

INITIALIZING SUCCESSFUL COMPUTERIZED

SYSTEMS IN SCHOOLS

by

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A professional paper submitted in partial
fulfillment of the requirements for the degree

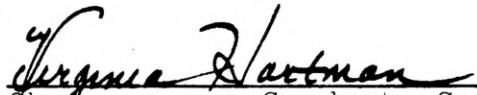
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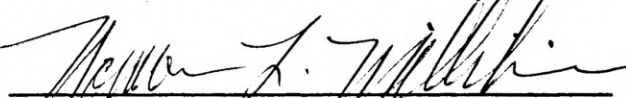
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ABSTRACT

Microcomputers are becoming an important part of equipment in many schools today. In order for schools to make the most of this equipment, planning and organization has to take place before the computer is installed.

Information was gathered from numerous sources. These sources included library research, demonstrations of hardware and software, courses taken, and interviews with students, teachers, and vendors. The information was interfaced to cover all major factors that influence a successful system.

This project gives guidelines on how establishing a successful computerized system could take place. The five major factors presented are personnel, vendor selection, hardware selection, software selection, and site preparation. If these areas are handled correctly the computerized system at the school will be an asset to all involved.

Personnel were found to be the key factor in all computer-oriented systems. Enthusiasm in using the new system is more important than actual knowledge. Purchasing software that is well documented enables the teachers to get involved quickly with making the computer useful in the classroom. Hardware should be easy to use and easy to maintain. Maintenance is the responsibility of the vendor; therefore, vendor selection is also very important.

CHAPTER I

INTRODUCTION

Computers are becoming a major part of the business world, not only in large corporations but also for the smaller enterprises. H. Robert Stocker (1981:25) feels that the student must be taught how to utilize this computer-based technology efficiently to accomplish the objectives of the office. In order to fulfill this task schools need the equipment that is being used in today's modern offices--microcomputers.

Microcomputers became available to the general public in 1975. Since that time, numerous companies have developed and are now selling microcomputers. With this large variety of computers, school personnel need help in deciding which is best for them.

During the 1980's and the first six months of 1981, more computers were installed for classroom use than during the entire preceding decade. This amounted to 70,000 units with a cost of \$102 million in 1980. The trend is expected to grow 31 percent annually to 270,000 units by 1985 (Business Week, 1980:68). In order for these computers to give the maximum benefit, the planning before purchase and the selection of the computer are important parts of implement-

ing a computerized educational system.

This professional paper developed guidelines for the planning and selection process to assist school personnel to generate a successful computer-oriented system.

Statement of the Problem

The problem of setting up successful microcomputer-oriented systems in schools takes careful planning and organization. Many factors influence the value these computerized systems add to the students' education. School personnel need guidance in recognizing these factors and using them to their advantage. This project developed guidelines for this planning and organizing process.

Need for the Study

The need for this study is expressed best as the need for microcomputer systems in schools. The Policies Commission for Business and Economic Education in their "This We Believe About Business Education in the Secondary School" (which can also apply to post-secondary schools) states:

We believe that

. . . The sequence of learning experiences should be planned so that the student will achieve his highest occupational competency upon completion of his program.

. . . Instructional equipment and facilities should be comparable to those found in the businesses where students are likely to be employed.

. . . In-school laboratories that simulate business conditions can be effective means of providing business education (PCBEE:1977).

In order to fulfill this requirement schools are purchasing microcomputer equipment. People in charge of these purchases are many times doing so without the proper planning. These people need certain questions answered. These questions are listed below.

How does a person begin to set up a successful microcomputer system?

What safety precautions are necessary?

What is needed before the computer arrives?

Where do teachers learn how to use this equipment?

What is required for good hardware?

What is required for good software?

Where should the computer be located?

These questions are answered in Chapter V of this project report.

Limitations of the Study

1. This professional paper does not compare the different features that computer manufacturers have developed.

2. The different software packages were not compared.
3. The professional paper was limited to the procedures necessary for planning and purchasing the initial computerized system in a school.
4. The gathering of information was limited to material published in 1979 and beyond.
5. The costs of microcomputers and their peripheral were not discussed.
6. How to use the computer as a teaching tool was not discussed.

Definitions of Terms

The following terms have been defined through the use of documents distributed by computer manufacturers, computer programming textbooks, and Webster's New Collegiate Dictionary. The majority are taken from a Guide to Buying Computers, a Datapoint Publication.

ANSI. American National Standard Institute is an agency concerned with setting up industry-wise standards.

Assembly Language. A programming language supplied by the computer manufacturer to enable programmers to write machine-oriented programs capable of performing binary-level operations. Each manufacturer has a different Assem-

bler that works with its machines.

ASCII. American Standard Code for Information Interchange is an industry standard computer code for converting alphanumerics and punctuation into binary numbers.

BASIC. Basic is an easy to use, high level language that works best in solving equations, often used in business data processing.

Batch Processing. When information is entered into the computer as a group, it is called batched.

Baud. A measure of speed in data transmission, expression as number of bits for second that can be transmitted

Belt Printer. The belt printer is a rugged, medium-speed printer that uses a rotating belt to transfer characters to paper.

Bit. A bit is a single digit in binary math. It is either a 1 or a 0.

Byte. A byte is a group of bits treated as a group, usually 8 bits. The terms byte and character are used interchangeably.

Buffer. The buffer is a part of a computer's memory where data can be stored temporarily until the computer is ready to use it.

CAI. Computer Assisted Instruction, allows the computer to interact with the student. Software used to teach students.

Canned Programs. Programs that are commonly used in most businesses that are available for purchase from manufacturers or other users of the same type of system.

