, was no longer defined by an industrial engineer but by each individual worker in cooperation with the supervisor. Each worker thus became more aware of his achievements and abilities and the relationship between the workers and supervisors changed dramatically. The supervisors respected the individuality of each worker and no longer functioned primarily as a disciplinarian. Instead, the supervisors became "assistants" and functioned to help their subordinates meet their goals by insuring that necessary resources were available. The workers became more aware of their own weaknesses and strengths and were allowed the opportunity to improve themselves by exchanging ideas with fellow employees and "job instructors". This resulted in the employees setting goals for themselves that were in most cases higher than those set by the engineers.

Watson strongly believed in the policy of promoting from within the organization. By promoting from within the organization, IBM gained further company loyalty and avoided many acceptance problems that arose from hiring outsiders. Watson also developed a technique of firing with the company. A transfer to a department or position out of the mainstream of current company priorities was considered punishment because of the decrease in the transferred employee's status with the organization. The transferred employee, however, was allowed to make contributions to the company and regain the lost status and self-esteem.

Along with wages and job security, IBM has always thought it was equally important that the company respect the dignity of its employees. Management also recognized the individual has his own problems, ambitions, abilities, frustrations, and goals. Wanting to be certain no one got lost in the organization and, most of all, that no individual became a victim of any manager's unfairness or personal whim, Watson instituted a new policy. The Open Door policy grew out of Watson's close and frequent association with individuals in the plant and field offices. It became a natural thing for them to bring their problems to him and in time it was established as a regular procedure. The policy allowed employees to voice grievances or complaints to any level of the

organization, including the chairman. Employees are thus protected from a manager's unfair treatment.

In the thirties, the government became IBM's biggest customer. When it began to do business with the federal government, some of the company's own protective and lucrative practices exercised in conjunction with Remington-Rand came under scrutiny. Sales policies of IBM, an arrangement between it and Remington-Rand, and the content of contracts between IBM and customers leasing its machines were areas of prolonged inquiry. Under the Sherman Act and Clayton Act, the government instituted its case against IBM, within two weeks after Roosevelt took office. Tabulating machines leased to federal agencies imposed upon them a requirement to buy the necessary punch cards, not on the open market, but from IBM. At the same time, IBM and Remington combined to restrain commerce it was charged. The agreement described in the charges was cancelled by stipulation before trial began and Remington-Rand agreed to consent to any decree entered against IBM. IBM, which at Watson's insistence, declined to settle the issues by consent procedures and elected to go to trial. IBM filed objections to some of the facts, as stipulated by the government and the judge upheld its position. But on the main issues, Watson was caught and had to agree to desist perpetually. The case dragged on and the U.S. SuPreme Court on April 27, 1936, upheld the government,s case. Watson responded with more dignity, but with not much more understanding than Patterson had done on more serious charges. What the government saw as restraint of trade and monopoly, Watson clearly thought was progress.

Throughout its history, computing equipment has been developed to meet two different needs: the scientist's need for rapid, complex calculating and the businessman's need for tabulating and keeping track of data. Sometimes these two lines of development have diverged; at other times they have come together. For the business customer, the punched card accounting machine was the predecessor of the computer; but scientists, too, had first turned to business machines for help in their calculations. By the middle thirties, IBM had captured more than eighty percent of the market in punched-card machines from Remington-Rand, its only competitor. When the new technology developed, it was in a favored spot. When the United States entered World War ll, Remington-Rand diverted much of its effort to making ammunition. Watson, also patriotic, sent a telegram to the President, putting the company's facilities at the government's disposal. The company retooled in part for war production, turning out bombsights, rifles, and other ordnance, but most IBM plants Were directed to speed production of data processing equipment on overtime schedules. Machine production was increased and thousands of IBM data processing machines were conscripted from normal business operations for wartime record-keeping and control. Even at the front itself, IBM machines brought up in mobile units followed U.S. troops in the field to help minimize the paperwork. A roomful of IBM tabulators helped the Navy to break the Japanese code before the Battle of Midway. The machines went everywhere and thousands of men who landed with the machines and operated them became businessmen already sold on the merits of IBM. The company took only one and a half percent net profit on its war production contracts and used the money to set up a fund for war widows and children of company employees. IBM had entered the war a $40 million company and it came out a $140 million dollar company; tripling its factory space and doubling its work force.

Also at this time in history, Howard Aiken was developing Mark and Eckert and Mauchly brought out the all-electronic Eniac (as detailed in the earlier computer history section). The age of the computer had come and just as IBM was on the verge of its greatest growth, Watson's attitude about growth changed. He suddenly did not want to become the chief executive of a large business, but wished to remain the owner of a small one. He began to sabotage development operations and market plans, distrust his employees, and believed his employees were not ready for more responsibility. If Watson had remained at the head of the company much longer, he might have destroyed the very dream he had strived to accomplish. Reluctant to relinquish his

position, he was forced to abdicate by his closest associates in the company, including his two sons. His older son, Thomas J. Watson Jr. was put into the president's chair in 1950 and Watson stepped into the position of Chairman of the Board.

