INTEGRATION OF COMPUTERS INTO EDUCATION

Sara J. Pass

IED 499
Senior Honors Project

Thesis Advisor
Dr. Alice I. Robold

Ball State University
Muncie, Indiana
August 1985
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>II.</td>
<td>PRELIMINARY ADMINISTRATIVE DECISIONS</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Funding of Computer Purchases</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Developing A Budget</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Guidelines for Hardware and Software Purchase</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Placement of Computers in the Building</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Key Position of Administrators and Teachers</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Developing The Curriculum</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Equity of Computer Use</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Obstacles to Integration of the Computer</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Teacher Training</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Conclusions</td>
<td>11</td>
</tr>
<tr>
<td>III.</td>
<td>INTEGRATION OF COMPUTERS INTO CURRICULUM</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Drill and Practice Programs</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Keyboarding Skill Programs</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Word Processing Programs</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Tutorial Programs</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Data Base Programs</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Simulations</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Programming</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Integration: A Slow Process</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Computers in Mathematics</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Computers in Science</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Computers in Social Studies</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Computers in Writing</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Technological Training</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Motivational Force of the Computer</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>Conclusions</td>
<td>23</td>
</tr>
<tr>
<td>IV.</td>
<td>COMPUTER SOFTWARE</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>A Look at Software Quality and Availability</td>
<td>25</td>
</tr>
<tr>
<td>Chapter</td>
<td>Page</td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>------</td>
<td></td>
</tr>
<tr>
<td>Reasons for Low-Quality Software</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Characteristics of Poorly Designed Software</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Producing High-Quality Software</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>The Difficulties Involved in Evaluation and Purchase</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Some Steps Toward Solving the Problem</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>The Role of Educators</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Conclusions</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>V. EXPECTATIONS OF COMPUTERS IN EDUCATION</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>Advertising Affects Parental Expectations</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>An Innovative Response to Parental Expectations</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>A More Typical Response to Parental Expectations</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Need to Make an Active Response to Parental Expectations</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Expectations in the Development of Computer-Based Learning Materials</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>and Curricula</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expectations of Organizational Changes</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>Computer Expected to Become a Tool</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>Expected Improvement in Educational Software</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>Objections to Computers in Education Refuted</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>Future Developments with the Computer</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Conclusions</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>VI. SUMMARY</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>BIBLIOGRAPHY</td>
<td>44</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION

The computer is making its way into our educational system today. Being sure that it gets started on the right foot should be a major concern for the educators involved. Many decisions must be made concerning hardware and software purchases, curriculum development, teacher training, and integration of the computer into the classroom. This paper intends to study briefly the administrative decisions involved in the integration of computers into education, to look at the variety of software programs presently available, and to explore some future educational expectations of the computer.
CHAPTER II

PRELIMINARY ADMINISTRATIVE DECISIONS

In the attempt to put computers into the classroom quickly, administrators must not forget to first answer some fundamental questions concerning funding, placement of computers in the school, and changes that will occur in the educational program (3, p. 64). If an instructional computing program is to enhance students' learning, administrators must also encourage positive attitudes in teachers and students and provide adequate hardware, software, and instruction in the proper use of computers in the classroom (61, p. 32).

Funding of Computer Purchases

Few schools can afford to purchase computers and related equipment and software through their regular budgets. Those that manage to do so generally have a higher ratio of students to computers than do those schools that obtain outside funding. Such funding is available from a diverse group of sources, including special grants, general school system funds, donations from manufacturers and the fund-raising efforts of the PTA or teachers (54, p. 67).

Developing A Budget

When establishing a budget for computer purchase, administrators must remember to include a substantial amount of monies for selection and purchase of educational software (29, p. 246-7). Other areas often overlooked in the establishment of the budget include the repair and maintenance of the computers purchased and training of teachers to use those computers as integral parts of classroom instruction (56, p. 253).
Guidelines for Hardware and Software Purchase

The Computer Technology and Reading Committee of the International Reading Association has published Guidelines for the effective use of technology in Reading Classrooms which include characteristics of hardware that must be considered before purchase. Only durable hardware that produces highly legible text displays and is safe for the classroom should be purchased. Such hardware should also meet the classroom needs which may include compatibility with software chosen to fit the curriculum, sufficient memory capability to meet anticipated needs, availability of compatible data storage devices, screen displays which produce legible print with minimal glare and radiation, a keyboard and the availability of other input devices and adequate and reasonably priced technical support from the manufacturer or distributor. Accompanying instruction manuals that are clear and understandable for persons with minimal experience with computers are also extremely beneficial.

Included also in the guidelines are characteristics of appropriate educational software. The committee first advises that software selection should be based mainly upon curricular needs and the learning process of children. High quality educational software should contain clearly stated and followed instructional objectives that are consistent with established learning theory. The activities should use the unique capacities of the computer fully, and the instructions should be simple and direct students in learning without explanation from the teacher (13, p. 80-81).

Placement of Computers in the Building

The placement of computers in the building is another consideration for administrators. Several patterns of placement are being used in
schools today. Some schools have one or two computers that may be checked out by teachers when needed for classroom instruction. Other schools put one or two computers in the rooms of interested teachers for use in their classrooms. Sometimes one or two computers are rotated by schedule from room to room of interested teachers or possibly every teacher. One computer may be shared by every three teachers for use in each classroom as scheduled by those three teachers. One computer may even be placed in every classroom and used periodically. Another possibility is the establishment of a computer lab in a vacant classroom (54, p. 44). Some schools may even build a microcomputer network, making a time sharing system.

Often computer learning seems more effective when done in a computer lab than when done in the classrooms, primarily because lab personnel are usually better prepared in using the programs than regular classroom teachers who have had little or no training in using the computer for learning. It is also easier to supervise a class working on one task than one working on several different tasks simultaneously (54, p. 45). However, well-stocked computer labs may go severely underused while students wait for turns to use the one or two computers placed in the classroom (8, p. 22). Charles Blaschke, president of Education Turnkey Systems, in Falls Church, Virginia, says that school districts are realizing that computer learning must be integrated into existing classes rather than just in computer labs, where only a few teachers know how to use the computer (17, p. 576). In order to get the desired results of having computers in every classroom being used by students and teachers as learning tools, all classroom teachers must be trained to use and aided in using the computer in daily instruction. The proper balance may be a
combination of computers in the classroom being used by trained teachers and computers in a lab that is supervised by personnel specializing in computer education (54, p. 45).

