ADMINISTRATIVE USES OF MICROCOMPUTERS IN SCHOOLS

BY

Bernard Zajac

A Thesis
Submitted to the Faculty of Graduate Studies
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ABSTRACT

This study creates a model that can be used by school administrators to introduce microcomputers for administrative tasks and tests the usefulness of the model by superimposing it on the experiences of a large school system which has recently taken that step.

The study was undertaken in four phases: 1) creation of a preliminary model; 2) views from theoreticians, commercial suppliers, and users about the preliminary model; 3) creation of a refined model; 4) superimposing the model on the experience of a large school.

A questionnaire was completed by users and potential users, theoreticians, and commercial suppliers. Interviews were used as a 'follow-up' where an elaboration of the questionnaire responses were needed.

This study indicates that administrative uses of microcomputers in schools are most likely to be successful if: the functions to be performed are identified; software can be identified to complete the identified functions; appropriate hardware is selected to 'run' the software; and sufficient money is made available to purchase quality software and hardware.

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ADMINISTRATIVE USES OF MICROCOMPUTERS IN SCHOOLS

Chapter I Definition of the Problem

Most North American school divisions must now cope with problems attendant on using computers as part of their administrative support systems. "Considering that microcomputers have only been available for purchase by schools since 1977, it is surprising how rapidly they have been integrated into many facets of Educational use." (Ogletree and Haskin, 1983).

Yet, surprisingly, there is very little published research concerning the administrative uses of microcomputers in schools. Most of the literature concerning the implementation of administrative computer systems deals primarily with mainframe computers or generalized software on microcomputers.

With or without theoretical guidance, school administrators are now establishing the conventions that will guide further implementation well into the twenty-first century. As Mojkowski (1986) states, "Rather than merely anticipate the future, principals will need to invent it."

The problem is that few administrators understand both the administration of schools and the nuances of computer use. As McGraw (1966) stated, "Unfortunately, few administrators have been trained to use them; few administrators understand the tools' place

in our society." So far as the more efficient management of current tasks is concerned, that may cause few problems, but as the power of computers begins to interact with the nature of these tasks, there is the danger that unfortunate decisions may have serious deleterious effects on the efficiency of the schools' entire support system.

This thesis is a model clarification study with the objectives of:

1.   Creating a useful model that could be followed by a school administrator wishing to introduce microcomputers for administrative tasks.

2.   Testing the usefulness of the model by superimposing it on the experience of a large school system which has recently taken that step.

The study was undertaken in four phases.

Phase I

A preliminary model was created which incorporated those categories and relationships between categories that seem to be commonplace in the field. There does not seem to be any evidence that these categories would be disputed by anyone working in the field.

This preliminary model was used as a guideline in formulating the lines of exploration and the questions used in phase II of the study.

Phase II

Views were solicited from a spectrum of five theoreticians, three commercial suppliers, fifteen experienced users, and six

potential users, with the intent of refining or altering the preliminary model so as to account, in some way, for all the information collected.

Phase III

All the concerns raised in phase II were integrated into a refined model that could be used for the intended purpose.

The protocol is presented in two phases:

a) An overview. The user can employ this overview to structure the steps involved in implementation and identify key decisions that must be made.

b) A detailed presentation of the model.

Two things must be said about this protocol. First, large parts of it have not been and are not likely to be subjected to rigorous experimental test. The magnitude of the question places this protocol beyond the scope of that sort of research and certainly what could be done in a thesis.

Second, the results of this study are therefore more a polemic than a detached analysis. To have any hope of providing guidance to practitioners, it almost has to be. But for that reason, much of the advice given in this thesis is open to question and only parts of it are open to experimental test. The proposed model should therefore be as useful in provoking questions as in providing a framework within which more detailed and possibly experimental studies could be conducted.

Phase IU

The best test of whether or not the protocol from phase III is useful will be to evaluate the experience of school divisions that employ it, hopefully with continuous evaluation.

That project is beyond the purpose of this study. Instead, it is superimposed on the experience of one school division with a view to inferring whether or not the most effective actions taken in that division are consistent with the protocol and whether or not the protocol would have flagged what emerged as problems.

It would be erroneous to suppose that any one such test is a serious validation of the model because the process is, to some degree, circular. The protocol was created so as to account, in part, for practices found to be successful and troublesome by users, including users from that school division.

Chapter II The Preliminary Model

There would be little disagreement in the field that the following represents the main concerns when introducing microcomputers in schools for administrative purposes.

D WHAT IS ALL THIS GOING TO COST?	**A** IDENTIFYING THE SITUATIONS CALLING FOR IMPLEMENTATION	**E** WHAT PROBLEMS WILL BE ENCOUNTERED?
	B A DETAILED SPECIFICATION OF THE TASKS TO BE PERFORMED	
	C ALLOWANCES FOR FUTURE NEEDS	
	F A PROTOCOL FOR IMPLEMENTATION	
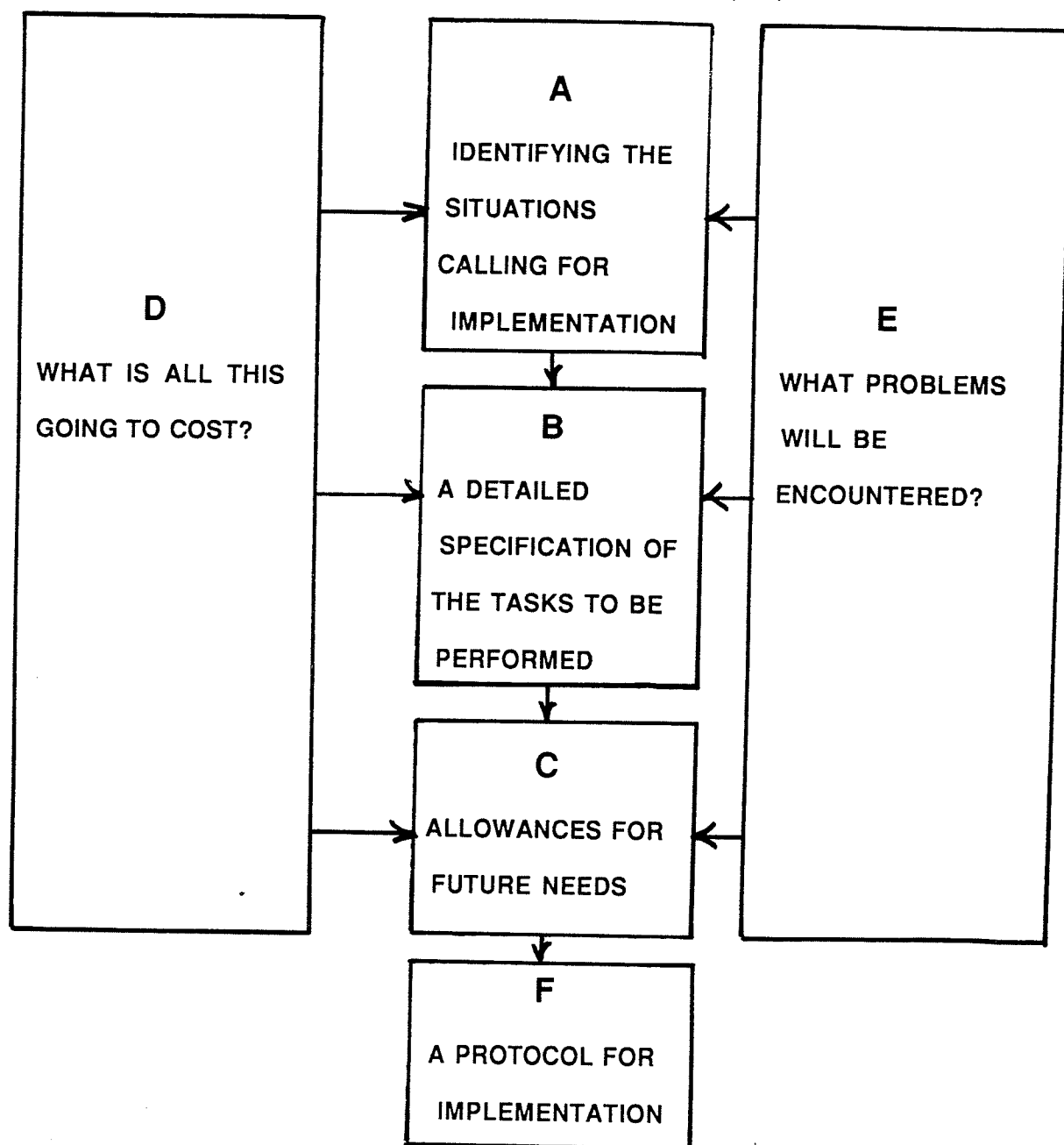
figure 1

