Microcomputers in education and their applications in administration

Byron D. Clemsen

University of Northern Iowa

Copyright ©1985 Byron D. Clemsen

Follow this and additional works at: https://scholarworks.uni.edu/grp

Part of the Education Commons

Recommended Citation

https://scholarworks.uni.edu/grp/2230

This Open Access Graduate Research Paper is brought to you for free and open access by the Student Work at UNI ScholarWorks. It has been accepted for inclusion in Graduate Research Papers by an authorized administrator of UNI ScholarWorks. For more information, please contact scholarworks@uni.edu.
Microcomputers in education and their applications in administration

Abstract
The single most significant technological achievement of the twentieth century might well be the computer. Capabilities of the computer at present are just beginning to be tapped. What the future has in store is anyone's guess. Computers can perform repetitive tasks with less error than human workers can, as well as work 24 hours per day, 7 days per week without need for rest. Technology has improved both in regards to the speed with which it performs computations as well as the capacity for memory storage. With the latest advancements, computers now have the ability to communicate interactively within a state, region, as well as globally (Gustafson, 1985; Monteau, 1984).
MICROCOMPUTERS IN EDUCATION AND
THEIR APPLICATIONS IN ADMINISTRATION

A Research Paper
Presented to
The Department of Educational Administration
and Counseling
University of Northern Iowa

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts in Education

by
Byron D. Clemsen
August 1985
This Research Paper by: Byron Dean Clemsen

Entitled: MICROCOMPUTERS IN EDUCATION AND THEIR APPLICATIONS IN ADMINISTRATION

has been approved as meeting the research paper requirement for the Degree of Master of Arts in Education

Robert H. Decker

6-26-85
Date Approved
Advisor/Director of Research Paper

Norman McCumsey

6-28-85
Date Approved
Second Reader of Research Paper

Norman McCumsey

6-28-85
Date Received
Head, Department of Educational Administration and Counseling
The single most significant technological achievement of the twentieth century might well be the computer. Capabilities of the computer at present are just beginning to be tapped. What the future has in store is anyone's guess. Computers can perform repetitive tasks with less error than human workers can, as well as work 24 hours per day, 7 days per week without need for rest. Technology has improved both in regards to the speed with which it performs computations as well as the capacity for memory storage. With the latest advancements, computers now have the ability to communicate interactively within a state, region, as well as globally (Gustafson, 1985; Monteau, 1984).

Educational administration is beginning to use computer technology in the following areas: 1) accounting, 2) attendance, 3) counseling, 4) grading, 5) inventory, 6) scheduling, 7) student records, and 8) miscellaneous areas such as athletic scouting, parent reporting, negotiations, and vehicle maintenance reporting (Cutts, Matthews, Winkle & Nicholls III, 1982; Sutherland, 1983). Software technology that can assist the educational administrators in performing their job are:
1) spreadsheets, 2) data bases, 3) word processing, and 4) commercially produced educational administration programs. These commercially produced educational administration programs are able to assist administrators in scheduling, tracking truants, grade reporting, attendance and projecting pupil enrollments (Kacanek, 1984; Matthews & Winkle, 1982; Yost, 1984; Young, 1984). The recordkeeping tasks such as attendance, truancy, scholastic achievement as well as co-curricular schedules all demand time from an administrator's day, which can be done effectively and efficiently on the microcomputer.

The review of literature will contain three parts. Historical origins and developments of the computer will be reviewed first. Next, the educational uses of the computer and microcomputer will be discussed. Finally, possible administrative applications of the microcomputer will be explored.

HISTORY

Humans first used their fingers and toes as devices for counting. They progressed using piles of stones to count beyond the fingers and toes which they possessed. Humans quickly developed the need to make
complicated computations which lead to the development of the early computer. The abacus, a manual computing device consisting of a frame holding parallel rods strung with movable counters, was developed to help individuals count and is still in use today (Bitter, 1984; Gustafson, 1985).