Walter J. Koetke, Jr. feels that microcomputers are highly successful because they are individual tools. When a computer is deprived of this quality by being attached to a network, it loses a lot of its effectiveness in education. He says that, "In the majority of cases, the schools are spending time and money on microcomputer networks to obtain most of the disadvantages and almost none of the advantages of time-sharing systems" (28, p. 164).

**Key Position of Administrators and Teachers**

The amount and quality of hardware and software available in each school is affected greatly by the involvement, assistance and guidance, or lack thereof, of the principal. Likewise, the use of the computer in the elementary school is directed by the educational philosophy and preparation in the use of the computer of the principal and teachers of that school (54, p. 43-44).

The educational philosophy of principals and teachers and their familiarity with computers cause the computer to be incorporated into the curriculum in different ways. Some computer curricula emphasize the use of prepared software for all students in kindergarten through eighth grade. Others emphasize programming skills for grades three through eight. Still others use the computer as a reward for good behavior or work that is denied to irresponsible students. Some teachers use the computer as a tool daily and others less frequently. Computer literacy is taught as a separate course in some schools, and others integrate it into many subject areas without teaching a separate course (54, p. 44).
Developing the Curriculum

Proper planning and adequate funding of computer purchases must be followed by careful curriculum development and appropriate teacher training. The integration of computers into the classroom will be hindered if any of these tasks are overlooked (3, p. 67).

How and what to teach children about and with computers is a major question among educators today. Although elementary curricula often include something called "computer literacy," many teachers don't fully understand what they are to teach. Two top educators address the question of teachers, "What is computer literacy?". Andrew Mollnar points out that computer literacy, as it is taught today, includes a little history of computers and a look at how they are used today in business and industry. The course may include a small amount of time spent on the computers, but this time is generally very limited by the poor ratio of computers to students. Computer literacy is, therefore, often a "superficial overview" of computers. David Moursund explains what computer literacy means to him. He says, computer literacy is the knowledge of the computer that later leads to the ability to use it as a useful tool for learning. He feels a simple introduction to the computer is only a small step toward using it as a tool. He feels that students need enough instruction and hands-on experience so that they can themselves integrate the computer into each subject area for use in solving problems and saving time (38, p. 86).

A John Hopkins study revealed that courses of computer introduction and computer programming are the most common ways that computers are being used in schools today. Yet, the integration of computers into the curriculum is advocated by educational leaders as the only effective use
of computers in education. Ken Brumbaugh, executive director of the Minnesota Educational Computing Corporation, states, "only those things that are integrated throughout your total learning experience stick with you." Children need to understand what the computer can and does do by using the computer often in their school experiences and, by this, gaining a general understanding (3, p. 69).

Dr. Mary Alice White, director of the Electronic Learning Laboratory at the Teachers College of Columbia University in New York City, observes that advanced schools provide computers in each classroom to be used by students as "electronic pencils" and do not teach a course in computer literacy or teach programming skills. In this way, the computer has become a learning tool (3, p. 69).

According to a report of a federally funded project, State Leadership Assistance for Technology in Education, computers are being used more and more as tools to write and analyze data, while less emphasis is being placed on programming and computer literacy (48, p. 302).

**Equity of Computer Use**

Along with the consideration of how and what to teach comes the quotation of who should use the computer. From the Guidelines for the Effective use of Technology in Reading Classrooms published by the Computer Technology and Reading Committee of the International Reading Association comes this appeal:

"All persons, regardless of sex, ethnic group, socioeconomic status, or ability, must have equality of access to the challenges and benefits of computer technology. Computer technology should be integrated into all classrooms and not limited to scientific or mathematical applications" (13, p. 81).

According to Bobby Gordson, a top educator, computers can be used
effectively with preschool children as well as with elementary students. Some activities included for preschool children are: number, letter and pattern recognition, and introductions to counting and reading. Mr. Goodson also states that young children do not require as much preparation or supervision at the computer and that there are a lot of computer programs designed for teaching preschool concepts (38, 82).

Obstacles to Integration of the Computer

Although the computer may make the most important changes in education in the near future by enriching teaching, exposing students to new technology and making problem solving easier, many teachers treat it as merely a toy or an activity for the creative student. Even though the computer is widely used in business for communication and computation, schools are slow to incorporate it into the curriculum as a replacement for old techniques. If the computer is to enhance education, it must be used as a tool in the teaching of writing and mathematics, using each day the capacity of the computer practically (19, p. 258).

The biggest obstacle to changing the educational system to include computers integrated into every classroom is often the minds of people (19, p. 258). Some advocates of change, therefore, focus on changing the minds of educators. They see the potential each teacher has to effect the education of hundreds of students and even the effect those students will have in the future (32, p. 182).

The complaints of poor quality software and the power of computers to dehumanize and centrally control people are heard by computer advocates and accepted as accurate but not accepted as reasons to continue educating students as though computers do not exist (56, p. 253).
Teacher Training

Administrators who wish to implement computers in education must consider teacher preparation. According to Harry A. McQuillen, president of CBS Educational and Professional Publishing, "the lack of teacher training on micros is the biggest single impediment to their use" in the classroom. Dr. Mary Alice White, director of the Learning Laboratory at the Teachers College of Columbia University in New York City, notes that individual teachers often trained themselves as they pioneered the first computer education programs, but "to expect a whole generation of teachers to suddenly acquire computer skills is a bit much." Administrators, therefore, must make an effort to assist teachers in gaining the knowledge necessary to use computers as educational tools.

Teacher training programs have been started in several states for the purpose of providing thorough computer knowledge for teachers. Teachers Colleges are also beginning to include computer training in the curriculum (54, p. 71). The need for teacher training is great. According to a top educator, Andrew Mollner, the task will entail "retraining an entire generation of teachers" (38, p. 88). For example, in New York City, a staff of four has been assigned the awesome task of training some 70,000 teachers. The availability of hardware at training centers poses the biggest obstacle for this staff which has managed to train eight to nine thousand of New York's teachers (54, p. 71).