A. Situations Calling For Implementation

Poirot (1981) states there are four a priori considerations that, taken individually or in combination, are relevant to implementing computers for administrative purposes. These are:

1. Where large amounts of data are processed in well defined ways.

2. Where processing is highly repetitive.

3. Where speed of processing is important.

4. Where the task(s) to be performed cannot be managed by manual means.

B. Performance Of Tasks

It is better to think of computers as instruments for performing tasks rather than solving problems. Viewed that way, the completion of tasks may be part of a solution, but rarely a complete solution. 'Solutions' generally entail varieties of tasks, usually including some completed by hand and by other equipment as well as by computers.

The administrator must then begin by deciding which manually performed current tasks can be computerized and which tasks not now being performed should be considered for computerization.

There seems to be no escape from the logic of supposing that the above outline of user requirements will help to define the microcomputer system needed and facilitate communication between the administrator and those who will advise him or her on technical matters.

C. Future Planning

It seems reasonable that at the outset consideration should be given to potential future administrative uses of whatever system is implemented. It is obvious that it would be a mistake to purchase a microcomputer system this year that will not have the capacity to manage the next years' tasks. But it is not so clear how far into the future such projections should be made; what the 'horizon' of decision-making should be.

Next, hardware must be chosen that will run the software that is selected. It is at least commonly reported that some school administrators assume there is some mythical "best deal". There is a consensus within the field that as Hoachlander (1983) argues, there is no such thing. "Persuing the 'perfect system' is an elusive, never-ending quest that will leave the user with nothing rather than the ideal system that meets all one's present and future needs". What a school should buy depends primarily on the tasks which the computer is to perform, but personal preferences may also be involved. No expert will say that one microcomputer system is 'better' than all others. It is commonly agreed that since computer equipment continues to evolve 'needs' are often generated by new capabilities, and that it is therefore prudent to select equipment that is as close to being 'state of the art' as possible given other constraints.

D. Cost

Few would dispute the proposition that some sort of analysis should ensure that only tasks which a computer can perform at a

lower cost than by any other means should be computerized. It is more difficult to complete a valid cost-benefit analysis for tasks not now being done, but if only informally the administrator should at least consider the question.

Any such analysis depends either on knowing in some detail what computers <u>can</u> do or on having available guidelines of the sort that this study is intended to supply.

This preliminary model presupposes that, as planning proceeds, the potential cost of each component may become more precise and that there may be continuing interaction between cost estimates and priority decisions.

E. Potential Problems

Computerization is not an unmixed blessing. Crawford (1985) identified four potential problems. These include:

1. Computer phobia - the fear of the problems which a computer might cause. This study will render some advice on how phobias should be addressed at the outset or at later times.

2. The cost, in that initial hardware and software costs could outweigh the benefits to be gained during their probable lifetime.

3. Computer illiteracy and staff training. Even in the absence of phobias, the cost of staff training must be addressed; in staff time, dollars, or in some combination of the two. Training should be provided as a part of the purchase price. As the task being performed becomes more complicated, the more important user training becomes.

4.   Security. The administrator should address the question of limiting access to data and to the system at the outset. The solution is rarely a simple 'top-down' hierarchical one, and has to do with more than access to data.

A password system can restrict access to confidential information. Different levels of security can be used to permit access to different types of data. For example, the guidance office, the attendance office, and the administrator's office may each have access to only that data necessary for their work.

But where precautions have not been taken, the results of unauthorized access to data or to the system itself can be disastrous.

While it does not happen very often, in an hour or so a persistent 'hacker' can usually gain access to any ordinary system, and the cost and inconvenience of making that impossible is generally prohibitive.

The best solution is to create a sequence of frequent back ups at regular specified intervals, say twice a week. The information stored on the disks is usually worth a good deal more than the disks themselves, and system faults not detected early can contaminate the most recent back-ups..

F. Decision to Implement

Since some criteria will be more important to one school administrator than to another, the ultimate recommendations must allow for consideration of those qualities of microcomputers that match users' current and projected needs.

Chapter III The Model

A survey of theoreticians, commercial suppliers, experienced users, and potential users was conducted with the intent of modifying or refining the preliminary model, identifying the most cogent considerations within the model, and creating what amounts to an implementation manual for the administrator.

Consistent with the intent of this study, no details of the long and subjective process of compiling the results of the various surveys of theoreticians, commercial suppliers, experienced users and potential users are provided here. The protocols and instruments used in those surveys are supplied in appendices 1 and 2.

The model in figure 2 is the end result of that process. It is proposed as being, as of this time, a suitable guideline for an administrator contemplating the implementation of a microcomputer system for administrative purposes.

It will be seen that it varies considerably from the preliminary model provided in Chapter 2. Some possible concerns identified there are no longer considered to be cogent, some new concerns are, and it is no longer seen to be necessary to relegate cost and staff problems to parallel tracks.