COBOL. Common Business Oriented Language is a programming language that simplifies business data processing programs. Its instructions are very similar to ordinary English.

Compiler. The compiler is a computer program that translates instructions written in a specific high-level programming language into machine language that the computer can understand.

Courseware. Courseware is computer programs that are used only as a teaching aid.

CPS. Characters Per Second used to express the speed of printers or anything that produces text.

CPU. Central Processing Unit is technically, the logic and arithmetic circuitry inside a computer. Where data actually is processed.

Cursor. Cursor is a movable sport on the computer screen that indicates where the next character will be displayed.

Daisy Wheel. The daisy wheel is a wheel with characters around the rim used on some types of printers to transfer characters to paper. They provide the closest to typewriter-quality text of all the mechanical printing methods.

Data. Data consist of information transmitted to or from a computer.

Data Base. The data base consist of all the information stored in a computer system.

Disk. A disk is a flat, hard rotating plate or plates used to record information magnetically.

Disk Drive. The disk drive is a device that holds and rotates a magnetic disk or disk pack during data transmission. It also includes an access mechanism and several read/write heads.

Diskette. Diskette or floppy disk is a circular mylar coated disk used to store information.

Downtime. This is the time the computer system is not in working condition.

Dot Matrix. A method used in some printers to transfer images to paper. The characters are made up of small dots, like the lights on an electric scoreboard.

Firmware. Firmware is instructions to the system

stored in a special, non-erasable memory. The firmware menu usually offers a number of choices of instructions that an operator can pick from.

FORTTRAN. FORMula TRANslation is a programming language used mostly to do complicated mathematical problems in science and engineering.

Hardware. Hardware is the physical components of a computer system, including all its mechanical, electronic, electrical and magnetic parts.

High-Level Language. High-level languages are programming languages that are close to being English.

Interactive. An interactive computer, or program are able to carry on a textual conversation with its operator. The computer prompts the operator, helping him through a routine, checks the information it receives for accuracy and notifies the operator when a mistake is made.

Interface. Where two devices in a computer system meet and connect is called interface. A device that permit other devices to be linked is also an interface.

K. Kilo represents 1024 or 210 bytes of storage, usually estimated at one thousand bytes of storage power in the computer system.

Line Printer. The line printer is a printer that

prints a full line at a time. Gives very high speed, but the printing quality is generally not as good as that of character printers.

LPM. Lines per minute is a way to express how fast a printer prints.

Machine Language. Machine language is the lowest level computer language, and the most precise. Every manufacturer has a different one.

MB. Megabytes are 1,024,000 byte, estimated at a million bytes.

Memory. The storage available in the computer for data processing.

Microcomputer. Microcomputers are the smallest computers currently available.

Minicomputer. Minicomputers are computers bigger than a microcomputer but not a full size computer. Minicomputers support more than one terminal usually up to 16.

Multiprogramming. Multiprogramming is the procedure of dividing a computer's memory into "partitions" to run multiple programs at the same time.

Network. A computer network is a group of computers interconnected by telephone or telegraph lines for communications.

Peripheral. Peripheral consist of any device in a data processing system, other than a computer, required to do the work.

RAM. Random Access Memory means that items stored can be retrieved as needed regardless of their location in storage.

Response Time. The time it takes for an action to be completed. Generally, the interval between executing a command or inquiry at a terminal and receiving the answer at the same terminal.

ROM. Read only memory is non-erasable system instructions built into the computer.

Software. Software refers to all the programs that run on a computer telling it what to do.

Terminal. Terminal is any device used to put information into, or remove information from, a computer. A keyboard and screen or printer that provides a human interface.

Time-sharing. When two or more users work on the same computer at the same time, it is called time-sharing.

Vendor. Vendors include anyone who sells anything to do with computers from the full-line manufacturer to the seller of ribbons for the printers. Suppliers is another name for them.

Turnkey system. A computer system that comes complete with software is called a turnkey system. The computer is ready to be used as soon as it is installed.

Organization of the Study

Chapter I established the purpose for this professional paper in giving assistance to personnel initializing microcomputer systems in schools. The scope of the project was determined by setting the limits of the research.

Chapter II reviewed literature pertinent to the development of guidelines in establishing a successful computerized system. Past research indicated four main areas of concern: personnel, hardware, software, and computer site preparation.

Chapter III summarized procedures used in conducting the research necessary for the study. The sources used were library research, microcomputer demonstrations, vendor interviews, teacher surveys, and experiences with student microcomputer users.

Chapter IV describes the guidelines to be used in generating a successful computerized program.

Chapter V summarized this professional paper and gives recommendations of followup reports to verify that when these guidelines are followed the results are predictable.

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A bibliography and appendix section were included as a reference.

CHAPTER II

REVIEW OF THE LITERATURE

Numerous methods have been developed to ensure that the microcomputer selected will have a positive influence on the situation for which it was purchased. These methods have been developed by vendors, users, and computer technology experts. There have also been some guidelines suggested for the educational institutions planning to acquire microcomputers. The methods most appropriate for educational systems were studied.

Research identified four major areas of concern in developing an effective computerized system. Each of these areas were investigated, and the key items of concern to school systems were presented in this chapter. The four major areas identified by research are listed below.

- Personnel should consist of those people who will be operating and supervising the computer.
- Hardware should consist of the computer and peripheral units that are needed for complete computerized system.
- Software should consist of all the programs that enable the computer to accomplish the different tasks required.

- The computer site should include where the computer is to be located and what safety precautions are necessary for proper maintenance.