Inservice computer training is being employed by many school districts. In these programs, the inservice instructor is a faculty member and can, therefore, support and assist trainees during and in between training sessions. This continual interaction of instructor and trainee/colleague has proven very beneficial in establishing a solid foundation upon which
to develop curriculum (61, p. 32). Some inservice computer training
begins with the school administrators. The participating administrators,
in this way, learn of the sizeable task facing the classroom teacher, and
may become willing to budget monies to fund adequate training programs
(38, p. 88).

The Computer Technology and Reading Committee of the International
Reading Association suggests that programs should be established to help
teachers use technology intelligently in the classroom by introducing a
variety of applications for computers and encouraging "thoughtful and
informed evaluation, selection, and integration of effective and appro-
priate teaching software" into the classroom (13, p. 81). The goal is
to familiarize faculty members with computers, so that they in turn will
integrate them into the curriculum and classroom (54, p. 46).

One way being proposed to help teachers become acquainted with the
functions and uses of the computer is giving teachers computers to use
to aid them in their tasks of developing handouts and recording information.
In this way the teacher discovers first hand the power and convenience of
computers and is better able to develop means for using them in class-
room instruction (56, p. 254). For it is the teacher who can best de-
terminate the appropriate uses of the computer in a given classroom (56,
p. 253). Producing teachers with a good understanding of the use of
computers is "the key to efficient use of computers in education" (56,
p. 254).

The teacher has large workload that is increased if learning about
computers is assigned as a task and lessened if it is first used by the
teacher as a personal tool. Being comfortable with the computer first,
the teacher is free to add another dimension to his or her classroom
teaching with the computer (39, p. 32).
Even when provided with hands-on experience that allows the teacher to become familiar with computers, the use of the computer as a teaching tool takes effort. The disappointing results of film projectors, televisions and language labs in the classroom remind educators that failure to expend enough effort in directing the use of technology in the classroom will diminish its effect on education (3, p. 67). Many see the effective use of computers directly related to the effort of the classroom teacher (54, p. 44).

Before a program can be used by students, the teacher must do a lot of preparation. The students may need information or background to gain full benefits from the program. The teacher is required to preview the program, decide what information is essential or beneficial for students to have beforehand and gather that information for presentation to the class. The program may need monitoring throughout and a follow up discussion to insure that the students benefitted from their experience (39, p. 38, 42).

Conclusions

When planning to put computers into the classroom, administrators must encourage positive attitudes among the staff and provide adequate funds for the selection and purchase of software, for repair and maintenance of the computers, and for training of teachers. The Computer Technology and Reading Committee of the International Reading Association has published guidelines which include characteristics of hardware that should be considered before purchases of hardware are made. Among the desirable characteristics are durability, compatibility with chosen software, adequate technical support from the manufacturer, and accompanying instruction manuals that are clear and understandable.
An administrator can choose from several different patterns of placement of the computers in the building. Computers may be shared from room to room, or a computer lab may be set up in some central location. The proper balance may be a combination of the two. The educational philosophy of principals and teachers cause the computer to be integrated into the classroom in different ways and will be reflected in the curriculum that is developed.

Complaints of poor quality software and the dehumanizing affects and central control that computers possess are obstacles to the integration of computers into the classroom that must be overcome. The lack of teacher training is also an issue that must be addressed and an obstacle to be overcome. The effort of the classroom teacher may have the greatest influence on getting the computer integrated into the classroom.
CHAPTER III

INTEGRATION OF COMPUTERS INTO CURRICULUM

Before beginning to use computers to teach mathematics, science, social studies, and writing, considerations must be made concerning what is good teaching practice in each of those subjects and how the computer can aid in that teaching and enhance what students learn (7, p. 21). The curriculum must be developed around "what kind of experiences elementary children need" (61, p. 31). Different types of programs must be examined for their effectiveness in helping children to think better, solve problems and improve skills (54, p. 46).

Mari Endrewite, a top educator, feels that the computer should not be limited to use for only one application; the computer is a flexible machine. It is whatever kind of machine the software used makes it, and children need to understand this feature (38, p. 88). Already there are many types of programs to choose from; the following are some: games that drill and practice subject matter, games that drill faster use of the keyboard, word processing programs, tutorial programs, data base programs and simulations.

Drill and Practice Programs

Instruction followed by computer-assisted drill and practice has proven as effective or more effective than that followed by traditional methods of drill and practice, and computer-assisted drill and practice is less time-consuming than its traditional counterpart. For effective use of these programs, the student must have previous knowledge of the facts involved. Such programs should not be confused with those that
actually teach new concepts or information. Although drill and practice does have its place in education, it puts no emphasis on higher-order skills such as problem solving (51, p. 35).

**Keyboarding Skill Programs**

Keyboarding skills are essential to making full use of the computer as a powerful writing tool. Henry Becker, a top educator, who realizes this fact also points out that such skills require coordination that does not develop until third or fourth grade in most students (38, p. 86). Molly Watt, another top educator, reports that there is good software that does not require a lot of typing and allows young children to interact with the computer by pushing only a few keys. Children can begin using programs that enhance problem-solving skills even before they can type (38, p. 83-84).

**Word Processing Programs**

The disk needed for adding word processing to a computer is reasonably priced, at $59.00, and makes word processing attainable for most schools (8, p. 22). Students enjoy the neat, professional appearance of a paper printed from a word processor, and teachers find them easier to correct.

Teachers report that students seem to notice their errors much more when looking at their work printed on a screen than when looking at their own handwriting. This may be because their penmanship distracts from the noticeability of errors and because most work read is printed, therefore errors stand out more on printed page (38, p. 86).

With a word processor, students can make corrections and edit without retyping the entire work (38, p. 86). A word processor will also
correct spelling that is nearly correct so that the student can concentrate more on communicating clearly (19, p. 258). Most students appreciate the aid a word processor lends to the process of writing (38, p. 86).

**Tutorial Programs**

Evidence suggests that tutorial computer assisted instruction can lead to higher achievement than traditional instruction methods used alone (51, p. 35). The tutorial program can be used by almost any student within the recommended age range without prior introduction to the material (47, p. 62). In addition to this, students at remedial levels show marked improvement when computer programs that work on their specific weakness are used (51, p. 35).

Extensive work on problem solving using the computer enhances an understanding of mathematical topics and aids in developing strategies of approach to problems. Playing strategy games with the computer in geometry produces high gains in achievement in that area (51, p. 35).