The model is supplemented by detailed commentaries on each of its cells. In some cases specific advice is given. In other cases, questions to which the administrator should obtain answers are posed.

```
┌─────────────────────────────┐
│              A              │
│   IDENTIFYING FUNCTIONS     │
│   TO BE PERFORMED           │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│              B              │
│   IDENTIFYING SOFTWARE      │
│   REQUIRED TO PERFORM       │
│   TASKS IDENTIFIED IN "A"   │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│              C              │
│   IDENTIFYING HARDWARE      │
│   REQUIRED TO RUN THE       │
│   SOFTWARE IN "B"           │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│              D              │
│             COST            │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│              E              │
│   POSSIBLE RECONSTRUCTION   │
│   OF PRIORITIES AND FUNCTIONS│
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│              F              │
│   PLAN AND IMPLEMENTATION   │
└─────────────────────────────┘
              │
              ▼
            ◇ G
            DECISION
```
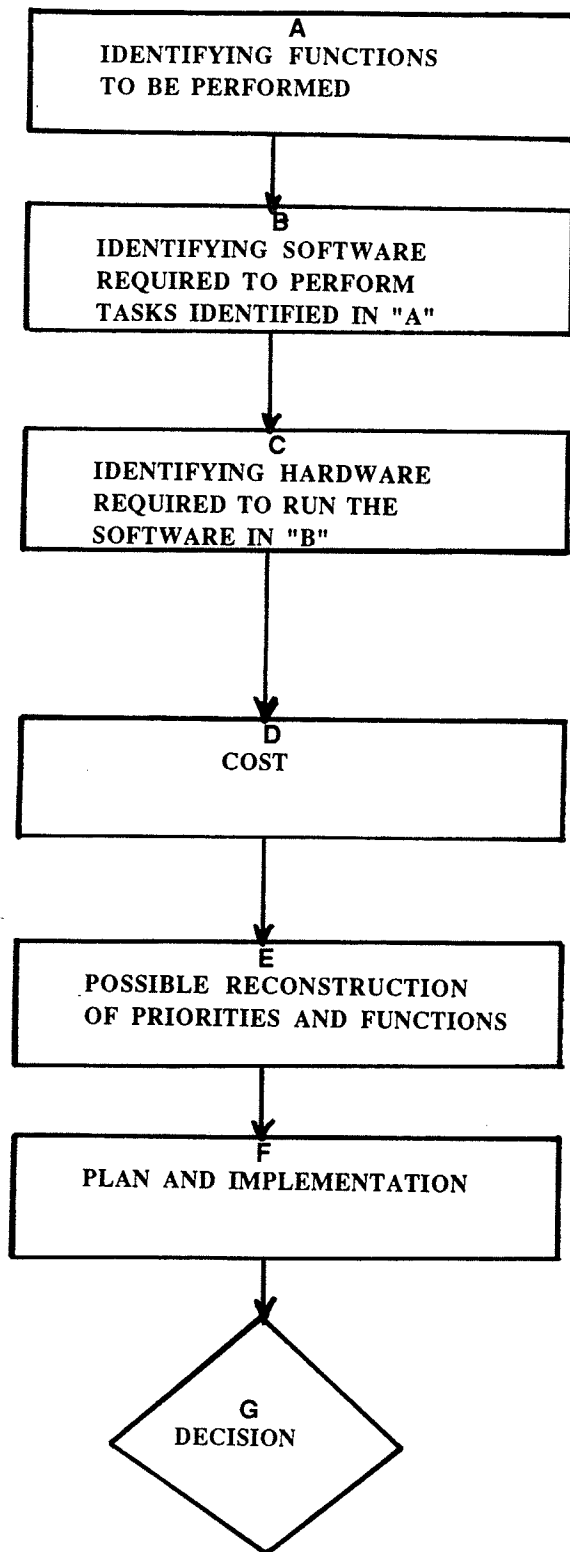
A.   Concerning Current Functions:
1)   to code for large amounts of data
2)   to manage repetitive procedures
3)   to enhance speed

B.   Concerning Potential Functions:
1)   immediate candidates for computerization
2)   tasks not now being done that are candidates for computerization

C.
1)   keyboard
2)   display (including the choice of colour or monochrome display)
3)   printing--quality and cost
4)   printing--speed and cost
5)   vendor support

D.
1)   software
2)   hardware
3)   staff training
4)   physical facilities

E.
1)   lack of hardware/software
2)   lack of money
3)   reluctance of staff

F.
1)   phobias
2)   training

G.
1)   follow through or not

figure 2

A. The Functions to Be Performed

Hansen, Klassen, and Lindsay, (1978) conducted an extensive survey which indicated the impact computers have had upon school and district administration. They came to the conclusion that computer use facilitates more effective resource management, better decision making, better long-range planning, and more time to work with people. Their overall conclusion was that school administrators will generally find advantages in using microcomputers in their facilities.

Harris (1985) lists the following positive reasons for the implementation of microcomputers for administrative uses:

1. improved decision-making at all levels of management;

2. more effective analysis;

3. better organizational communication;

4. facilitating scheduling, planning, calendar management and inventory control;

5. more effective coordination of office activities;

6. decision making being pushed downward in the organization; and

7. a 25% reduction in unproductive time.

Dennis (1979) in an introduction to listing the administrative functions a computer can perform states; "A large portion of a school administrator's duties involve management. The things that are managed are people (of several types), money, facilities and other resources, learning, and time. One of the most important bases or ingredients of management is information. The school administrator cannot function without information. And the quality

of the information available determines, in a large measure, the quality of the management achieved."

As Barbour (1987) states, "Administrators are embracing computers to fight what has become public enemy number one: paperwork." Administrators who are using computers tend to look for technological ways to save time, reduce paper work, and increase office efficiency. Some administrators not using microcomputers want to continue fighting the paper war because it is all they know how to do.

The circumstances that flag potential advantages in computer use are:

1.   where large amounts of data are processed;

2.   processing is highly repetitive;

3.   speed of processing is important; and

4.   tasks cannot be preformed satisfactorily by manual means.

Crawford (1985) offers the following categories of software have proven useful for administrative uses in schools.

1. <u>Attendance recording software</u> meets the need for daily absence and lateness information as well as cumulative records over any specified time period. The several dozen existing microcomputer software packages for keeping track of attendance can generally be narrowed to a handful by eliminating all of those which do not meet local requirements.

Most attendance software records period-by-period or course-by-course attendance. If the software completes only daily

attendance, its benefits may not justify its cost. Other attributes of attendance recording software that may be relevant are:

1. Categories of absences

2. Lists of parents'/guardians' names with phone numbers

3. Form letters addressed to parents after specified numbers of absences

4. Automatic dialing of home phone numbers during evening hours with a taped message to parents/guardians and a recorder for the parent/guardian responses

5. Transference of attendance data to a higher level computer system.

2. Business management software covers a broad range of tasks. The available packages tend to be specific and narrow in scope. Examples of business management software are budgeting, financial accounting and food service software. **Budgeting software** usually covers fund, function, object, and program budgeting, along with possible central budgetary control. **Financial accounting software** encompasses the accounting of activity and club funds, along with other internal accounts and student billing or accounts receivable. **Food service software** includes cost analyses, food sales revenue accounting, and nutrition analyses.

3. Grade analysis and reporting software performs tasks varying from producing student grades for six-week to nine-week periods based upon classroom performance to producing final

transcripts, grade point averages, and class ranks. These tasks include:

1. Definition of grading scales
2. Use of card readers or optical mark scanning for speed and accuracy of data entry
3. Calculation of grades
4. Production of report cards
5. Selection of report card comments from a file of previously prepared statements
6. Selection of honour roll students based upon grade-related qualifications
7. Checks of credit requirements
8. Counsellors' briefings based upon grade-related search criteria defined by the counsellor.