Personnel

Implementation of a computer system has a lot to do with the training of the personnel who are going to operate the equipment.

Initial training that took place at the Palatine High School in Chicago, Illinois,

familiarized the teaching staff with a microcomputer, identified how the machine operated, demonstrated instructional applications, motivated the teachers by attempting to lessen "computer-phobia" and resistance, provided individualized instruction to each member of the staff, demonstrated purchases software applicable for the teachers' subject areas, assisted teachers with any help needed to program the computer or utilize it for instructional purposes (Grossnickle, 1981: 9).

This training was accomplished by giving the teachers opportunities which included the following: in-school orientation and training; an in-depth after-school course; in-school and after-school individual "hands on" projects with the trainer; and teacher exploration of the methods possible to extend and enrich student learning in the classroom using the microcomputer. The initial phase of inservice training involved twelve weeks of training

sessions which covered operation of the equipment, examination of software, and identification of specific application of the microcomputer for instructional use. The teachers were given three semester hours of graduate credit for this training. Two short microcomputer introductory courses were also offered. Teachers were also given release time from their regular duties to develop their computer skills (Grossnickle, 1981:10).

Teachers were found to be the key in this successful computerized system. Having a positive attitude toward the computer was the most important factor.

Hardware

The procedures developed for planning and organizing the purchase of the hardware were the most numerous and the most varied. The two cited were are a good representation of the others found. They have both been condensed to include only advice for buyers when initiating a new system and what would be of value to a buyer for school use. The other article cited was developed from comparing microcomputers used in school.

Datapoint Procedures

Datapoint procedures were developed by Datapoint

Corporation and were printed in a booklet entitled A Guide To Buying Business Computers.

First: The buyer should become familiar with the jargon used in connection with computers. This gives the buyer the advantage of being able to communicate with the different salesmen and not be misled by what they are saying.

Second: The buyer should understand that computers are not the answer to solving all the current problems. Computers are only as good as the people who operate them. Many of the computer errors that are cited in news reports are not the computer's error but a human error. When the computer is malfunction, it is not operating.

Third: Investigate the industries that are selling microcomputers in local area. Listed below are questions that should be answered:

1. How long has the company been in business?
2. How many computer installations do they have?
3. What is their annual sales volume?
4. How many products do they make and sell?
5. Are they financially stable?
6. What is the background of their top management?
7. Do they have a history of introducing new ideas?
8. Do they have new ideas on the drawing boards?
9. Do they offer an option to lease, buy, or rent the computer? (Datapoint, 1980:11-13)

Fourth: The buyer should look at the maintenance that different industries offer. Listed below are ques-

tions that should be answered.

1. How many service representatives do they have in the field?
2. Where are the service representatives located?
3. What is the average service response time?
4. Do they offer service contracts?
5. What kind of performance level can be expected from this computer system?
6. What about spare parts? (Datapoint, 1980:13-14)

Fifth: A priority list of the positive aspects of each vendor makes the selection process easier. The selection of the hardware is now to take place. Listed below are the questions to ask about the equipment (hardware).

1. How flexible is the hardware?
 2. Can it be part of a dispersed network?
 3. Will the system be easy to expand?
 4. Does it have more capacity than needed now?
 5. Is this manufacturer's hardware compatible across the entire line?
 6. Can new functions be added to the system?
 7. Can the new hardware be made compatible with the old hardware?
 8. How easy is the hardware to use?
 9. What does the hardware look like (screen, lettering noises, style of design)?
 10. Will the system need a special environment?
 11. How long before the new system can be shipped?
 12. How long will it take to install the system?
- (Datapoint, 1980:16-19)

Sixth: The software (programs) should be considered that can be run on each kind of hardware. Listed below are questions to be answered concerning the software available for the different systems.

1. Does the manufacturer offer a good software library?

2. Will the system use "high-level" languages?
3. How close is the company's version of "high-level" languages to the originals?
4. As the system grows, will the software still be usable? (Datapoint, 1980:19-30)

Seventh: The cost of the system should be considered. Listed below are the questions to be asked about the cost.

1. What is the hardware cost?
2. How much will training cost?
3. Does the company offer customer training?
4. What will software cost?
5. What will programming costs be? (Datapoint, 1980: 22-23)

Eighth: What will this system do for me?

A priority list of the systems requirements compared to what is available can be very helpful in making the final decision.

Digital Equipment Procedures

These procedures were developed by Digital Equipment and were printed in a booklet entitled The Beginner's Guide to Small Business Computers.

First: The buyer should evaluate what is desired in a computerized system. The following questions should be answered before any equipment is purchased.

1. What are the immediate and long-range goals?
2. What changes do you want to directly implement?
3. What benefits of a computer are most important? (Digital Equipment, 1977:8)

Second: The buyer should conduct a feasibility study. This study will estimate the benefits of the computer against the cost.

Third: The vendor should be selected. Vendor selection is best accomplished by referral through a colleague, an accountant, people who already have the equipment, or from inquiries to computer manufacturers.

Fourth: The buyer should evaluate the department's physical surrounding and personnel. Other changes when implementing the system could involve personnel or the physical arrangement of the other equipment in the department. Along with the study of the current environment, any specific problem that is to be solved with the introduction of the new system should be listed by priority.

Fifth: A request should be developed by the buyer outlining the requirements of the system. This request should be presented to the vendors or suppliers. The vendor or supplier will then provide a proposal stating the cost and what can be purchased to fulfill the buyer's requirements. In evaluating the proposals, the following questions should be answered.