**Data Base Programs**

Ted Perry, a well-known computer specialist in northern California, explains data base as being like a file cabinet with a built-in secretary. The "file folders" are empty until the user enters the information and establishes the labels and categories for the information. Once the information has been entered, it can be located in a few seconds for use by the student (39, p. 32, 38).

**Simulations**

Simulations use experience to teach both facts and concepts (47, p. 62). Some simulations are not accurate, however, even a good simulation
is not the real thing. Simulations are not intended to be used to replace real experiences that are available to students. However, there are things that one cannot do in a class. Simulations are available that take students out to sea to hunt for whales or on a rocket trip through space, and these are good science experiments on computers. Simulations may also be coupled with an actual experiment, for instance, the dissection of a tadpole. The real experiment is supported by the machine simulation (57, p. 28).

**Programming**

Programming skills are also taught in many schools, however, Molly Watt and other top educators feel that programming need not be the emphasis of computer education. She feels that there are a number of software packages that put the child in charge of the computer, to make choices and to express personal ideas (38, p. 88). "Computer activities are valid if they are part of a flexible and relevant plan" (61, p. 31). Many educators expect programming to lose emphasis as teachers learn more about using the computer as an instructional tool. They expect keyboarding, word processing and data base to replace programming as the focus in years to come (54, p. 45). However, others continue to advocate teaching programming skills. They feel that in order to explore the many different questions that arise, students need to be able to write programs (28, p. 164).

**Integration: A Slow Process**

The use of computers in teaching the subject areas is not universally agreed upon by educators today. Some are not enthusiastic about the introduction of technology into the classroom (7, p. 22). While others foresee the computer being used in all disciplines at all levels
as a valuable supplement to conventional instruction (10, p. 170).
The integration process, however, has been random, with little coop-
eration between educators, government and private companies. There
is little agreement on how computer technology should be incorporated
into education. Because of the immaturity of the field, the lack of
precedent and policy has made integration of computers into the class-
room slow and difficult (3, p. 67).

**Computers in Mathematics**

The National Council of Teachers of Mathematics observes that
mathematical applications and problem solving are the basis for the
technology of tomorrow and suggests that students in grades five thru
eight must receive an adequate computer education to prepare them for
success in our technological society. Mathematics education, therefore,
must assume an increasing role in integrating computers into education,
for the ability to exchange information with and about computers is be-
coming increasingly important in our society.

The Council advocates the need for students to work directly with
computers in practice, programming and simulation exercises. It also feels
that having an understanding about the role of mathematics and computers
in society in general and in career planning more specifically is important
for students (53, p. 35).

According to a matrix for integrating computers into school cur-
riculum published by The National Council of Teachers of Mathematics, the
use of the computer in processing information and using algorithms is a
major objective in all mathematical content areas. While the history of
computing and programming and software are minor objectives in nearly all
the mathematical content areas. The operating of calculating devices and
computer hardware along with computer applications and computing implications are also objectives in mathematics according to this matrix (53, p. 37).

Marilyn Burns, a nationally known educator who teaches workshops using higher-level thinking skills in mathematics, says the key to teaching mathematics and using the computer in the classroom properly is the teaching of problem solving. Good problem solving programs let students make decisions, experience the outcome, evaluate, make more decisions based on their experiences and calculate and deduce answers to problems. She concludes, "children need to learn to solve problems rather than just learn how to compute." Skills that can't be used have no purpose. Thinking skills help children cope with the real world (25, p. 44).

Computers in Science

Elementary science instruction is weak for a number of reasons. Teachers often have little background in science and, therefore, feel unprepared and uneasy about teaching it. Science is not given high consideration in the time schedule or the budget, especially in recent years. Nonetheless, there is general agreement about what science education ought to be. A report prepared by a federally sponsored commission on science, math and technology education notes that the elementary science program should be made up of daily lessons with frequent hands-on experience taken from all the science disciplines (57, p. 26).

The computer can aid in science instruction; however, at this time, the field is not well developed. The demand has not been great because of the small time allotment for science and the small size of the science
budget in most schools. The software presently available for science instruction is scarce, and much of it is of poor quality. Most educators who use computers for science instruction at this time write their own programs (57, p. 26, 28).

Bill McDonald, of the Montgomery County Center, cautions against the purchase of programs that are strictly drill and practice because such programs do not provide good science experiences. He also warns that some people who program do not use accurate information, so content of programs should be examined carefully. Mr. McDonald advises the purchase of software that suits the established science curriculum. Computer programs should be an integral part of the curriculum not a separate instructional unit (57, p. 28, 32).

The computer can be used to do mathematical calculations quickly. In this way, science experiments that involve difficult calculations but simple concepts can be done with the aid of the computer. Teachers at the Montgomery County Center use an experiment designed to show how much salt is in the sea water. The students do the experiment, the computer does the equation and puts a representation of the salt and water on the screen (57, p. 28).

At Talcott Mountain Academy in Avon, Connecticut, a private elementary school grades 5 – 8, Marc D'Antonio, an astronomer and teacher, has his students use the computer to calculate and map the probable locations of different stars at a given time. Then he has his students check their predictions through observation of the stars.

Simulations are also used and made by students at Talcott. One student created a program that simulates the dissection of a tadpole. Other children use this program to guide them in dissecting a real
tadpole. The emphasis at Talcott Mountain Academy "is on getting students to realize that the computer is a tool—a means, not an end," says Terry Tirrell.

Computers in Social Studies

Educators in the field of social studies agree that the process of gathering, categorizing and analyzing information and making generalizations based on that information should be emphasized in the elementary social studies curriculum. Although textbook facts need also to be taught, the social studies teacher should help students develop skills that will be valuable for a lifetime, information gathering and analytical thinking skills.

The teaching of social studies using the process approach is not dependent upon the computer. Students can use surveys or interviews to gather information, plot and graph the information, and make displays or reports to analyze the results and not use a computer. However, data base programs are being enthusiastically considered by those educators looking for ways that the computer can contribute to a process-oriented social studies curriculum (39, p. 32).

Although data base programs are gaining the greatest amount of attention, there are some other programs that deserve praise also. There are several popular programs that involve students in simulation. "Oregon Trail" by Minnesota Educational Computing Consortium and "New Word Discovery" by McGraw-Hill Search Series are two of these simulations (39, p. 42). Unfortunately, such programs are not plentiful, and a lot of software now available for social studies is drill and practice of states, capitals, continents, U.S. presidents and the like (39, p. 32).
Not every area of study lends itself to the kind of sorting and analyzing that data bases do best, but a computer, when used where it is most appropriate, can raise interest and inspire investigation. "The computer adds possibilities and a touch of magic that delights teachers and students alike" (39, p. 42).