4. Inventory and property records software perform the function of an electronic filing system adapted to the task of cataloging equipment and other fixed assets, inventory, and textbooks. Each software package contains predefined types of data to be kept on each item in the electronic file.

5. Scheduling software is available that performs tasks from student locator to full-scale, variable-length-period scheduling of both staff and students. A comprehensive scheduling software package usually pushes a microcomputer closer to its capacity than does software for any other administrative task. Administrators should be skeptical of advertised claims and should explore the software and hardware costs implicit in selecting a scheduling package that will meet local requirements.

Appropriate scheduling software can perform the following tasks:

1. Test student requests against various combinations of course offerings for possible conflicts

2. Develop a master schedule within specified constraints with a minimal of conflicts

3. Provide for priority assignments for required courses and selection of elective courses

4. Create block schedules for groups of students

5. Provide alphabetized lists of teacher/staff assignments

6. Create individual student schedules

7. Maintain enrollment/withdrawal transactions along with alphabetized lists by class and by student

6.   Staff/personnel records software manage the following types of data:

1. Certification data

2. Skills inventory

3. In-service education activities

4. Educational training

5. Schedule

6. Other data such as name, address, and phone number.

The software should be able to search a very broad base. The usefulness will often be more tied to flexibility than anything else.

7.   Student records systems generally allow for maintaining information on each student such as name, sex, parents'/guardians' names, emergency contact(s), address(es), phone number(s), birthdate, ethnic group, languages spoken, homeroom,

locker number, school advisor, immunization status, previous school, etc. Well-designed systems permit the administrator to define additional data items unique to a school.

Make sure that a proposed system allows authorized users to scan the file flexibly for any desired item of data; for example, a student with a first name of "Bryan" instead of "Brian," students who belong to specified ethnic groups, students who seem not to be living where official records say they are living, etc.

It should be possible to create printouts of selected data for any group of students in any order. For example, the administrator may wish to create a printout that may have all students in alphabetical order for a set of criteria of interest to that office; a guidance office printout must contain some of the administrator's report data items but also confidential student data of concern only to that office; an attendance officer's report might be alphabetical by homeroom with only selected other information; and the nurse might want a list of only those students without all immunizations in alphabetical order by homeroom.

8. **General application software**. The first priority for general application software is that it be general, rather than replicate available software designed for specific tasks. General application software is of three basic types: data management systems, electronic spreadsheet systems, and word processing systems.

General application software has several advantages over specific function software.

1.   It can be more cost effective because of the multiplicity of its uses. This is because there are often more similarities in the processing of data for the various administrative function than there are differences.

2.   It allows the administrator more flexibility in designing formats for data input, data files, and information output. It might better meet the administrators' local needs.

3.   It is more likely to be available from a local retailer rather than from a mail-order supplier.

4.   It is less likely to have "bugs" in it.

    9. Data management systems. Many microcomputer buyers do not understand or appreciate the potential of good data management systems.   Every potential administrative microcomputer buyer should take the time to be briefed concerning the potential of a good data management system as to assess their potential. In a school setting, a good data management system could well be the most economical and productive tool for instructional management, inventory and property records, media center management, staff/personnel records, and student records.

    A good data management system gives an administrator the ability to generate reports without programming, so that information from the data base can be printed within the format most useful to the administrator. Regardless of what may be said in the brochure concerning a data management system's potential, if its full capabilities are not clear to an administrator who knows nothing about computers or programming, it will never achieve that

potential. Here quality documentation is crucial and, unfortunately, some common documentation falls far short of that criteria.

10. Electronic spreadsheet systems. An electronic spreadsheet system handles the kind of data and information that one would normally put in a table with rows and columns. A typical table might have 63 columns and 254 rows. Within these parameters you can create many formats and can often perform massive calculations or manipulations of data with a few keystrokes.

The electronic spreadsheet is a matrix of columns and rows, the intersections of which define positions into which one can enter numbers, alphabetic titles, or formulas. If you wish, for example, you can make an electronic spreadsheet look like a school's monthly budget/expenditure report.

The rows can become combination function-object budget entities and the columns can become final budget amounts, expenditures for the year-to-date, outstanding encumbrances or commitments, proposed expenditures, and unencumbered and uncommitted balances which can be appropriated.

If you want to see what would happen to your school's entire budget when changes are made to any function-object entities on this electronic spreadsheet, an entirely new budget document can be generated, incorporating these changes instantly. Thus, "what if" types of questions can be easily answered. Hours of time could be invested to obtain the same result if these same calculations were done manually.

Most problems that can be solved with a calculator, a pencil, and a sheet of paper can be solved with an electronic spreadsheet

system on a microcomputer. The video screen on the microcomputer becomes a window through which part(s) of the large electronic spreadsheet can be viewed. The screen can be split either horizontally or vertically to view two parts of the spreadsheet simultaneously, or the screen can be scrolled horizontally or vertically to view any one section of it.

11.   Word processing is the writing of new text or the recalling of a previously written text from memory, editing it, and producing it in a final form on paper. Before choosing word processing software, the prospective purchaser should be thoroughly briefed by an independent expert as to the features that are available in word processing systems. An administrators' own word processing needs will determine which features are most important to him or her.

The computer makes radical changes in the traditional typewriter mode of producing print copy. With typewriters, all corrections and modifications must be done on paper and each new version creates a new paper copy. Correcting one typing mistake often entails the production of an entire new page. It is now common knowledge that with computerized word processing all correcting, editing, and modifying can be done in the computer's memory. When all of the changes have been made in the document, it takes very little time to produce the final copy on paper. It is not so common knowledge that in time this technical shift gradually changes the practices of those who generate copy. Entire new procedures evolve for the circulation and control of draft copies, and they tend to evolve over time. Someone, usually the administrators'

secretary, must pay explicit attention to the management of that flow and its evolution, and must therefore keep everyone informed as to how it is evolving.

Proposals, contracts, forms, reports, and some letters may involve a great deal of standardized text, possibly with minor changes. Word processing allows an administrator to cut out inapplicable words, phrases, sentences, and paragraphs, or substitute others at will. There is no need to retype an entire document. When the changes are made, the microcomputer will again rapidly print out a copy. The skeleton text remains in storage for later use.

B. Identifying Potential Software

Administrators should never choose software based on price alone. Pogrow (1985) said it best, "The 'cheap' model is often the quickest road to ulcers as it usually does not work effectively--if it works at all."

When software is purchased, what is usually purchased is the right to use the documentation and software. The publisher still owns the software.

1.   There are various levels at which desired software can be purchased. These include:

    a)   by individual program , that is, a disk is purchased for each computer that will use it.

    b)   by "network" licence. That is, a licence is purchased which allows for use in a "network" or group of

computers, regardless of the number of computers in the network.

c)   by site licence, where by payment of an annual fee or a onetime fee, the program may be run on any machine or network in the physical location.

d)   by Board licence, which allows software to be used anywhere within the purchasing school division.