1. Will the proposed system do a good job?
2. Can the supplier live up to the claims in the proposal? (Digital Equipment, 1977:10)

If any part of the proposal is not clear, the supplier should clarify or expand on the requested item until it is understood by the buyer.

In evaluating the proposals and making the final selection of the equipment, the following steps are helpful.

1. See a working version of the future system.
 2. Check supplier's references by calling on some of their customers.
 3. Check out the manufacturer of the supplier's hardware (Is the manufacturer in business to stay? Are the products highly regarded?).
 4. Insist that your hardware comes from the manufacturer only, in order to avoid disputes or violations of warranty.
 5. Make sure the supplier puts safeguards on the sources coding of your applications (to protect against fire or other forms of loss).
 6. Insist on easy back-up procedures for files.
 7. Define acceptance criteria for your system, including formats of input and output and the time it takes to do specific functions.
 8. Take delivery of your hardware with at least some working applications.
 9. Ask your supplier about on-going software maintenance, in case you ask for changes to your applications.
 10. Buy a system with growth potential (always buy at the middle or bottom of the line).
 11. Buy a system that is expandable by adding on system elements, such as memory, terminals and disk, rather than by expensive conversions.
 12. Follow up on your responsibilities (especially preparing the site, getting your people ready, and re-printing your forms to fit the new computer).
- (Digital Equipment, 1977:11)

After the computer selection has been made, the internal control for the system should be considered.

1. Where the computer is to be located.

2. Rules for inputting formats, and procedures are to be established.
3. A system for maintaining and backing files and records is to be developed.
4. Introduce the computer to all personnel involved with the system so a sense of familiarity is developed. (Digital Equipment, 1977:12)

Hennessy Research

A. K. Hennessy conducted research in the Manchester area in England by studying schools using microcomputers.

Listed below are the minimum requirements his research found:

1. a full alpha-numeric keyboard capable of withstanding hard use from students;
2. a BASIC compiler/interpreter;
3. memory to hold at least 200 lines of program instructions at a time (4000 characters - 4K bytes of RAM);
4. ability to record programs and data on magnetic tape or disks;
5. upward expandability with regard to memory size, and additional such as an operating system for disks;
6. linkage to a printer without a separate interface unit;
7. linkage to a video display;
8. as few connectors and leads as possible;
9. local dealer support for maintenance, routine technical queries and repairs;
10. a library of at least 100 programs suitable for educational use;
11. an advisory service available from time to time on weekday to deal with questions that local dealers cannot handle, or specialized educational queries; and
12. manuals covering the workings of the equipment and the software with sufficient detail and clarity for the new user. (Hennessy, 1981:38)

Software

Guidelines for software selection were taken from Auerback Systems Development Management editorial consultant Peter Freeman.

First: The overall evaluation of computer software products should concentrate on the following areas:

1. Evaluation of the existing uses, users, and performance of the product.
2. Determination of the flexibility of the package to fit the prospective applications environment.
3. Evaluation of the quality of construction and content of the software product.
4. Evaluation of the ease of modification of the software product for customization to the potential application and the addition of future enhancements. (Freeman, 1979:33-04-02-2)

Second: The professional evaluation of the software package should concentrate on the following factors:

1. The content and quality of computer programs.
2. Program flows, controls, and systems interactions.
3. Operational tests and safeguards.
4. Flexibility and expandability.
5. Documentation. (Freeman, 1979:33-04-03-4)

This means that they should:

1. Adhere to reasonable standards.
2. Have adequate documentation.
3. Be logical in structure.
4. Be easy to follow and understand.
5. Be flexible and relatively easy to change.
6. Be modular in construction.
7. Be easily tested and validated. (Freeman, 1979:33-04-03-6)

The documentation should be thoroughly reviewed for content and accuracy.

1. Overview of the software product, its structure, and application objectives.
2. Explanation of input procedures and data items including edits, tests, errors, and control steps.
3. Explanation of output reports and data items including a definition of their source and/or deviation.
4. Step-by-step operating instructions including start-up, recovery, shut-down, program calling, audit tests, etc.
5. Failure analysis matrix with recommended action steps to be taken to restore proper processing.
6. Maintenance request procedures and service response events.
7. Systems logic flow diagram.
8. Narrative overview of the system.
9. Good flow diagram and logic narrative for each system's module.
10. Readable record layouts with detailed data element definitions including sizes, edits, and data sources and uses.
11. Input and output record layouts with definition elements.
12. Definition of program-level options.
13. Definition of all variables.
14. Explanation of any open or reserved variables or code sections.
15. Definition of all audit tests and edits in the system. (Freeman, 1979:33-04-03-4)

Third: Vendor support for the software areas to be reviewed include:

1. Customization of input, output, and options on the software.
2. Operational installation and setup of the system of the buyer's hardware.
3. Training of operators and system users.
4. Audit of the system operations after some actual use.

5. Specifications of number days or man-hours to support the package.
6. Availability of telephone consulting to help in using and understanding the package.
7. Availability of retainer-type of priority maintenance service to assure top attention and help to keep the system running. (Freman, 1979:33-04-04-10)

Fourth: Software should be tested as soon as possible after purchase. Areas to be tested include the processes that involve the following:

1. All of the transactions
 2. All errors possible
 3. Expected error combinations
 4. All major reports generated
 5. End-of-period processing
 6. File maintenance options
 7. Audit trial and tests.
- (Freeman, 1979:33-04-03-12)

Computer Site Requirements

The computer is an expensive piece of equipment. Listed below are safety tips for protecting the microcomputer. These should be considered before the computer is purchased, and all the costs should be considered part of the cost of the computer. This list was taken from Inmac, a periodical, the 1982 April-August edition.