Computers in Writing

Writing, as a subject, is being discussed by language arts educators today because students are failing to learn to write. James Howard, senior associate of the Council of Basic Education and author of Writing to Learn, emphasizes that writing is more than the ability to use good grammar, to spell and punctuate correctly. "Good writing is evidence of good understanding." Mr. Howard advocates writing in all subject areas to help students really learn. In his opinion, writing is one of the best means that students have of learning and knowing (8, p. 22).

According to Donald Graves, researcher, author and professor of education at the University of New Hampshire, students need to study what they write to see that it matches what they intended to say. However, students are often hindered in their writing by the feeling that what they put on paper with a pen is somehow sacred or unchangeable. Often feedback from other readers is valuable in finding missing or misleading information. To get this aid, however, students must copy and recopy the entire paper.

The computer, equipped with a word processor, enables the student to produce temporary, rough copies easily and get feedback from readers quickly. Because the process becomes less tedious when the computer is used, students may be more likely to revise written work. Mr. Graves
believes that a crucial breakthrough in writing is achieved when a student senses the gap between what he wrote and what he intended to say, and the computer can help in this breakthrough (8, p. 24, 26).

David Thofern, a fifth grade teacher, looks at writing as a process rather than as an isolated task. Children first brainstorm, organize ideas, research their subject and outline what they plan to write. Then they actually write their thoughts. Next, they analyze, synthesize and evaluate what they wrote. Finally, they revise, edit and publish their works.

In this process, students are required to find a sense of purpose and vision of an audience. They revise their works because they realize that they haven’t gotten their ideas across to the intended audience. Although the computer won’t teach this attitude toward revision, it does make the revision process a lot easier. A word processor allows students to insert, delete or rearrange words with a few keystrokes. It also produces professional-looking papers that please students (8, p. 24).

The teacher is important in the teaching of writing. The teacher must help students to realize the purpose of their writing, discern the audience to which they are writing and decide when their ideas have been clearly presented (8, p. 24). The teacher must also present the computer and its functions to the students and give them supervised hands-on experience with purpose, so that the computer becomes a usable tool for communicating ideas and not just a machine that absorbs or overwhelms them (8, p. 22).

Technological Training

Those educators who recommend integrating computers into the elementary classroom and curriculum want to take advantage of the capabilities
of the computer as an instructional tool. They hope to better prepare students for our technological world by producing students who are not afraid of the technology that is developing and who can use that technology to its fullest (3, p. 64). They contend that the students of today must be educated in technology so that they can make intelligent decisions concerning its use in the future (28, p. 169).

Their efforts are in response to reports from commissions, business leaders, educators, parents and government officials that presently many of this generation of Americans lack understanding and the skills to actively participate in our technological world (3, p. 64).

Motivational Force of the Computer

Educators have found that the strong motivational force of the computer often overcomes fears of inadequacy and previous failure, and allows students to pursue a different path toward mastery of the skill. It allows a chance to catch up in areas of weakness with little antagonism (61, p. 31).

Often students thought to have either discipline or learning problems have benefitted the most from computing. A well-designed program is individualized in pacing and feedback, and is able to meet the needs of students and, by this, avoid many discipline problems (61, p. 32). The computer makes children want to try more (10, p. 176).

Karen Bryant, a top educator, found the computer to be of equal attractiveness to both girls and boys. She cautions against forcing students to use the computer, but she advises trying a variety of types of programs to gain interest in the computer (38, p. 86).

Conclusions

Integration of the computer into the curriculum can be successful
once it has been decided what is good teaching practice in each subject area and programs have been located that follow good teaching practice and meet the instructional needs of the students involved. There are many types of programs from which to choose. There are also several different viewpoints taken concerning the function of the computer in the scheme of the daily instruction in each of the subject areas. Nevertheless, however the computer is designated function, the motivational force of the computer has proved to be one of its great assets, getting and keeping the interest of many students.
CHAPTER IV

COMPUTER SOFTWARE

If the computer is to make an impact on elementary education, curriculum must be designed and integration made complete. To accomplish both of these tasks, greater attention must be given to educational software (54, p. 69). The quality of educational computing depends greatly on the quality of software present at the school and the way that it is used (29, p. 245).

A Look at Software Quality and Availability

Although the amount of software available has increased greatly in most subject areas over these past few years, the quality of much of this software has been consistently low overall. As the numbers of computers being used in schools grow, the potential buyers of low-quality software will grow as well. It is very difficult for teachers and administrators to judge the quality of software, especially since so much of it is of such low quality. They are easily satisfied with an inferior product because they have not experienced a superior one (5, p. 240-242).

Evaluators working for the EPIE Institute found that 60% of the programs they evaluated fell in the categories of "Not Recommended" or "Do Not Consider," 35% were labeled "Recommended" and only 5% were viewed as "Highly Recommended" as of April 1984. It was also found that only 20% of the programs evaluated were learner-tested by the publisher during the developmental processes. Not only this, but often designers of programs also missed another vital consideration in the development of
software, that is, interactive feedback. These two elements, learner-
testing and interactive feedback, would greatly increase the educational
value of the software published (29, p. 247–248).

**Reasons for Low-Quality Software**

The field of educational software development is still quite young,
and this fact contributes to the problem of low-quality software. (29,
p. 246). Some contend that good languages have not yet been developed
for personal computers and that too many languages and dialects exist,
causing difficulty in developing good educational software (27, p. 174).
The expense of marketing, which sometimes becomes the major focus of the
producers, also detracts from the money available for careful design and
evaluation (29, p. 247).

Most state purchasing agencies want textbooks and software to be
correlated, so many publishers are supplying a complementary line of
software to go along with their textbooks. A problem often arises,
however, when software is no longer being used as it was intended and
becomes merely a textbook on the screen (54, p. 69).