2.   Different software houses have different legal requirements regarding copying of their software -- some allow unlimited copying within a Division, while others prohibit copying for any reasons.

3.   Unit software cost in itself therefore means very little. Further, some inexpensive and readily available software is also of minimal value. Substantial up-front costs for a quality program may prove to be more cost-effective over the long run.

Recent developments in computer technology have brought to school administrators a sophisticated level of microcomputer capability which is largely untapped.

School administrators can easily use a microcomputer to automate present tasks. Software for monitoring student attendance, updating student academic records, and designing course schedules are the most widely accepted.

School administrators must lead their schools to anticipate and address issues and problems that have been previously overlooked or ignored. As they begin to reconfigure and rethink the tasks at hand, new possibilities of information organization and analysis will occur, which will lead to microcomputers adding value to the information transmitted to: the staff; the board office; the

parents; and the community. School administration and staff will be able to access research data bases such as the Educational Resource Information Center (ERIC).

School administrators should look beyond current microcomputer use to other necessary school activities, such as public relations. 'High powered' word processing and desk top publishing software are available for the creation of newsletters, mailing lists, posters, and signs to the community. These technologies could also be used to complete student handbooks and school policy manuals in an attractive professional format.

The future of microcomputers for administrative tasks will only be limited by the imagination. With the aid of the microcomputer, administrators will have immediate access to reports such as student withdrawals from school and student attendance problems in a particular grade level or course. The use of the microcomputer with its ability to share or import data from various software packages will allow administrators to do their jobs with greater flexibility, accuracy, efficiency, and confidence.

C. Hardware

The physical location, that is, the amount of space available, must be considered when determining computer hardware.

It is not necessary to become involved in a great deal of technical detail about potential hardware. It is more important that you:

1. Choose a vendor that is capable of providing continuing support. It is generally better to purchase most of your hardware

and peripherals from a single vendor, as support can be provided in an integrated way.

2.   Keyboards usually come in standard typewriter format. Those which most resemble the keys of a good quality electric typewriter will be best for administrative uses. Any special keys for the operation of the microcomputer are usually located at the ends of the rows. A microcomputer usually requires more control keys than are necessary on a typewriter. Administrators should not be surprised to learn that the more sophisticated microcomputers usually have more control keys. But these microcomputers are usually capable of performing more administrative tasks efficiently than microcomputers with less sophisticated keyboards. Thus, although it may take staff a little more time to learn the use of them, more sophisticated keyboard may be more efficient.

Some keys are of the "calculator" or "chiclet" style. Such keys generally feel uncomfortable to most typists and are not recommended for continuous keyboarding use.

3.   The colour of the screen may be black, green, grey or amber. Make this decision carefully, as your staff will spend many hours looking at your choice. Administrators should involve appropriate staff members in the decision.

Display quality is important when someone is going to be working at the microcomputer for many hours at a time. Some displays have better resolution than others; that is, the characters are sharper and more distinct.

For word processing, an 80-character-wide screen will be best. Without it, a typist cannot see the full width of the text as it will later appear on paper.

4.   The printers typically found in schools hit an inked ribbon with ready-formed characters; they are called character impact printers. Many of these are "daisy wheel" printers, so called because the characters are disposed around the hub of a plastic disk like the petals of a daisy. These printers give typewriter quality reports, but they are quite expensive.

The daisy wheel offers many typefaces, just as do many typewriters. Better quality daisy wheel printers offer provisions for proportional spacing, variable line spacing, subscripts, superscripts, bold face, underlining, double underlining, and so on. Most of these things are done under software control so no mechanical adjustments need be made to the printer itself.

Lower priced printers form a character by driving a set of closely spaced wires or pins against an inked ribbon. Since the pins produce an array or matrix of tiny dots, these printers are called "dot matrix" printers. The quality of the print depends partially on the number of pins used to form the characters. In general, the more pins, the better the quality of print.

The speed of dot matrix printers is generally several times greater than that of character impact printers. They also have more flexibility with different type sets, non-standard characters, and graphic designs.

Non-impact printers are a third choice of printers. This type of printer does not use an inked ribbon. Characters are transferred

to the paper using a variety of techniques including spraying ink, using electrostatic charges, or using heat to transfer the characters. The major advantages of non-impact printers are their speed and quietness in comparison to impact printers.

The most popular and functional non-impact printer is the laser printer, which uses the same technology as state-of-the-art photocopying machines. The poorest quality laser printer has twice the dot density as the best quality dot-matrix printer, which accounts for their high quality printing. They are also very fast; the slowest laser printer has twice the speed of the fastest impact dot matrix printer.

Laser printers offer a wide variety of fonts and faces, giving offset-quality printing and superior graphics.

Some printers accept regular 8 1/2 by 11 inch paper; these are usually referred to as friction-feed printers. They feed the paper through as does a typewriter. Others take only continuous paper such as fanfold paper with sprocket holes along the sides. These are usually referred to as tractor-feed printers. Tractor-feed printers have two adjustable sprockets, called tractors, that pull the paper through the printer a precise distance for each line-feed command from the computer.

Some printers may take paper no wider than 8 1/2 inches, but because of their dot matrix style, may use a compressed print to squeeze extra characters on each line. Other printers accept paper 14 inches wide as well as more narrow widths. Most tractor-feed printers readily accept paper, mailing labels, cheques, and other

business forms. Although the wider (14 inch) printers cost more, they are often a good investment because of their flexibility.

5. How much and what kind of memory should be available? Random access memory (RAM) should be at least 640 K , that is 640 000 characters or bytes of capacity, preferably 2 meg, that is 2 000 000 characters or bytes of capacity, for handling administrative tasks.

6. For administrative purposes, floppy and/or hard disk drives should be the only consideration for data storage. Floppy disks are popular for instructional software, but their capacity, speed of operation, and lower reliability may be too restrictive for administrative uses as compared to hard drives.

While floppy disks store from 100 000 to 1 250 000 characters, hard disks store from 5 000 000 to 40 000 000 characters, more than 30 to 50 times more than do floppy disks. If you must use more floppy disks for your operation than you have disk drives, then you also must begin "swapping" floppy disks in and out of the drives.

In addition to greater capacity, hard disks process data much faster than do floppy disks (at least 20 times faster). Where it might take 30 seconds to enter or change data on floppy disks, a hard disk would require less than 2 seconds. After estimating how many entries or changes you may have in a school year, estimate the staff time it will require to make them.

7. What kind of processing speed is desirable? Administrators should check the speed of the microcomputer, as too much time may be spent looking at a display screen scrolling data rather than

quickly accessing the desired data or performing the desired operation.

8.   Why network?   Many school administrators are turning to office and school networks as an alternative to stand-alone microcomputers.   In this type of arrangement, all the microcomputers in the physical building share a common disk storage device for loading software (and sometimes for saving documents), but normally revert to their independent status after software is loaded.