Proper protection against fire includes:

- A fire extinguishing system that does not use a water or CO₂ base as Halon.
- Train employees in the use of this kind of extinguisher.
- Store all papers, paper tapes, books, and cards away from the computer.

- Backup data, diskettes, and manuals, are to be stored in fireproof vaults out of the computer room.
- Keep all cables in good condition, check for worn or damaged spots. (Inmac, 1982:1)

Proper protection from any discharge of static electricity which can damage circuits and send false data to the computer includes:

- Protect the accessible area to the computer against static with covering on carpet, or shock absorber rugs and do not use chair with rollers.
- The computer is to be properly grounded.
- Printers should have a static eliminator.
- The air temperature is to be kept between 63° and 79°, and the humidity between 40% and 60%. (Inmac, 1982:1)

Protect against voltage spikes by one of the two options:

- The computer power source is isolated for the power lines to other equipment (copiers, vending machines, etc.).
- Protect the computer from voltage irregularities with power conditioning devices.

Protect the computer from microscopic specks of dust, smoke, and other particles.

- Enforce a no smoking, eating, or drinking rule in the computer area.
- Air filters should have plenty of clean usable surface.
- Keep the equipment clean, have it cleaned on a regular basis. (Inmac, 1982:1)

Protect the computer from vandalism by doing the following:

- Keep the computer area locked when not in use.
- The computer should be hidden from view from outside the building.
- Backup all software before it is placed into use. (Inmac, 1982:1)

Summary

Each of these areas should be included in planning the purchase of a microcomputer. This will enable the computer system to become a usable asset to any school. The computer has become an important part of many school curriculums. Systems that are well planned and organized have a better chance of success than computers purchased without it. The teacher who puts forth the time to learn how to use the computer as a teaching tool will have the best chance of success.

The procedures to follow for buying a computer for a school are similar to those used by small businesses. Planning and organization are just as important as having the budget to purchase the needed equipment. The choosing of the equipment has to be based on need and on what the computer is to be used for.

Personnel are the key to all computerized systems. Careful training and demonstrations are necessary to a quality operation.

The selection of hardware is not as important as the selection of the vendor. The vendor is responsible for all maintenance, repairs, and modifications of the system.

The software should be selected from packages that

have already been tested. The training provided and documentation are very important in the selection of software.

The computer system should be protected against fire, static, dust and other particles, and vandalism.

All of these factors influence the success of micro-computer systems in schools and businesses.

CHAPTER III

PROCEDURES

This professional paper developed guidelines necessary to initiate a successful computerized system within school districts. Information was gathered from various sources. This data was then used to develop guidelines for purchasing school oriented computer systems.

Source of Data

Information was gathered from numerous sources. Each source enabled the final guidelines to be developed by interfacing them together. Different methods were used:

- A library search was conducted.
- Information was collected from conferences, demonstrations, and clinics which were attended.
- Understanding of both hardware and software was generated through courses taken during the 1981-1982 academic year.
- Vendors were questioned concerning their hardware and software.
- Teachers were questioned to give advice on setting up a computer-oriented system.
- Experience was acquired by working with students using microcomputers.

A full description of each of these procedures is presented below.

Library Search

The library search was limited to 1979 and beyond. The periodical indexes used were Reader's Guide to Periodical Literature, Business Education Index, and Educational Index. Other citations were taken from bibliographies listed in applicable articles.

Conferences, Demonstrations, and Clinics

Conferences, demonstrations, and clinics were attended, and information was gathered from each experience. Information gained from Business Education Day held at Montana State University on May 1, 1982, was useful. A Computer Clinic for Montana Small Businesses held March 18 and 19 of that same year also provided additional data. Many demonstrations were presented which included microcomputer accounting application software and word processing equipment and software. Other demonstrations of equipment attended included Vector Graphic, Apple, Eagle II, Wang, Datapoint, TRS-80, and IBM Datamaster microcomputers. The Computer Aid Instruction demonstrated by Honeywell's DPS6/CAN-8 Instructional System also added valuable information for the purchasing guideline.

Courses Taken

For a greater understanding of how software is developed and utilized, several courses were taken during the 1981-1982 academic year. The course Small Computer Application, C.S. 431, dealt with developing software including documentation for microcomputers. Fundamentals of Information Processing, C.S. 351, gave instruction in modulization of programs and documentation. Computer Programming for Business, BuAc 321, and Business System Analysis, BuAc 322, explained how programs are properly written for businesses. Computer programming language courses were also undertaken. All courses were taken from Montana State University.

Vendors

Vendors were questioned concerning what they felt was necessary for successful computerized systems. The vendors interviewed were:

- Data System Marketing, which sells Altos;
- Computer lines, which sells Atari and Apple systems;
- Wang Dealership, which sells Wang;
- Radio Shack Dealership, which sells TRS-80s;
- Big Sky Data Systems, which sells Alpha Micro;
- Monroe Systems, which sells Monroe OE 8810/20;
- Prairie Computers, which sells Vector Graphics;
- Xerox Dealer, which sells Eagle II and Xerox 820 (SAM); and
- 4G Computers, which sells Datapoint.

Information was primarily gathered through reading booklets distributed by the vendors. Vendors were found to be more knowledgeable in salesmanship than in computers. The software and peripheral that were generally sold by each vendor were also discussed or demonstrated.