**Characteristics of Poorly Designed Software**

There are several factors that characterize poorly designed soft-
ware. The failure to use the interactive capabilities of the computer
and the use of extremely weak forms of it, such as multiple choice
questions, are signs of a poorly designed program. The lack of indi-
vidualized instruction is extremely detrimental to the value of a program.
Programs that use the computer screen as a textbook page or include lengthy
and difficult instructions are not well designed for these have extreme
difficulty holding the student's attention. Too much reliance on a
text or other auxiliary print materials is not good. Reliance on pictures
or other material that is entertaining or attractive but plays no role in helping students learn the material is evidence of poor design. Programs which contain content that does not fit anywhere in the curriculum and games that have no educational merit should not be purchased either (23, p. 241). According to some in the educational computing field, the knowledge of how to produce high-quality software is available and is largely going unused. Programs are not being carefully designed and evaluated (5, p. 241).

**Producing High-Quality Software**

The ideal developmental process would include a team of professionals relying on carefully designed procedures for developing and evaluating and sufficient funding for completion of the task, producing a product of true value to the teacher (5, p. 241).

The development of good learning material is not simple. It demands competent people to carefully make improvements. It is costly; no effective shortcuts are available for developing computer-based learning material. Effective ways of producing computer-based learning exist and have produced sizeable amounts of material at costs comparable to those of any good curriculum development. The best test of any method of production of computer-based material is the learning effectiveness of the material produced (4, p. 179).

Across our nation, computer companies are busy working to win public school contracts, and the demands of schools are being well thought out. Experts believe that surviving this great competition will depend not only on prices, but also on the company's ability to encourage production of high-quality software for its microcomputer (46, p. 303).
The Difficulties Involved in Evaluation and Purchase

Purchasing computer software is a difficult task for a number of reasons. Presently, there are a great number of products and companies in the computer software field, making it difficult to locate a reputable company from which to make purchase. The programs themselves are difficult to select also (29, p. 245).

Teachers' guides, scope-and-sequence charts and lists of instructional objectives which would help to provide a sense of how the materials can help in teaching seldom accompany software packages. Few software producers allow previewing of their product before purchase, because they are afraid that the program will be illegally copied and returned unpurchased. Even when previewing is granted, assessment is difficult because programs should be tested with real learners which is time-consuming. But, even when these difficulties have been overcome, high-quality software is difficult to find (29, p. 246).

Seeing through the veil of very effective advertising campaigns is a difficult task for most consumers. High-quality software is often hidden by the glittering advertising of its low-quality competitors. Often, the producers of high-quality software can not afford the advertising necessary to make their products known (29, p. 248).

State Leadership Assistance for Technology in Education, a federally funded project, concluded that federal officials need to provide information about and analyses of programs to state officials who work with technology in the elementary school (48, p. 302).

Charles Blaschke, president of Education Turnkey Systems Inc., suggests that officials form statewide (or multi-state) coalitions for software development, distribution and evaluation. In this way, the
coalitions could correspond with the software publishers in a more unified and efficient way than individual schools (48, p. 301-302).

The Computer Technology and Reading Committee of the International Reading Association suggests that local area and national networks of information should be designed to make a pool of information about software on the market available to teachers who make software selections and provide linkage and information exchange among institutions and professional exchange among institutions and professional organizations (13, p. 82).

Ken Brumbaugh, executive director of the Minnesota Educational Computing Corporation, would like to see reviewers of software publish a list of the best software from each discipline or grade level so that state or regional centers could make those products available for teachers to sample before purchasing from the company. He also feels that state educators are wasting time and money conducting their own software reviews that duplicate existing reviews (54, p. 71).

Some Steps Toward Solving the Problem

The SLATE project reports that state officials in education are getting involved by examining ways to use computers to help students learn mathematics and science. Mr. Blaschke has observed districts joining together to create statewide telecommunication systems for the sharing of information and educational materials (48, p. 301-302).

For the last two years the Educational Products Information Exchange (EPIE) Institute has maintained a database that continuously monitors the entry of all commercially available software onto the market. Relevant consumer information is stored and updated and made available to all schools
in states that support the function of the database. The project was established to provide schools with reliable software information about what is available, what each program is designed for, the cost, what hardware is necessary and evaluation recommendations.

Teams of trained software evaluators assess the quality of a representative sample from the database. They use a carefully researched system of software evaluation that analyzes and assesses the instructional and technical design of each program. They also test the program with learners. The process is very expensive and time-consuming, but it is producing the most valid and reliable software evaluations now available (29, p. 247).

Molly Watt, a top educator, suggests that teachers within a school each focus on one type of software and become specialized in evaluating that type, then share the evaluations made with all other teachers interested in them (38, p. 88).

It is realized, however, that the teachers expected to make such evaluations are limited in their knowledge of computers and available computer software. It is helpful to remember that evaluating computer software is similar to evaluating any other type of learning program.

The following is a list of questions that should be asked about software that is being evaluated.

1. For what purpose will the software be used? Will it teach new information, skills, or concepts, or will it reinforce or supplement, providing enrichment or remediation? Will it provide development of computer literacy or simply entertain?

2. Who will be using the program? What are the age, grade, and ability of its intended users? Can it meet their developmental needs?
3. What are the objectives of the program? Are they clearly stated in accompanying literature and evident in the program?

4. What knowledge and skills must the user possess in order to find success with the program? Do the intended users possess these?

5. Is the program making full use of the interactive capabilities of the computer?

6. Is the program likely to motivate and interest the intended users?

7. Who is in control of the program – the computer or the student? The student needs to be able to go at his own pace, review instructions and material, loop back, and exit.

8. Is the ability level suitable to the intended users? Does it have more than one level?

9. Is the design instructionally sound? Is it logically organized?

10. Are the instructions to the program clear and short, with limited points and appropriate vocabulary?

11. Is the reinforcement positive and non-degrading? Is there generous praise for correct responses and little or no positive reinforcement for incorrect responses?

12. Does the program provide record of student progress which is valuable to student and to teacher?

13. Is the program grammatically sound and free from unnecessary computer jargon and spelling errors?

14. Does the screen lay out and design (color, line, graphics, music) help make the program effective? Is the print clear and easy to read?

15. Can the program be used over and over by the same student without becoming boring? Is the program free from dated material that might make it inappropriate in the near future?

16. Is the command code that runs and loads the program both simple and clearly displayed in the accompanying instructions?