There are two major advantages to networking:

1.   Cost-savings--In some networks, peripherals, such as printers, may be shared by all users on the system so that only one peripheral device need be purchased.   While network software prices tend to be higher than individual workstation prices, a good rule of thumb is that once at least 4 or 5 workstations are on the network, purchasing network licenses for software becomes more cost-effective.

2.   Flexibility--most networks have varying levels of security and control, which enables users to tailor-make the use of the system to their own needs.

The major disadvantage to networking is:

1.   The continual use of networks requires the continual presence of a skilled network operator, since most networking systems call for continuing tending, regardless of what may be said in brochures.

9.   The cost of continuing service and warranties must be included in network cost estimates.   Quality products generally offer higher quality service and warranty.

10.   Slater and Lynch (1986) also suggest optional input devices such as card readers, optic readers, or scanners as well as optional output devices such as a modem to connect the computer to a telephone line for accessing the homes of students or other computers.

D. COST

Under no circumstances should an administrator purchase a microcomputer just because he or she can afford it.   It generally does not cost much more to buy quality hardware.   Potential buyers should prorate hardware expenditures over the probable lifetime of the system.   It is important to note that computers are sold in different ways.   Some microcomputer systems are sold on a piece-by-piece-add-on basis, that is,   a price for the computer, price for the monitor, price for the keyboard, mouse, colour graphics card, cables, printer connections, communications ports, voice capability, etc.   Others are sold on a "price includes all" basis.   It is important to compare 'like' systems.   The cost and availability of staff training should be included in all estimates of the cost of microcomputer systems.   Further, the cost of compatible peripherals are often overlooked when purchase decisions are made.

E.   Reconsideration of Priorities and Functions

Once the functions desired,   software availability,   and hardware availability are determined, administrators may be forced to alter their priorities and the functions expected to be performed by a microcomputer system.

The software and/or hardware may not be available to address the local needs. There may not be enough money available to purchase a suitable system unless priorities are altered to allow the channeling of money to complete the system purchase. Staff may become reluctant to indicate approval because they are fearful of their lack of expertise or the workload required to become familiar with the system.

F. Planning and Implementation

Sharman and Cothern (1986) state "as our survey indicates, the growing dependence on computers for office work and the easing of price and training obstacles are positioning computers for rapid future growth in school administration. Frankly, we don't think you'll have much choice in the coming years; computers are in your future. Most of you will accept them because you recognize their potential for increasing productivity and for freeing you to provide the leadership you're hired to provide." This indicates that the advantages of microcomputers in school administrative tasks are becoming so great that even reluctant principals must eventually accept them. Any implementation will succeed or fail depending on sound purchasing decisions and the staff who are intended to use it.

Many administrators feel that the computer in the office is inevitable, with the principal learning new skills. Slovacek and Dolence (1985) state "...micros probably will not be replacing any staff of administrators. Rather, they will be used as a productivity tool and will refocus managerial efforts to include new tasks." "To gain greater control over the collection, analysis, and use of

management information, schools are increasingly purchasing stand-alone microcomputers to perform specific types of applications" (Pogrow, 1985). Administrators have been trained in "planning, organizing, motivating, and controlling" (Hersey, 1969) within our educational system. Administrators must understand both computers and the administrative needs of their school. Unfortunately, as McGraw (1966) stated, "few administrators have been trained to use them; few administrators understand the tools' place in our society." Initially, it may be worthwhile to allow staff some time to experiment with a microcomputer before any in-service is held. To do this you must have at least one staff member who knows how to operate the microcomputer(s) and can help others. It is preferable to budget some staff time to allow staff to become familiar with a microcomputer before they are expected to use one.

It is not necessary to have all staff trained right away. A better strategy is to focus on immediate users and staff who show interest in getting involved. Dellows (1986) states that "the ultilization of microcomputers by secretaries, clerical workers, or administrative assistants, in support of administrators is the most efficient use of the new technology." In short, the selection of a computer for administrative use should receive as much attention and consideration as the selection of a new member of staff. There must be a well thought plan for the process as well as an understanding of the dynamics involved in learning to use a computer and particular programs successfully. Knowledge is probably the best safeguard against fears and hesitancies. Administrators do not need to be experts in the microcomputer field to use them and to

make wise decisions concerning their implementation. Just as most adults in our society do not know the 'nuts and bolts' of a motor vehicle, but do know how to drive one, a similar working knowledge of microcomputers is all that is necessary. Pogrow (1984) says "The ease of using new software makes it more feasible for an individual without technical background to use computers effectively." Froese (1984) uses the following two criteria in determining an administrators' claim to computer literacy:

1. being familiar with the administrative tasks the microcomputer can be expected to perform; and

2. becoming experienced in using the microcomputer with packaged administrative programs.

Neil (1984) agrees with this type of implementation of microcomputers for school administrative uses. She lists the following guidelines to allow for successful implementation:

1. implement gradually with sufficient training and time for practice;

2. start with an application that is relatively simple and has a high probability of success;

3. do not try to convert the entire staff at once; and

4. if the staff is large enough it is desirable to have a few people train at the same time so that they can support and interact with each other.

G. DECISION--Either Do It Or Do Not!

Computers cannot make poor managers better administrators. Instead, computers can make good administrators more efficient.

The decisions principals make now about the new technologies are vital to their growth as administrative leaders and to the improvement of their schools. Pogrow (1985) lists eight trends to reinforce the necessity of school administrators choosing to use microcomputers in their schools:

1. The rapid increase in the number of companies producing administrative software for secondary schools and the rapid growth in the quality of available programs.

2. The shift towards purchasing software from a vendor instead of developing it in-house.

3. The movement away from consortia and service bureaus toward purchasing and operating one's own computer.

4. The shift away from single central computers toward distributive processing (process where computer and computer processing are spread throughout the school division).

5. The increase of computerization in more administrative tasks.

6. The use of new devices to make existing applications efficient.

7. The more direct involvement by principals and staff in working directly with computers.

8. The development of more powerful computer systems.

Chapter IV A Post Hoc Application

This chapter reports a first test of the usefulness of the model by superimposing it on a large school system which has introduced microcomputers for administrative tasks in the last decade. Whether the selected school system would have been more successful had it followed this model is influenced by the fact that this model was created in part to account for the practices seen to be effective and troublesome by the same observer who computed the model. There is therefore some circularity involved in attributing too much to the apparent value of the model.

In 1983, this school systems records and reports were processed by MES (Manitoba Educational Services). The cost of computer services to the school was approximately $10 000. The first priority of the school was to replace the MES service. The second priority was to establish a comprehensive information system. The administration decided to change to using microcomputers for administrative tasks. A plan was developed to implement microcomputers at the administrative level. A search for software and hardware was initiated by one of the three vice-principals in the school. In 1984, CEMAS was the only comprehensive software package available and was purchased. Available evidence indicated that it could do the required job for an installation cost of approximately $10 000. Within this plan the tasks selected for computer management were, attendance records, student timetable schedule, discipline tracking, grade reports, accounting, demographics, and mark analysis.

Criteria were established for comprehensiveness, integration of various components, dealer support, and cost.