Teachers

Teachers who attended the Business Education Day held on May 1, 1982, were asked to fill out a questionnaire concerning microcomputers. This questionnaire gathered information about what was actually happening in secondary schools to that date. Details of this survey are recorded in Appendix A, Page 51. This was not a tested statistical instrument and was intended for informational purposes only. Two questions included in the questionnaire pertained to this project. Question #5 dealing with how the school's computer equipment was installed, and question #7 dealing with hints and recommendations to prospective buyers. Both of these questions were important factors in developing the guidelines.

Working With Student Users

Experience was acquired in working with students using the microcomputer as a training tool. Training in

accounting application on the microcomputer was given to students in an Office Simulation course. Another course dealt with word processing on the microcomputer. The programming language BASIC was also tutored using the microcomputer.

Analysis of Data

From the data gathered, those relating to the development of the initial computerized system in schools were interfaced to form the guidelines. Data relating to specific microcomputers were not needed for this project. The guidelines were presented by major areas of importance relative to the success of a computerized system in an educational program. Each major area was further defined by listings of steps to follow during the planning and organizing phase of initializing computerized systems.

CHAPTER IV

DATA ANALYSIS

For schools to develop a successful computerized system, planning and organization must take place. There are five major areas which are necessary. These are listed in order of importance.

1. Personnel -- the teachers and other staff members who are going to have access to the microcomputer in their classrooms.
2. Selection of the Vendor -- the person who is going to sell, maintain, install, and repair the equipment.
3. Selection of the Hardware -- the microcomputer and the peripheral that is necessary for the intended task the computer is to perform.
4. Selection of the Software -- the programs that are necessary for the microcomputer to perform the intended tasks.
5. Computer Site -- changes and modification to the area where the computer is to be housed along with safety precautions necessary.

Personnel

The operators of the computer are the key to all successful computerized systems. In order for schools to have a smooth-running system, the teachers must be enthusiastic and capable of using the microcomputer in their class-

rooms. All staff members, who have access to the microcomputer, must have certain skills and attitudes which are listed below:

1. Positive attitude toward computers.
2. Unafraid of the technology involved with computers (no computer-phobia).
3. Familiarity with computer jargon and capabilities.
4. Some experience working on a computer.
5. Knowledge in implementing computer applications into educational curriculum.
6. Some training on the microcomputer purchased with the software that is available for use.

These six items are more important than the vendor, hardware, or software that is to be used.

Time is needed for teachers to develop the skills necessary to operate their equipment. The system should be placed in an area where teachers have easy access to both the hardware and software. Workshops, seminars, and demonstrations can provide familiarity with microcomputers.

Selection of the Vendor

All local vendors should be investigated. Before purchasers speak with any vendor, familiarity with computer jargon is a must. A listing of commonly used terms is presented in the definition of terms in Chapter I.

The investigation is done by visiting the vendor's office of operation and asking questions, by visiting other schools and asking about the service their vendor has provided, and by talking to a few businessmen who are using the vendor's equipment. Some questions to be asked are listed below:

1. How reliable is the vendor in areas of maintenance and repairs?
2. What is the cost for repairs?
3. How soon can the new equipment be delivered?
4. How much training is provided?
5. Does the vendor provide equipment when equipment cannot be repaired at the school?
6. How long has the vendor been in business?
7. Does the vendor appear to be financially sound?
8. Does the vendor have a full- or part-time repairman on staff?
9. The average length of time to complete minor repair and maintenance?
10. Are spare parts stored at the shop?
11. Are service contracts available?

The purchaser has all the information needed now to select the best vendor.

Selection of Hardware

The selection of the hardware should be based on the primary use of the computer. Some items are important for all systems. These are listed below.

1. The keyboard should be comparable to the typewriter keyboards used in the school. Keys unique to computer system should be placed so as not to confuse the use.
2. The microcomputer system should have at least two disk drives. This allows for easy backup of software packages.
3. The memory (RAM) should have a minimum of 32K.
4. The connectors and leads should be held at a minimum.
5. The system should be easily expandable to include additional expansion units, printers, and memory capabilities.
6. The system should be capable of being linked to other computers to form a network.

Microcomputers used by schools include word processors, turnkey systems, and programmable systems. The next step for the purchaser should be to define the primary function of the computer. These questions are to be answered.

1. Number of computers to be purchased? If the number is greater than five, a minicomputer should be investigated.
2. What are the immediate and long-range goals?
3. What quality of printer is needed?
4. What departments are to have access to the computer?

5. What courses are to be taught using the computer?
6. Will the computer need to be mobile?
7. Does anyone on the staff know a complete language or have a desire to learn? Which language?
8. Number of students who have access to the computer.

After these questions have been answered, a proposal should be developed and then presented to the selected vendors.

In reviewing the proposal, cost now becomes a major factor. The cost of the system includes the cost of the microcomputer, the printer and the expansion unit if the microcomputer does not include two disk drives. Other costs that could be negotiated involve a maintenance agreement, installation cost, training cost, and all other non-peripheral units. The cost and type of software available for each microcomputer should also be considered. When reviewing proposals, the computer system as a whole is to be considered.

Selection of Software

The software used for educational purposes on microcomputers is available in three categories: packages developed for use in businesses, packages developed as teaching aids, and programming packages that enable the user to develop programs. Features recommended for all software

packages are listed below.

1. User manuals should include:
 - complete easy-to-follow instructions on how to separate the program
 - instructions on how to format and backup the diskettes
 - description of all menus, input forms, and output generated.
2. Program documentation for all systems except turnkey system should include:
 - the program written in a high-level language
 - a description of all programmed data names used
 - a description of each programming module
 - the kind of software that is available for this type of hardware and the cost of this software.
3. Training should be provided for all staff members using the software package purchased, not a demonstration package.
4. The vendor should agree to make return calls to answer all questions concerning the software.
5. Software should be purchased only when the plan to implement it has been completely formulated.
6. As soon as the package is purchased, it should be set up for use in the classroom situation.
7. All software should be backed-up as soon as purchased, and the original should be stored in a safe place away from student and faculty use.
8. Three back-ups should be copied to protect against copied diskette malfunction.