Pascal invented the first calculating machine in 1642, which was developed on the base ten numerical scheme (Gustafson, 1985). This machine used cogged wheels with the numbers 0 through 9 marked on the circumference which enabled it to "carry" a revolutionary concept. Today, a computer language named "Pascal" has been developed in his honor (Bitter, 1984).

Several other people made contributions to the computer era. Babbage, considered to be the father of computers, designed what is considered the first practical mechanical calculator in 1852 (Bitter, 1984; Gustafson, 1985). He also developed the idea of the mechanical digital computer, which he called the analytical engine. This was the true beginning of the modern computer (Bitter, 1984).

Punch cards to program the computer, similar to those used in the looms of the textile factories, were
developed in the 1840s by Byron (Gustafson, 1985). During this same time period, Boole developed a logic of mathematics using a binary numbering system; a system which uses only two digits. This logic is still used today (Bitter, 1984).

All of these previous inventions laid the groundwork for Hollerith, who used punch cards. These punch cards were "read" by electronic censors. This new idea was used in the tabulation of the 1890 census. This new method was so successful that punch cards were quickly introduced and adopted for business purposes. Hollerith formed his own company, the Tabulating Machine Company, which became International Business Machines (IBM) in 1924 (Bitter, 1984; Gustafson, 1985).

The next major step happened in 1939 when Atanasoff and Berry designed the first electronic digital computing device (Bitter, 1984). Atanasoff was a physics professor at Iowa State College and Berry was his assistant, together they developed the computer to perform linear algebraic equations. These early primitive computers appeared in the 1940s (Leo, 1980). Developed in 1944, the MARK I, was programmed with the assistance of a paper tape. This machine was huge,
measuring 51 feet long and 8 feet high as well as having 1,000,000 parts (Bitter, 1984). The MARK II followed in 1947. It was considered a major advancement in the computer industry, having the capability of being 1000 times faster than the MARK I.

These early machines were developed by IBM which became the American leader in computer technology. Besides being huge, the machines were noisy and demanded huge amounts of electrical energy. The electricity was required for the thousands of vacuum tubes which created tremendous heat. Thus, air conditioning systems were required to keep the machines from overheating. These early IBM machines were capable of performing up to 5000 additions per second (Bitter, 1984).

Another individual who contributed to the modern computer age was von Neumann. He felt that the computer should have three main parts: arithmetic, control, and memory. Also, the computer was designed to have the ability to have input as well as output. Dr. von Neumann also developed the idea of binary arithmetic to represent all numbers (Bitter, 1984). His work along with others lead to the development of the first true computer systems.
The size, electrical requirements, and other factors made computers impractical for the average person to own, which meant the government was primarily the principle user of early computers. The stage was now set for the development of transistors, which took place in 1947, by Bardan and others at Bell Laboratories (Gustafson, 1985). Transistors began to replace the old vacuum tubes and the age of miniaturization was upon computers (Bitter, 1984). As the computer became smaller, the cost, and power requirements were lowered as well. Thus, the public began to enter the computer age.

Transistors, themselves, presented several problems. The transistor circuits were expensive, cumbersome, and the distance between transistor, though small, did limit the speed of the circuits (Bitter, 1984). Computers had come a long way since their early beginning, but new developments were on the horizon.

Development of integrated circuits, in 1963, brought about a totally new world of computers. Whole computer sections could now be placed on a single silicon chip. Computers became faster, more reliable, and capable of storing large amounts of data. As a result of transistors and integrated circuits,
computers became less expensive and were produced for use worldwide.

Development of the large-scale integrated circuit (LSI) in the mid 1970s brought about further revolutions to the computer industry. Due to the large-scale integrated circuit, vast amounts of information could be stored on a single chip. The digital watch, pocket computers, and citizen-band radios, which used large-scale integrated circuits, dropped in price dramatically (Bitter, 1984). The computer became more powerful and performed functions faster than ever.