The administration placed a very high priority on the training of staff. About $3 000.00 was spent on the training of staff.

Ease of use of the system was also deemed to be very important, as it was believed that without staff commitment, the system would fail.

Teaching staff, clerical staff, paraprofessionals, and administration all have access to all information on the system. The teaching staff, paraprofessionals, and administration have 'read only access'. The clerical staff and an administrator have both read and write access.

An effort was made to work with one software and hardware dealer. This was to avoid having a software dealer blame a hardware dealer and vice versa when problems arose.

Because of the school's large student population, speed of processing and printing were deemed to be of high importance.

It was decided that the data that would be viewed did not warrant the extra expense involved in the purchase of colour monitors.

Currently, this school is running the Columbia School System with an IBM 286 processor and a 70 megabyte hard drive. There are seven networked "work stations" located throughout the school.

This followed much of the protocol set out in Chapter III. In the main it was successful. Administration attribute their success to the fact that they:

1. determined what functions they wanted the microcomputer to perform;

2. determined what software was available to perform specified tasks;

3. determined what hardware would allow for the successful operation of the selected software;

4. allocated sufficient funds to purchase the selected software and hardware;

5. planned the implementation of the microcomputers for administrative tasks; and

6. followed through with their decisions.

The main problems encountered center on the training of support and teaching staff to use the system. There is still a reluctance by staff members to use the system . It seems that they may have under-estimated both phobias and staff reluctance to use the system perhaps because some people feel they cannot keep up with all these changes.

Appendix 1

EDUCATIONAL ADMINISTRATIVE USES OF MICROCOMPUTERS QUESTIONNAIRE

1. Did you develop a plan to implement microcomputers in administrative tasks? If so, please briefly describe the plan.

2. How did you assess your microcomputer requirements?

3. What functions do you want the microcomputer to perform?

4. How important was the training of staff?

5. Did you consider the ease of use of the system--(people using the system may not be familiar with it or the users' heart may not be in it)? How important was this factor?

6. Who has access to what information in your administrative microcomputer system?

7. How important was support (dealer) compared to cost?

8. How important is speed of processing in your system?

9. How important is speed of printing in your system?

10. Did you consider colour vs monochrome monitors? If so, what factors influenced your purchase?

11. Was there a predetermined criteria for selection of software? If so, what was it?

12. How important was dollar cost in your purchase?

13. Is suitable software available for your system requirements?

14. Is suitable hardware available for your system requirements?

15. Are there other more cost efficient ways of performing administrative tasks as compared to using microcomputers?

16. Do you perceive any potential problems in using microcomputers for administrative tasks?

17. If you were to plan for school administrative uses of microcomputers, what would you do different today that was not done in your current situation?

Appendix 2

INTERVIEWS WITH THEORETICIANS, VENDORS, AND USERS

The vendors interviewed all agreed that, they the vendor, must be able to assess the requirements of the user by fully understanding the situation. The system that is eventually purchased must allow for the user to grow into it rather than grow out of it. The vendors indicated that in the long run purchasers receive what they pay for, therefore, an inexpensive microcomputer system will not perform as well as a more expensive system.

Customer satisfaction is of prime importance to the vendor. The service and support they provide to the user will strengthen relationships between themselves and the users.

The vendors indicated that through their experiences there are two scenarios in determining if speed of processing and printing is crucial to potential purchasers of microcomputers for administrative uses. These are:

1. Schools currently using a manual system do not perceive speed of processing and printing as an issue. These administrators never knew any better. They see the machines as faster than what occurred with the former human manual system. These administrators are content with the new computer system until they gain expertise, experience, confidence in the system, and general literacy. These users have the potential to quickly "out grow" their microcomputer systems.

2. Second time users are not prepared to wait for processing and printing of data. Therefore, any new microcomputer system

purchased must be quicker or they will not even consider purchasing it.

The vendors indicated that when printing out student timetables, student reports, and attendance records, speed of printing was important. The quicker the printer, the better! But, when printing documents such as letters home to parents, quality of printed copy was much more important than speed to the administrators and schools they dealt with. The issue of colour monitors compared to monochrome monitors was deemed as an elitist and ego situation rather than a practical decision. The vendors felt that colour monitors were not necessary for the majority of the applications that most administrators were using microcomputers. Unless graphics are an application, high quality monochrome monitors are the best and most practical monitor for the current administrative applications.

The vendors indicated that potential administrative users of microcomputers should become computer literate to assist them in "growing into" a system comfortably. They also indicated that it was much better to purchase a system that allowed for "growing into" rather than "growing out of", which could be very expensive and frustrating for novice administrative users.

All users surveyed believe that a plan must be developed to implement microcomputers into administrative tasks. To assess their needs, administrators must look at what they want to do with the information in the schools, and what software and hardware would best suit those needs. The administrative users of microcomputers all indicated that a plan to ·implement

microcomputers in their schools was conducted to meet their current and future needs.

Training of staff was deemed crucial to the success of any plan of microcomputer implementation for administrative tasks. On the job training (learning by trial and error) was seen as a hindrance in implementation. It was also seen in many cases to discourage staff from seeing the value of the system. There is always resistance to change and many individuals demonstrated apprehension to using microcomputers. With continued training and experience gained, people become more comfortable with the system. Considerable revenue should be spent on the training of staff. There must be a commitment on the part of the operator. A very dedicated person can make a system work all by themselves.

The users indicated that dealer support was extremely important and they would not "trade off" positive dealer support for lower cost of software and/or hardware. Toll free customer support lines, user groups, training sessions, etc. only enhance the situation.

Although several surveyed users indicated that the cost of a microcomputer system was crucial to their final purchase decisions, the majority of the users and all the vendors interviewed believed that the successful completion of the determined needs should be the deciding factor in the final purchase. Those surveyed indicated that if the microcomputer installation for administrative tasks was a priority, the money would be found somewhere in the school budget or the board office budget to install the most suitable system.

Often, upgrades to hardware and software occurred because the computer industry continues to advance at a very rapid pace.

A potential problem of schools using microcomputers for administrative tasks is that administrators are not always properly trained on the use of the system and the secretary(ies) often end up "running" the system.

Using computers initially may cost more than performing a task manually. However, the users indicated that this drastically changes as the users become more cognizant, more accurate, and more confident of the system. The initial "growing pains" are worth it as accuracy and accessibility to up-to-date data allows for users to deal more effectively with students or other job related tasks.

Potential problems perceived by the users:

1. Administrators can become "computer nuts" and forget about the main purpose of their jobs.

2. The system can become overly dependent on the computer operator(s).

3. Staff may perceive the school functioning for the computer as opposed to the computer functioning for the school.

4. The system can provide too much information, creating a situation that administrators sometimes cannot "keep up" Both the vendors and users indicated that the software purchased for administrative uses in schools ideally should:

1. Be "bulletproof", that is, not 'crash' when data is input incorrectly.

2. Have comprehensive documentation to assist the users.

3.   Be capable of being modified by the user to suit the individual needs of the user.

There is no "one" way to evaluate hardware because administrator needs vary.