In turnkey systems modifications of software to fit the given situation are part of the service contract. All other systems are modified by one user or by the vendor, usually for an extra charge. When purchasing software, viewing demonstrations of the system in action is a must. Packages developed for business should be viewed in the actual business situation. Ask the users how easy the system was to learn and implement. For packages developed for educational instruction, the purchaser should visit other schools using the package. Another place to find out about tested software for educational purposes is the EPIE's Micro/Materials files. The EPIE has tested and evaluated several packages. (EPIEgram 1981:6) For this listing write to

Educational Products Information Exchange (EPIE)
43 West 61 Street
New York, New York 10023

Other pertinent questions to be answered concerning the software are:

1. What happens if the power goes off when the package is in use?
2. What happens if the wrong date is entered in the system?
3. What happens if the wrong command is entered?
4. How are errors corrected?

Site Preparation

Where the computer is to be housed is an important factor for all computerized systems.

1. The microcomputer should be located so the printer does not disturb other classrooms.
2. The microcomputer should not be seen from outside the building to avoid vandalism.
3. Storage for papers, books, and other flammable items should not be located by the microcomputer to protect against fire hazard.
4. The temperature should be kept between 63 and 79 degrees and the humidity should be kept between 40 and 60 percent.
5. Protection against static electricity should be established in the room. Static electricity causes data to be recorded incorrectly.

A set of rules and regulations should be developed concerning the use of the computer. These rules are to include:

- No smoking, eating, or dinking in the computer area.
- All software is to be backup before placed into use.
- The room is to be locked when not in use.
- The room is to be equipped with a fire extinguisher that does not use a water or CO₂ as a base.

Late spring is an excellent time to acquire the microcomputer. This gives the teachers ample opportunity

to experiment with the microcomputer before school starts in the fall. The teachers should also be given the opportunity to use the microcomputer in the summer months to develop their computer skills. Most diskettes have to be setup before they are ready for the user. If more than one computer is purchased, designating one for teacher use only could be helpful.

A library of the available software should be maintained. It should be accessible to all staff members. Many packages can be at use in numerous educational situations.

Summary

In order for schools to develop successful computerized systems certain guidelines should be followed. The system has to be planned and organized to ensure that students' educational needs are met.

The teaching staff is the key to a smooth running computerized educational systems. The staff should be encouraged to learn about all types of computers.

The selection of a reliable vendor adds much to the reliability of the equipment. Important factors on choosing a vendor are ability to maintain the equipment and willingness to supply the training.

The selection of the hardware is to be based on its

planned use. This planned use is to be developed before the vendor is contacted.

The purchase of software is to take place only when its implementation has been planned. Good documentation is essential to reliable software.

The microcomputer site involves much more than where the computer is to be located. Protection against vandalism, static electricity, dust particles, and fire are a necessity. Other factors to be considered include: when to purchase, rules and regulations, and a software library.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

Because the cost of computers has gone down and the reliability has continued to increase, schools are purchasing microcomputers. These computers are being used as teaching aids in many business departments. In order to develop successful computerized systems, planning and organization must take place. This professional paper gives procedures to follow in developing these systems. The major factor involved in this process are:

1. Personnel -- the teachers working with the equipment should be enthusiastic about the program. They should be given the opportunity to learn how to use the equipment.
2. Vendor -- the selection of a reliable and responsible vendor is the second biggest factor for the computer's success. Vendors should be willing to give training to the staff and to demonstrate the equipment. Keeping the equipment in repair and installing the system is the responsibility of the vendor.
3. Hardware -- the microcomputer and peripheral should be selected on the basis of its use. Influence on type of hardware include number of computers to be purchased, if the computer is to be moved, and types of courses using the computer.

4. Software -- the software should be selected on benefits it provides the user. The documentation and user's manual are the most important factors to consider. Seeing the program in operation and asking questions of the users are among the best ways to select software.
5. Site Preparation -- where the microcomputer is located and the safety precautions provided could be a factor in the usability of the system. The computer should be located so that teachers have ample opportunities to become familiar with its operations.

Conclusions

People in charge of purchasing microcomputers for school need several questions answered.

1. How does a person begin to set up a successful microcomputer system?

The successful microcomputer system begins with the teaching staff. Their desire to implement the system as a teaching tool is the most important factor.

2. What safety precautions are necessary?

Safety precautions necessary include backing-up all software, rules for use of the computer, and the proper location of the computer in the school.

3. What is needed before the computer arrives?

Before the computer arrives at the school, the

teacher should become acquainted with computer operations. The place where the computer is to be housed should have proper wiring for the equipment, should be sound proof, and should have temperature control and a static control system.

4. Where do teachers learn how to use this equipment?

Teachers can learn about the use of computer equipment by taking courses, going to workshops and seminars, and reading on their own. If one member of the teaching staff has the knowledge, it can be presented to the other members. Extensive knowledge is not required. Training of the actual equipment and software should be provided by the vendor.

5. What is required for good hardware?

The hardware required for schools include a standard keyboard, 32K memory, expandable, and at least two disk drives. The type of printer and the other capacities of the microcomputer should be based on the type of implementation.

6. What is required for good software?

The software should be well documented, flexible, and easy to modify. The user's menus and instructions should be easy to understand.