17. Are the operating and instructional manuals helpful, well-organized, and easy to understand? Is key information readily available and clearly stated? (3, p. 250)
The Role of Educators

Educators today may be able to affect the quality of software being produced by diligently searching for high-quality software and purchasing only that which is well designed. Of course, training and informing teachers about what to look for in quality software is of utmost importance in reaching this goal. Such discrimination in selection of software may cause companies that produce consistently low-quality software to change their practices or leave the field (29, p. 246, 248). However, even if educators become more discriminating in their software purchasing, there might still be a wealth of mediocre and poor programs on the market because of the increasing number of educational programs sold to parents for use by their children at home. And for this reason, producers may not be forced to improve the quality of their software at all (49, p. 247). Nonetheless, the students will still benefit from the efforts that teachers put forth in finding high-quality software for use in the schools.

Conclusions

The purchase of well-developed software is vital to integrating the computer into education. The educator has much to choose from, the competition between computer companies is great. Guidelines for evaluating the software available are a great help to the educator who is faced with sorting through low- and high-quality software looking for programs best suited for the students he teaches. Reviews of software available can also help the educator choose wisely the software to be purchased. As educators learn to evaluate software and choose only high-quality material, computer companies may produce more high-quality software for purchase.
CHAPTER V

EXPECTATIONS OF COMPUTERS IN EDUCATION

Computer companies have exaggerated the advantages of the computer for students through their media campaigns, and parents have formed expectations, accordingly. Parents, therefore, are putting pressure on educators to produce an educational computing program that will produce great success among their children. Educators, without the knowledge, experience, or funds to do so, are caught in the middle. They need to determine carefully the best way to incorporate the computer into the curricula, but feel they must act quickly in response to parental demands for computers in the classroom.

The American educational system is undergoing some real reconstruction, and the computer is at the heart of many of these changes. Much research is being planned and conducted to determine the computer's place in our educational system. Many improvements are expected both in educational computing and in education as a whole. There are, of course, some who object to the use of computers in education. Others, however, see computers playing an important role in education in the near future.

Advertising Affects Parental Expectations

Computer companies are producing an advertising campaign that in effect tells children and their parents that success in school and life is directly tied to owning a computer. Bonnie Brownstein, a top educator, worries about what these advertisements are saying to children whose schools don't have computers and who parents can't afford to buy
them. She feels the message can be devastating. It may be telling eager children that they have no chance for success because they have no computer. Dan Watt, another top educator, feels also that the advertisements exaggerate the advantages a computer can give students. He does feel, however, that access to computers will give people a better chance for success and that our society should make certain that all people have access not only to computers, but also to all technology that is affecting the way our nation thinks and works (38, p. 83).

According to Talmis, Inc., a market-research group, one out of every six parents with school-age children has already purchased a computer for their child's use at home. This statistic indicates that parents are hearing the advertiser's message. They think that they are buying their children some real advantage in education (29, p. 245). David Moursund, a top educator, reminds us that an intellectually challenging environment—both in school and at home—gives children a real advantage over others who do not have such an environment. He concedes that, in some ways, a rich intellectual environment can be bought, but he also points out that the purchase of a computer cannot make up for a lack of intellectual input from parents. The average parent cannot make his child a success simply by buying a computer. A computer with no plan for helping the child learn to use it and to tie it to what he is learning at school will do very little good for the child (38, p. 83).

**An Innovative Response to Parental Expectations**

Most schools responded to parental demands for computers in the schools by pursuing the goal of "computer literacy." However, recently, some school districts began offering training to parents on how to make
effective use of the computer at home in supporting what the child is learning at school. The schools are helping the parents exchange hardware and software either directly from parent to parent or through the local libraries. Some districts are even helping parents purchase computers under extensions of their purchasing contracts at significant discounts. In some districts, low-income families who participate in the parent training program are being loaned computers purchased from monies raised locally and through federal or state dollars (29, p. 245, 248).

A More Typical Response to Parental Expectations

Most educators are feeling pressure from parents whose expectations for the computer has been shaped by the advertisements. They feel that they must pursue educational computing, yet they also feel that they are undertaking a task for which they are not prepared in knowledge, numbers, or finances. They know that if they do not commit themselves fully to the task of helping to realize the great potential of educational computing, they will be criticized for failing to meet their responsibility of preparing students for the future (29, p. 245, 248). Educators sometimes get too concerned about quantity instead of turning their attention toward quality. Quality is an easier variable to express to parents. Finding quality software is a more difficult task, and truly incorporating the computer into the curricula is even more difficult.

Need to Make an Active Response to Parental Expectations

Regardless of the difficulty of the task, teachers cannot ignore the facts that computers are a part of our daily lives and that computer
companies and parents are striving to get the computer involved in education as well. Teachers, therefore, need to consider how they can best incorporate this new technology into their classrooms and begin including the computer where they can. Teachers' knowledge and input will be of great value in helping educational computing, its hardware and software, grow toward goals that can best suit students and teachers in the schools (56, p. 253).

Many of the decisions concerning the direction that educational computing will take in the near future can lie with teachers. Teachers need to find or be given a vision for the creative ways computers can help children explore things differently. It is crucial that computers make a qualitative change in children's education. The computer should not simply do the same old stuff in a more streamlined way (7, p. 22). Only the motivation of the vast potential that the computer has can keep teachers striving to find the right amounts and types of learning material and hardware and thus shape educational computing into a true benefit for our children (10, p. 173).

If educators choose not to become involved in the development of educational computing, the end may be a continual spiral downward for the students of our nation. If educators take an uninvolved, business-as-usual approach, commercial forces will increasingly dominate the development of computer-based material and distribute low-quality software to schools and homes. Most instruction at all levels will remain centered on books and lectures, and computer-based material will only be supplementary. Teacher training programs will continue to ignore the interactive capabilities of the computer. The achievement of students
will continue to drop, accelerated by the use of low-quality software. Eventually, large American corporations will be forced to find well-trained workers overseas to fill the positions that American workers will not be equipped to hold (5, p. 242).

**Expectations in the Development of Computer-Based Learning Materials and Curricula**

Political and business leaders alike agree that in order for the United States to maintain its world position and for it to provide the best possible education for its citizens, the national system of education must be reformed from first grade through college. The development of new curricula and curricular materials is the beginning of this reformation. Some are making an effort to include computer-based learning materials in the new materials being developed. Such materials must incorporate a wide range of learning theories and approaches. Learning modules will be developed in each content area to insure that our educational system becomes more diverse and pluralistic (5, p. 243).