Shortly thereafter, the two generations of Watson clashed over an anti-trust action that was instituted in 1952. IBM had become so big that it had become a monolith beyond the range of competitive influence. They also built good machines thereby reducing the effectiveness of the competition. Patents, research, and a superior sales force had tightened the IBM monopoly. To Watson Sr., the government's restraint of trade case had no merit because he could not believe the fact that the company monopoly was no less real because it had developed through good business practice. The consent decree was so galling to him that he rejected it. The case dragged on with Watson unable to adjust to the intricacies of corporate law and modern times. Finally Tom Jr. committed IBM to the consent decree-countermanding patriarchal power to become in his own right, the power behind IBM.

The second generation of management at IBM dates from the 1950's when the company was in potential danger. Tom's first move was to get the one man organization rehabilitated and functioning as a corporation with a dozen separately managed divisions. He brought cohesion to the sprawling bureaucracy. He resorted to conventional management techniques and processes to steer IBM into an organization capable of absorbing the shocks of growth. The recruitment of scientists by the thousands changed the body and face of IBM after 1957 when the company crossed into the circle of billion dollar corporations. Foreign operations were growing fast with sales approaching the two billion dollar mark in 1960.

In the years between the mid-fifties and early sixties, a number of companies, with highly educated, inventive, and daring men began to put diversity and specialty in computer technology. IBM, on the other hand, faced with the need to stabilize production, programming and service in order to supply customer demands had neither the freedom nor the economic need to vary or significantly improve their systems. Improvements in computer design and technology were developing so quickly they could not be easily incorporated into a long-run production line. As a sales and service company IBM constantly sought to hold its grip on the market by persuading its customers that service, stability, reliability, and longevity were more important than technological advancements. Because of the enormous sums of money necessary to develop and maintain a first class sales force, many of the companies were not financially capable of keeping up with IBM in spite of their research and design edge.

In order to guarantee command of the market it became imperative that IBM take a massive and risky step forward. Over a period of four years in the nineteen sixties, IBM dumped in staggering amounts of capital to develop an entirely new system. System 360 was a gigantic undertaking which revolutionized IBM. It got the company into manufacturing its own components, and it changed the engineering and manufacturing operations into a truly worldwide effort, with overseas labs and plants helping for the first time to produce one product line for use in both domestic and foreign markets.

The system introduced some radical notions; compatible software for the entire product line allowing computer users to move up from one model to another over a vast range of powers. All the peripherals and software had to be redesigned which was an enormous undertaking. Crisis after crisis plagued the development and pushed back delivery dates of the new machines. Typically, IBM kept the competition at bay with their excellent sales and service force and the promise of something revolutionary.

By the end of 1966, 60,000 new employees and by 1967 five new plants had been added to the IBM family. It was the most costly privately financed commercial project in U.S. history; costing two and a half times the

cost of development of the atomic bomb. Because of the multitude of problems, it would be 1967 before all the 360 software was delivered and another two years before all the programs were tuned up and running well. Estimates put the cost of developing, maintaining, repairing, and enhancing the system at $500 million. These included programs that controlled the computer's operations and those that translated the newer higher; level languages into binary code. In September of 1966, at the height of all the troubles, IBM still managed to ship out four thousand 360 computers. It is a tribute to the company's marketing ability that they were able to hold on to their customers despite all the problems that developed with the computers.

When the smoke cleared and the anguish was over, System 360 proved to be a tremendous boon to IBM and the decision to launch the whole undertaking proved to be a good one. IBM's successful formula almost proved to be its undoing when the Johnson administration, on its final working day in office opened a massive anti-trust case against the company. IBM was accused of monopolistic and anti-trust practices. As of October 1980, 103,041 pages of transcript, covering the questioning of 81 witnesses; 928 depositions and 11,644 documents had been introduced. The federal suit dragged on for several years, at a cost to IBM of several hundred million dollars in legal fees, until it was abruptly dropped in January, 1982 as having no merit.

Lesson One

Objective Students will learn the chronological order of events important to the computer revolution.

Method Students will hear the lesson covered in the beginning of the unit title "History of the Computer". The unit can be adapted easily to the ability level of the group. I have found that a chart or a transparency for an overhead projector showing the date, machine, and contributor is helpful. Also I have found that either the tool, itself, a model or even a picture helps to make the explanation easier.

Activities Time lines are helpful in putting the events into sequence especially when other significant events of the period are included (ex. Eniac was developed during World War II). This also allows the student to see the rapid progression of the computer industry in a comparatively short span of time (the first four generations of computers will fall within the last three decades). Crossword puzzles, word searches, and scrambles are excellent tools for reinforcement on an individualized basis.