7. Where should the computer be located?

The microcomputer should be easily accessible by all staff members.

Recommendations

It is recommended that the presented guidelines in Chapter IV be followed by schools planning to purchase microcomputers. These guidelines involve: personnel, vendor, hardware, software, and computer site preparation. Initializing successful computerized systems in schools should be an easy process.

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APPENDIX

1982 OVERVIEW

WHAT'S HAPPENING WITH COMPUTERS IN YOUR SCHOOL?

Name _____

School _____

Address _____

School Phone Number _____

1. What kind of computer or computers is your school using now and how many do you have?

Apple	<u>18</u>	Northstar	_____
Burroughs	_____	Prime	_____
Cado	_____	Superbrain	_____
Data General Corp.	_____	TRS-80	<u>22</u>
Datapoint	_____	Vector Graphic	_____
IBM	_____	Victor	_____
Latah	_____	Wang	_____
NCR	_____	Other (Please	_____
Pet Commodore	<u>9</u>	specify)	_____
HP 3000	<u>1</u>	Hewlett Packard	_____

- 2.a. In what department are the microcomputers housed?

Math	<u>16</u>
Business	<u>18</u>
Music	_____
School Office	_____
(Administration)	<u>4</u>
Journalism	_____
Other (Please	_____
specify)	_____
Computer Class	_____

- b. Do other departments share the computers?

No 15 Yes 14

- c. Which departments share the computers?

Business Education, Math, Counseling, Special Ed, Office Occupation, Nursing, Mid-management, Food Service, Library Science, Career Center, Administration, Acc't, Data Process., Math Science, Economics

3. What kinds of courses are taught in your Business Department using the computer. Check all that apply.

Records Management	<u>1</u>	Data Processing	<u>3</u>
Management	<u> </u>	Accounting Applica-	<u> </u>
Word Processing	<u>10</u>	tions	<u>12</u>
Decision Making	<u>2</u>	Consumer Economics	<u>1</u>
Computer Literacy	<u>15</u>	Programming	<u>6</u>
Business Law	<u> </u>	Other (Please specify)	<u> </u>
Office Procedures	<u>1</u>	Typing	<u> </u>

- 4.a. Who developed the software in use, what system runs this package?

CP/M	<u>1</u>	It is developed by the hard-	<u> </u>
MP/M	<u> </u>	ware company, (i.e., IBM,	<u> </u>
TRSDOS	<u>6</u>	Vector Data Control)	<u>12</u>
		Your Department	<u>4</u>
		Other (Please specify)	<u> </u>
		Word Pro 4	<u>1</u>

- b. Please indicate whether the following is good, adequate or poor.

1. Documentation of the software is:		
5 good	7 adequate	2 poor
2. Manual (readable and understandable):		
5 good	7 adequate	2 poor
3. Modification and maintenance:		
5 good	7 adequate	2 poor

- c. What kinds of software is being used with the computers?

1. Word processing	<u>16</u>	
2. Accounting package	<u>4</u>	
a. General ledge	<u>7</u>	
b. Accounts receivable	<u>4</u>	
c. Accounts payable	<u>5</u>	
d. Inventory	<u>4</u>	
e. Payroll	<u>6</u>	
f. All of the above	<u>3</u>	
g. Other	<u>1</u>	(Visicalc
3. Programming	<u>15</u>	
a. Basic	<u>8</u>	
b. Cobol	<u>5</u>	
c. PL/I	<u> </u>	

d. Pascel	
e. RPG	<u>8</u>
f. Fortran	<u>6</u>
g. Other	<u> </u>
4. Other	<u>School and student records</u>

5. How was the equipment installed. Check all that apply.

Vendor delivered	<u>18</u>
Vendor set up system	<u>16</u>
Vendor demonstrated the system at the store	<u>1</u>
Vendor demonstrated the system at the school	<u>12</u>
Vendor training given	<u>8</u>
Vendor came back to give additional assistance	<u>5</u>
Comments	<u> </u>

6. How was the computer funded?

Donations	
By whom	1. Department <u> </u>
<u> </u>	
Regular Budget	<u>21</u>
Grants	
Federal	<u>2</u>
State	<u>3</u>
A fund raiser	<u> </u>
Other (Please specify)	<u> </u>

7.a. Give a listing of helpful hints for prospective buyers.

- Ease of moving equipment if used in several places
- Availability of maintenance/service
- Jobs to be done--software available
- Printer that can be interfaced--office letter quality of daisywheel
- Watch changing cost factors and technology factors--this market is quickly changing
- Shop around and compare
- Get demonstrations
- Check these against the goals of your program
- Look for software before buying hardware
- Get the software that fits you
- Have department heads such as Math and Business teachers making decisions in purchase
- Be sure you have some competent people in house

b. What would you recommend others to be aware of?

Much of the software available is not workable for
most individual programs without modifications
Need for inservice training for entire school staff
Need to sell necessity for keyboarding for all
students
Need for computer literacy-vocabulary
TIME needed to train teaching staff
Vendor pressure and vendor's perspective
Watch the delivery date--equipment may be outmoded
by time it is delivered
Software should be the prime factor
Kinds of software that is with the hardware
Scripsit is really not oriented towards classroom.
It is business oriented.
Problems with disk drives
Make backup copies immediately
Some programs cannot be altered because they are
coded or in machine language
Brand X hardware and software untried and non-docu-
mented software
Memory capacity
Useful for their particular needs

8. What is the ratio of males to females using the computers?

Male	60, 10%	70	40	50	84	64	60	
Females	40, 90%	30	60	50	100	16	36	40