Appendix 3

INVENTORY OF AVAILABLE SOFTWARE

ATTENDANCE RECORDING SOFTWARE

Classmate. Davidson and Associates, Incorporated. 3135 Kashiwa Street Torrance, CA 90505. This is a grading and attendance program. Grades, attendance and teacher's comments for up to 51 students per class are stored. The grades are computed and all records including assignments and parent reports are printed.

BUSINESS MANAGEMENT SOFTWARE

Canadian Payroll Systems. Maple Software Incorporated. 38 Inniswood Drive Scarborough, ON M1R 1E5. This full menu driven software offers flexibility to meet specific needs.

Simply Accounting. Bedford Software Limited. Suite 201-4180 Lougheed Highway Burnaby, BC V5C 6A7. This software is accompanied by two well documented manuals; a user's guide and an accounting manual to outline the program. To simplify the learning, a tutorial is also included.

DATA BASE PROGRAMS

D Base. Ashton-Tate. This software is very powerful allowing the user record retrieval, automatic updating, and report generation. The pull-down menus make easy work in the creation and use of the database.

PFS File. Scholastic Software Publishing Corporation. 123 Newkirk Road Richmond Hill, ON L4C 3G5. This software provides a tracking system for a wide range of data.

Inside Trax II. I-Track Corporation. 710 E. Park Boulevard, #204 Piano, TX 75074. This software allows the user to record and display information on individuals and to track organizations. The number and size of fields is predefined, the number of records is limited only by the size of the disk.

<u>Paradox.</u> Borland International Company. 4585 Scotts Valley Drive Scotts Valley, CA 95066. This software incorporates artificial intelligence technology to allow the user to create customized applications.

GRADE ANALYSIS AND REPORTING SOFTWARE

<u>Grade Manager</u>. MECC. 3490 Lexington Avenue North St. Paul, Minnesota 55126. This classroom tool records scores, computes grades, and prints grade reports. This software package allows for two grading methods, percentage grading and standard scores.

<u>Gradebook Plus</u>. Mindscape. 3444 Dundee Road Northbrook, Il 60062. This software package assists teachers in the recording and calculation of student scores and grades. It provides easy access to whole class records, or individual student's scores and assignments. A statistical analysis can be displayed, edited or analyzed with either visual or printed output. A mini word processor creates customized reports for effective teacher-parent communication.

<u>Report Card</u>. Sensible Software. This grading system allows for flexibility in grading by allowing the weighing of activities according to their importance, and allows for progress reporting throughout the school year.

INTEGRATED PROGRAMS

<u>Appleworks</u>. Claris Corporation. This software offers a word processor with a spelling checker, custom dictionaries and spelling summary, multi-line headers and footers, left, right, center, and decimal tabs, multiple tab rulers, and documents up to 300 pages in memory. The data base allows for up to 20 different reports per database. The spreadsheet has the ability to compute arithmetic, financial, trigonometric, logical statements, and reference strings.

<u>Enable</u>. The Software Group. Department M Northway Ten Executive Park Ballston Lake, NY 12019. This software allows for the sharing of data between five tools, word processing, spreadsheet, graphics, data base management, and telecommunications.

Excel. Microsoft Corporation PO Box 97017 Redmond, WA 98073. This software combines powerful analytical performance with presentation-quality graphics and an integrated database.

Lotus 1-2-3. Lotus Corporation. This software offers an integrated spreadsheet, database, and word processor. It was designed primarily to 'crunch numbers'.

Microsoft Works. Microsoft Corporation. PO Box 97017 Redmond, WA 98073. This software integrates the five most popular productivity tools in one program; word processing with spelling checker and mail merge; data base with reporting; spreadsheet with charting; drawing with page layout; and communications. This program can be used to write financial reports and correspondence; analyze scientific or financial data; track and sort data; and dial an on-line information service.

PFS First Choice. Scholastic Software Publishing Corporation. 123 Newkirk Road Richmond Hill, ON L4C 3G5. This software is a good and easy beginner's package. It is inexpensive and easy to use. This software offers a word processor with a thesaurus; a data base manager; and a spreadsheet with excellent documentation.

SCHOOL INFORMATION MANAGEMENT SYSTEMS

MacSchool. Chancery Software Limited. Suite 500 1168 Hamilton Vancouver, British Columbia. This software allows for course scheduling, grade reporting, and attendance recordkeeping. This package can be tailored to meet specific school needs.

The Enforcer. Mount Castor Industries. PO Box 488 E. Orleans, MA 02643. This software organizes school disciplinary records to improve tracking of students' behavior. The data can be tracked by student, date of infraction, teacher involved, disciplinarian, offense committed, and punishment administered.

The School System. Columbia Computing Services. 1380 Burrard Street Suite 600 Vancouver, British Columbia V6Z 2H3. This software offers a great deal of flexibility and support. Student scheduling, attendance recording, and academic progress are the main administrative features of this package.

Trevlac. Education Technology Program. 1970 Ness Avenue Winnipeg, MB R3J OY9. This software is capable of performing the three basic administrative tasks: course scheduling, grade reporting, and attendance recordkeeping. It also offers flexibility to customize the program.

SPREADSHEETS

Lucid 3-D. PCSG. 11035 Harry Hines Blvd. Building 206 Dallas, Texas 75229. This software is multi-dimensional. Any cell of the spreadsheet can contain a complete different spreadsheet that can be accessed by a single keystroke. Lucid 3-D uses a menu approach making it easier to recognize commands rather than forcing the user to remember them.

Quattro. Borland International Company. 4585 Scotts Valley Drive Scotts Valley, CA 95066. This software offers very high quality graphics and quick recalculation of formulas. Data is never lost, even during power failures, as Quattro keeps track of all changes during a session.

WORD PROCESSING

IBM Writing Assistant. IBM Corporation. PO Box 2150 Department 8WH Atlanta, GA 30035. This software is easy to learn and use. It is an excellent choice for the beginner and yet has some of the power associated with more complex programs. The high quality print and on-screen documentation make this a good program.

Microsoft Word. Microsoft Corporation. PO Box 97017 Redmond, WA 98073. This software package allows the user to create and revise long reports, research papers, class notes, and other academic papers. It combines speed and powerful features to produce publication-quality documents quickly and easily.

Multimate. Ashton-Tate. This software allows for quick booting, creating, editing, printing and importing of data. This package is easy to use with pull down menus.

PC-Write. Quicksoft Incorporated. 219 First North Box #224-PMAZ Seattle,WA 98109. A tutorial makes this software is easy to learn. The following features create quality finished documents; spell-checker, mail merge, and quick search and replace.

PFS Professional Write. Scholastic Software Publishing Corporation. 123 Newkirk Road Richmond Hill, ON L4C 3G5. This software is easy to use and learn, yet powerful to create reports with mail merge, built-in address book, spell checker, and thesaurus.

WordPerfect. WordPerfect Corporation. 120 Ninth Street East Cornwall, ON K6H 5R9. This software has excellent documentation, a tutorial, a thesaurus, and word speller. The user is able to integrate text and graphics for designing newsletters, reports, and other documents.

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