The next step was the development of very-large-scale integrated circuits (VLSI), which can have 50,000-1,000,000 of electronic components built on a single chip. Computing costs for the vacuum tube computers were estimated at $1.25 per 100,000 calculations compared to the cost of less than $.01 per 100,000 calculations on the very-large-scale integrated circuit computers. Computers had become increasingly reliable as well. The input terminal developed into a keyboard and cathode ray tube (CRT) where data was displayed on a screen. An outcome of the large-scale integrated circuit was the development of desktop
computers (Bitter, 1984). As uses for the microcomputer were developed, individuals began to incorporate the machines in businesses, homes, and schools.

APPLICATION IN EDUCATION

Early computers, being expensive and huge, were used mainly by big businesses and government. Microcomputers, being small and less expensive, found their way into small businesses and educational institutions, namely elementary and secondary schools, in the late 1960s (Cutts et al., 1982). Innovating computers in the educational process began crudely. Teachers were either not interested, lacked the time, or did not have the background to coordinate computer technology in their classrooms (Gustafson, 1985). Early software lacked quality in design and learning theory along with the organization and distribution of computing resources were not easily accessible (Gustafson, 1985). Generally there was little knowledge of how to use computers most efficiently in the classroom. Most important of all was the lack of funds from either local, state, or federal levels, to
promote this new educational innovation (W. M. Matthews, personal communication, March, 1985).

Schools were quick to find varied uses for microcomputers. Educators were eager to use microcomputers as aids in classroom instruction. Over two thirds of the school districts in the United States are currently using microcomputers or having them available to be used by either teachers or students (Ingersoll & Smith, 1984). Six microcomputer advantages of the microcomputer for education are:

1) initial cost, 2) ease of installation and servicing, 3) limited effect of "down time", 4) local control, 5) accessibility, and 6) no need for a cadre of experts (Joiner, Vensel, Ross & Silverstein, 1982).

Computer-assisted instruction (CAI) is a system in which computers are programmed to function as teachers (Bitter, 1984). Some examples of CAI are: 1) practice drilling of math and spelling skills or concepts, 2) storing and retrieving of scientific data, and 3) mechanical or architectural drawing can be done as well (Becker, 1982; Joiner, et al., 1982; Norton, 1985; Sutherland, 1983). Computer-assisted instruction is usually classified in one of four categories: 1) drill and practice, 2) simulation/modeling, 3) game, and
4) tutorial or any combination (Joiner, et al., 1982). The whole purpose of CAI is to assist educators in job performance as well as a means of individualizing instruction for students.

Another application of microcomputers is in computer-managed instruction (CMI) (Becker, 1982). Computer-managed instruction is a computerized system of recordkeeping, management, and lesson planning in an educational setting. Examples of computer-managed instruction or as it is commonly referred CMI are: 1) administering of tests, 2) assigning of study activities, and 3) keeping records of progress. This will in turn allow the teacher more time for actual instruction (Bitter, 1984).

Microcomputers can be used in all phases of education. Special education application is such an area, where microcomputers can be used in instruction of the hearing, speech, motor, or visually impaired. Hand-eye coordination can be improved through the use of microcomputers. Besides having the ability to develop new educational strategies based on information feedback, microcomputers have two distinct advantages in special education, they are: 1) provide clear instructions and expectations for immediate
reinforcement, along with a gradual progression of tasks to perform and 2) increase hand-eye coordination (Joiner et al., 1982).

As mentioned previously, both elementary and secondary schools have found several applications for microcomputers. Students can progress through subject material as they are able to master lessons presented. Through the use of microcomputers, the potential is there to be more creative, more productive, and to provide a more conducive atmosphere for student learning (Martellaro, 1981).

According to Gustafson (1985), students can learn material two or three times faster with the aid of computers compared to traditional methods of paper and pencil. Educators have found that their students enjoy time spent on microcomputers. The only shortcoming, according to Gustafson (1985), appears to be lack of sufficient software.