Exercises in matching dates to events, inventors to their inventions, and pictures of the machines to their names may be used.

Advanced students can further research the contributions to the development of the computer and their contributors and present their findings in oral reports. Students should present home made visual aids with their reports. I have found it quite easy to construct an elementary abacus of beads and wires or a model of an arithmetic machine out of cardboard.

Lesson Two

Objective Students will learn about the sales practices and philosophies of Watson and IBM

Method Students will hear the lesson in the unit titled "The Watsons and IBM". This Gill serve as the basis for class discussions about such topics as what makes an effective leader in business,

ethics in business, good sales practices, etc.

Activities The students will form mock businesses. They must design an effective sales campaign that includes advertising strategies, and slogans designed to capture them a share of the market.
Students can visualize themselves as the president of a large corporation. They are to write a handbook of company policies and guidelines they feel are necessary to promote a good company image.

Students can give a sales talk. Remembering that Watson was a great believer in effective sales presentations, students are to give a talk designed to sell their product or service to the audience.

Students should list the qualities Watson felt were important in an IBMer. They can then draw and label the important parts of their character (figure should be dressed in black suit, mandatory white shirt, etc.).

Students might participate in a debate about the individual vs. corporation conformity. Citing examples of pros and cons, students will present their opinions of this area of IBM philosophy.

Advanced students can present a mock sales convention a la Watson. Students can incorporate pep talks, awards, and even an original corporate song.

Lesson Three

Objective Students will be able to discuss the anti-trust suits brought against NCR and IBM and give and to give reasons for the actions

Method I will use the second part of the unit "Watsons and IBM" as the basis for discussion of monopolies, unfair competition, and anti-trusts.

Activities Students can discuss the ethics behind Patterson's campaign to take over the cash register market and IBM's good business practices that led to their monopoly and contrast the two.
Students can research and report on some of the important laws, cases, and figures of the late nineteenth and early twentieth centuries. They could include:

Clayton Anti-Trust Law

Sherman Anti-Trust Law

Standard Oil Case

John Rockefeller

George Pullman

E.C. Knight

Northern Securities

Case Federal Trade Commission

Students can either play the game, Monopoly or design an original game.

Students can research and report on the anti-trust suit filed by the Johnson administration and the findings.

Teacher Bibliography

Brock, Gerald. *The U.S. Computer Industry* . Cambridge: Ballinger Ballinger Publishing Co., 1975. More technical in nature and oriented towards economics.

Burnham, David. *The Rise of the Computer State* . New York: Random House, 1983. An extremely interesting book about the dark side of computers-including surveillance, data bases, and the potential for the misuse of computers.

Fishman, Katharine. *The Computer Establishment* . New York: Harper and Row, 1983. An extremely thorough look at the computer industry with a focus on IBM in the sixties and seventies.

Foy, Nancy. *The Sun Never Sets on IBM* . New York: William Morrow and Co., 1975. A look at IBM's overseas operations.

Goldstein, Herman. *The Computer from Pascal to Von Neumann* . Princeton: Princeton University Press, 1972. Computer history through the forties.

Halacy, D.S. *Computers: The Machines We Think With* . New York: Harper and Row, 1962. A history of computers from the abacus through the first and second generation computers of the fifties and early sixties.

Peters, Thomas. *In Search of Excellence* . New York: Harper and Row, 1982. A fascinating study of successful corporations and their techniques. Just out-I found it in a bookstore and couldn't put it down.

Rodgers, William. *Think* . New York: Stein and Day, 1969. Everything you'd ever want to know about the Watsons and IBM from the beginning through to the sixties.

Watson, Thomas. *A Business and Its Beliefs* . New York: McGraw-Hill, 1963. An inside look at IBM through an interesting series of essays written by the second president of IBM.

Wulforst, Harry. *Breakthrough to the Computer Age* . New York: Charles Scribners Sons, 1982. A look at computers from 1937 through the first electronic computers. Very thorough and informative. Has some interesting pictures

Magazines

Time , July 11, 1983. This edition of the magazine provides an up-to-date look at IBM. Very current information.

Student Bibliography

Kohn, Bernice. *Computers at Your Service* . Englewood Cliffs: Prentice Hall, 1962. A history of computers written for children. Glossary of terms is useful.

Stouffer, Marjorie. *Computer Time: Computer Calling* : Educational Insights, 1982. An activity book with lots of illustrations and information. Good for middle school. Also contains a book list in the back about other computer books.

Richman, Ellen. *Spotlight on Computer Literacy .* New York: Random House, 1982. A very current text on computers. Includes history of the computer and programming. Good format, nice illustrations and appropriate for middle school and any other older beginner.