Research efforts to learn how better to use the computer require much funding. Funding may increasingly come from federal grants but may also come from states, learning materials companies, foundations, and industries. Centers could be established all over the country for both research and development of new learning materials. These centers would combine a spirit of cooperation and rivalry that would help materials develop in a variety of approaches. The centers would be concerned with developing massive quantities of high-quality learning material, both computer-based and in other media, for entire courses of study. The development will consider newer, non-traditional options of school organization and delivery of material (4, p. 179-180).
Expectations of Organizational Changes

The new curricula and curricular material will lead to changes in the organization of schools and to new and more dignified roles for teachers. Many activities that now take place at school will shift to the home, the public library, and other places, since computer-based learning can take place almost anywhere. Those activities which can best be done in groups, however, will continue to be done in the school (5, p. 243). The declining cost of computers will make them more available to families and thus make this organizational change more probable. Some predict that the home will become the main learning center in the next ten years (35, p. 302).

Computer Expected to Become A Tool

As computer technology finds its way farther into more schools, computer hardware and software will develop in a more decentralized and humane fashion. Computers will be as common in the classroom as they are in other fields. They will be a tool much like pencils and paper are today. Textbooks will often include floppy disks with copies of the programs used within the book. The gap between the educational opportunities enjoyed by the rich and the poor will have narrowed. Students will be learning to evaluate critically the information that their home computers provide. The school, using the efforts of teachers and computers, may play a central role in the moral and intellectual development of youngsters (56, p. 254).

Expected Improvement in Educational Software

To keep educational computing on the course toward developing the computer into a tool, the quality of educational software must increase
soon and be put to good use both at school and in the home (29, p. 248). Unfortunately, the improvement might be too late to reverse some trends that are leading away from the goal of integration of computers in the curriculum and classroom. According to the 1983 John Hopkins study a large number of teachers that originally felt the computer could help them teach basic skills to their students now feel that the computer is best used simply to teach computer skills. Such teachers seem to be disenchanted with drill and practice software (54, p. 71).

Objections to Computers in Education Refuted

As with all new ideas, there are those who object to the use of computers in education. Some feel that the computer brings with it a "sterile environment," and there are undoubtedly some unpleasant side effects with any type of modern technology. One must consider, however, that most modern life depends on modern technology of which the computer is a key element. Business and industry use computers daily, and the computer's usefulness in these areas speaks for itself. As the use of computers continues to grow, the schools become more obligated to prepare students for the world in which they must live through the introduction of computers into the classroom.

Others object to the use of computers in the classroom because they observe that some students, because of lack of funding or various handicaps, are not given the same opportunities as others. The question of equity in education is admittedly a problem, not only with computers but in all aspects of education (19, p. 258). The best way to deal with the problem of equity is to creatively address the problem rather than attack the use of computers.
Karen Bryant, a top educator, feels that teachers are the key to solving part of the equity problem. She feels that teachers can inspire and convince a reluctant principal and school board to purchase more computers and software for use in the classroom (38, p. 86).

There are also many computer scientists now at work developing talking microprocessors and terminals so that blind, visually impaired, speech impaired and other handicapped people can use computers despite their handicaps. The efforts are producing results, but much is still needed in this area (59, p. 27).

Future Developments With The Computer

The computer will play a dominant role in future educational systems. The number of computers in schools and colleges will continue to increase. Computers will continue to evolve and improve, and their price will continue to come down. Their graphics capability will increase and more choices will be offered. We can expect bigger screens and better resolution of the images on those screens. Soon video disc technology will come into wider use. We can expect such features as voice and brainwave input to become practical as well (5, p. 242). Within twenty years the computer may be the major delivery system for education at all levels and in practically all subject areas, replacing books and lectures (4, p. 179).

Conclusions

Media campaigns made by computer companies cause parents to form expectations that put pressure on educators to make often hasty decisions about the details of integration of the computer into the curriculum. Educators need to be careful to look into the specific needs of the students
and teachers involved with the computer in their school. They also need a vision for what the computer can do in education presently and in the future.

Funding is needed to conduct the continuing research necessary to learn how better to use the computer and to develop computer-based material that uses the computer to its full potential in education. The computer already plays an integral role in business and industry, and it has potential to play a similar role in education.

Some teachers and others do not see the positive impact that the computer can have on students. Some teachers see the computer as good only to teach computer skills. Some others claim that the computer has too many unpleasant side effects and for this reason should not be included in education integrally.

All considered, it looks probable that the computer will continue to develop into a real tool in the classroom. Many improvements are already being made that make them even more desirable in the education of children.
CHAPTER VI

SUMMARY

The decision of an administrator to begin a program of computer education and integration of computers into the curriculum opens the doors for many other decisions. Sources of funding must be located and a budget established. Choices about the brand of hardware and software to be purchased must be made. The placement of that hardware in the building must also be decided upon.

Administrators and teachers both share a key position in the development of the curriculum. Questions and concerns about equity in computer education must be addressed and obstacles to integration of the computer into the classroom must be overcome. Teacher training, one of these obstacles, is of key importance to the success of computer based learning and integration of the computer into education.

The administrator or classroom teacher has many different types of programs to choose from when choosing educational software. Each type focuses on different needs of the learner or different skills to be taught. Several different types of programs will be chosen according to what best fits into the existing curriculum and the needs of the intended users.

Software has been developed for many of the different content areas, so the computer can be used in many different areas not just to teach computer skills. The computer can become a motivational force for students and get or keep them interested in areas of study in which they might otherwise show little interest.
The quality of existing software poses a problem for most administrators and classroom teachers. It is difficult to screen software and locate that of high quality. Often times the software of superior quality goes unnoticed because the manufacturer cannot afford sufficient advertizing, while low-quality software is plentiful. There are some pains-taking steps that can be followed to locate or recognize good-quality software.

Manufacturers of hardware also use extensive advertizing campaigns. They have created the disillusion that computers are a "quick-fix" to our nation's educational problems. Parents often times respond by pressuring educators to provide more computer instruction, and educators neglect sometimes to strive for true quality in the educational computing that they provide.

Despite the present difficulties that the educational computing field is experiencing, computers will continue to make their way into our educational system. In fact, our educational system is undergoing changes, and the computer is specifically being incorporated into the revised system and included in the future plans.
BIBLIOGRAPHY