Another educational use of microcomputers is that of a tutorial. Here computers become a teacher's aid and help students learn at an individual rate (Gustafson, 1985). Software for tutorials usually are for remedial purposes, where students progress as answers are correctly given.
Inquiry is an area in which computer-assisted instruction is rapidly growing. In this application students answer questions asked of them by computers, which relate to the needs of an individual student. Research has shown that students benefit greatly from this type of computer program (Bitter, 1984).

Computers and word processors are useful tools in schools. Application ranges from producing school newspapers and yearbooks to English classrooms where practical application of word processing in writing themes and papers are used. Through the use of word processing, students are able to view their work as well as to make corrections and print the context quickly. Research has proven that students are more willing to make the necessary revisions if a word processor is used (Gustafson, 1985). A by-product of using word processing has been increased typing proficiency. Computers also help in the developmental stages of learning to read and write (R. H. Decker, personal communication, June, 1985).

If education and teachers do not embrace the use of microcomputers to increase both their effectiveness and efficiency in the near future, public education will be put out of business by the private sector.
(Matthews & Winkle, 1982). To survive in tomorrow's world, students need computer literacy, which is gained by using computers, and it is the job of schools to provide them with it (McKenzie, 1984). Microcomputers are a universal educational tool which will lead to student, teacher, and administrative educational efficiency.

ADMINISTRATIVE USES FOR THE MICROCOMPUTER

Educational administration is beginning to tap the resources of microcomputers. Public laws such as 94-142 and 94-482 mandate individualized instruction as well as additional reporting procedures for administrators. The problem has been finding and retrieving information to solve the concerns of additional federal mandates. Microcomputers have been used to assist administrators in this role (Honeyman, 1985).

Probably the most effective use of microcomputers in the principal's office is word processing. Writing letters and reports can be completed more efficiently than has been the capability in the past. When used to its fullest potential, the microcomputer and word processing software can do the work of two full-time
clerical staff (Joiner et al., 1982). The burden of paperwork can be reduced from 20% to 70% by employing microcomputers in an administrative capacity (Pogrow, 1985).

An administrative use of the word processing capability is in the task of student suspension. Huntington (1984) suggested that the time saved is over 29 minutes per suspension. This is beneficial because suspensions have a way of happening when the principal is strapped for time. Letters, to inform parents of the suspension as well as causes for the suspension, can be performed on a word processor and look professionally done. All of this is accomplished by inserting the student's name in a form letter already stored on a computer disk, (Huntington, 1984).

Standard letters to parents telling of new programs or letters of commendation can be sent as well by employing the use of word processing. All of this is accomplished in minutes rather than hours as has been the practice in the past. These letters to the public can in turn help build good public relations.

Still another administrative application using microcomputers is in contacting parents of truant students. By using automatic dialers schools are able
to reach working parents of truant students after the normal school day. The system has a dialer with two tape recorders. One tape recorder plays a recorded message while the other tape player records the response from the answering party. Large and small schools throughout the United States have used these dialers, according to McGinty (1985), with a reported increase in average daily attendance.

Microcomputers can also be helpful in maintaining attendance records and generating reports (Gustafson, 1985). A student can be easily identified early as an absentee or truant case. In this way schools are able to handle the situation before it becomes a serious problem (Jacobsen, 1984; McGinty, 1985). As a result, attendance can be improved. Pupil enrollment projections, according to Kacanek (1984), can also be completed with microcomputers. This is helpful in scheduling classes for the upcoming year as well as scheduling faculty. It will also indicate to administrators if a personnel reduction or addition is needed. A more complete use of school facilities can also be analyzed which allow administrators to determine with precision, the number of teachers and classrooms needed (Williams & LeCesne, 1985).
Teacher evaluation is another function where administrative application of microcomputers can be helpful (Pogrow, 1985). Administrators can use software programs in the evaluation process when recording data. These files can be kept on disks, which take up only a fraction of the filing space, rather than taking valuable office space. Education instruments and letters can be stored and retrieved easily for future references. Cirillo (1984) has pointed out the value of this administrative capability.

Salary negotiations are also made easier through use of microcomputers. Salary input data can be made through keyboard options and changes can easily be completed quickly which result in greater instantaneous visual impact (Huntington, 1984). As a result of using microcomputers and spreadsheets from microcomputers, there is more data readily available to be discussed and options can quickly and easily be evaluated.

The term data base has several meanings. According to Bitter (1984), it means a systematic way of storing data files for future processing. Data-base management is a comprehensive software system that builds, maintains, and provides access to data.
Application of data bases can vary from student or staff records to financial records. More important is the fact that data bases are used when there is a need to store large amounts of repetitious information.

School administrators facing the burden of growing amounts of paperwork will find computer-based management systems helpful. According to Gustafson (1984), school administrators have demonstrated 50% to 70% reduction in the time it takes to generate files needed to run school when using computer-based management. There are many programs available and these range from filing programs to programs designed to do specific tasks.

These electronic filing systems will help organize the tasks an administrator must perform. An example is a student data file which allows for easy access and retrieval. Having the ability to access accurate, current data helps administrators in their decision making capability.

Though the advantages of using microcomputers are endless, there are also some shortcomings to be considered. Four limitations of the microcomputer are:

1) not every school can afford to own a microcomputer
2) and sufficient software required for administrative
application, 2) not all schools require a microcomputer due to the school's size, 3) not all administrators are computer literate or have a computer background, and 4) not all commercially produced software programs meet the needs of educational administrators. Privacy rights of students are also to be considered when employing the use of microcomputers for keeping students' records.

SUMMARY AND RECOMMENDATIONS

Computers and computer technology have improved tremendously from their early humble beginnings. From the abacus, to Pascal's calculating machine, to today's computers, with their very-large-scale integrated circuits, capable of completing computations in billionths of a second, computers and their potential are only limited by the human mind and its creativity and innovativeness. Computers are finding more uses in areas to help humans explore, research, and develop ideas to improve life.

School systems are also finding computers and their technology increasingly helpful. Almost daily new uses for computers are found in the educational field. As secondary schools, colleges, and
universities produce more students familiar with computers, the scope for computer use will expand. Teachers, along with their students, are finding computers beneficial to the performance of their tasks.

The dilemma facing the administrator is that high quality answers are needed almost instantaneously and microcomputers are helpful in this regard. This is not to say that microcomputers have all the answers to all the problems, but they are capable of helping administrators make decisions based on a larger body of information. Because of the many options that become available by using microcomputers, administrators are able to explore a wide range of solutions. Through the use of microcomputers and their innovations, administrators arrive at new solutions creatively (Fawcette, 1985). Microcomputers allow administrators to explore possible solutions to particular problems and through the use of spreadsheets, many of the "what ifs" can be explored for their feasibility.

Another problem which administrators face, once they have made the decision to incorporate microcomputers, is the selection of appropriate hardware and software. First, administrators need to assess the job they expect the microcomputer to
perform. By doing this, administrators will be able to select the correct software program. The size and amount of information desired will also be a determining factor in the proper selection of hardware.

Administrators must realize that not all problems can be solved by using microcomputers. Initially, microcomputers and their application should be small. This would allow administrators to become accustomed to microcomputers and their capabilities.

The job of educational administration is more than a clerical position. The time of administrators needs to be spent on administrative duties. Because of this, the use of microcomputers is imperative. Through the use of microcomputers, large amounts of information are available to administrators and at their finger tips for easy access. Educational administrators who have current and accurate information by which to assist them in decision making will have the potential to be more of an effective educational leader in their school system.

What administrators must do is carefully evaluate their position and then select the microcomputer and software best suited for their application; always remembering to begin small and add to the existing
system when possible. This in turn will enable administrators to implement microcomputers, peripherals, software, and hardware into their daily routine of managerial responsibilities. Mountains of administrative trivia can be completed through the use of microcomputers.
REFERENCES

Books


Periodicals


Daly, G. (1985). Information revolution will change our lives. *Des Moines Register, April 14, Section C*, 1 & 3.


