DOCUMENT RESUME

ED 202 675 SE 034 840

AUTHOR Kansky, Bob
TITLE Instructional Computing in Wyoming: Status and Recommendations.
INSTITUTION Wyoming Univ., Laramie. Science and Mathematics Teaching Center.
SPONS AGENCY Wyoming Univ., Laramie. Center for Research Services and Publications.
PUB DATE 81
NOTE 51p.

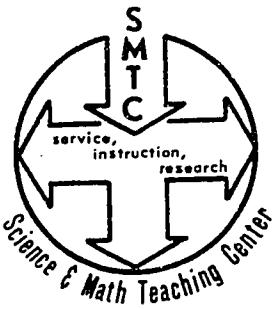
EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS *Computer Assisted Instruction; Elementary School Students; Elementary Secondary Education; *Instructional Innovation; *Mathematics Education; Mathematics Instruction; *Science Education; Science Instruction; Science Programs; Secondary School Students; State Surveys; *Teacher Attitudes
IDENTIFIERS Wyoming

ABSTRACT

The status of instructional computing in Wyoming's public schools as of April 1980 is reported. Specifically the document indicates the nature and extent of computer usage in grades K-12, summarizes teachers' opinions regarding the potential instructional uses of computers in the schools, and presents the recommendations of a select committee of Wyoming educators with respect to the statewide development of instructional applications of computers. (Author/CS)

INSTRUCTIONAL COMPUTING IN WYOMING:

STATUS AND RECOMMENDATIONS



Bob Kansky
The Science & Mathematics Teaching Center
Box 3992 University Station
Laramie, WY 82071
1981

Funding for the printing of this report was provided by
The Center for Research Services and Publications
The University of Wyoming
Laramie, WY 82071

PREFACE

This paper reports the status of instructional computing in Wyoming's public schools as of April 1980. Specifically, it indicates the nature and extent of computer usage in Grades K-12, summarizes teachers' opinions regarding the potential instructional uses of computers in the schools, and reports the recommendations of a select committee of Wyoming educators with respect to the statewide development of instructional applications of computers.

This study was executed by Bob Kansky of the Science & Mathematics Teaching Center of the University of Wyoming; he is the author of this report. The results of the survey were interpreted and recommendations were formulated by the Wyoming Ad Hoc Committee on Instructional Applications of Computers. The members of the Committee are:

Barbara Babbitt, Cheyenne
Richard Kean, Cheyenne
Robert M. Krisko, Thermopolis
Patricia Lang, Cheyenne
Rita Livingston, Casper
Walter H. Miner, Cheyenne
Robert L. Morissette, Cheyenne
Burl A. Parker, Cody
Barbara Robb, Big Piney
Emma Jo Spiegelberg, Laramie
Joe Stepans, Pinedale
Charles J. Wing, Cheyenne

This report has been prepared under the editorial direction of the Committee.

TABLE OF CONTENTS

LIST OF TABLES

SECTION 1

INTRODUCTION

Historical Notes

In September of 1979, selected public school educators from across Wyoming were convened for the purpose of directing statewide policy and procedures regarding instructional uses of computers. The 54 participants came from 22 of Wyoming's 50 school districts. The group included teachers from every precollege grade level, secondary teachers from seven subject areas, administrators, and curriculum coordinators.

The report of this conference[1] contains 39 resolutions. Resolutions 35-39 directed the Science and Mathematics Teaching Center to assist the Wyoming State Department of Education in conducting a survey

(a) to determine the nature and extent of computer usage in Wyoming's schools and

(b) to obtain the opinion of Wyoming educators regarding the potential uses of computers in the schools.[2]

The call for the survey was unanimously endorsed; discussion urged that it be done as soon as possible.

A task force of conference participants reviewed and modified a survey instrument submitted by the SMTC. In presenting the revised instrument, the task force urged that a multilevel, interdisciplinary group of public school educators be called upon to view the data gathered and to participate in the writing of conclusions and recommendations drawn from that data.

---

[1] Kansky, Bob. Conference Report: Wyoming Invitational Conference on Instructional Applications of Computers. Laramie: Center for Research Services and Publications of the University of Wyoming, 1979. (ERIC: ED 186 262).

[2] Ibid., p. 37.

Purpose of the Study

As early as the Fall of 1976, regional conference of public school educators and SMTC faculty revealed a growing concern for and interest in the functions of computers in precollege education. Students entering the University of Wyoming or one of Wyoming's seven community colleges were finding that many fields of study required work in computer science. Some schools had purchased (or were in the process of purchasing) computing time on available time-sharing systems; others were purchasing the new and inexpensive microcomputers.

By the Fall of 1979, the SMTC was getting frequent requests to aid school districts in selecting hardware or in locating instructional software for systems that already had been purchased. Conversations with school district personnel revealed that little or no thought had been given to the broad range of instructional uses of computers. The issue of "use" was usually an after-purchase consideration when hardware stood idle for lack of trained personnel or appropriate software. Statewide there was a need for planning, coordination, and education regarding instructional applications of computers.

At the 1978 Invitational Conference, Wyoming teachers expressed their willingness to guide the statewide development of instructional computing. Moreover, they decided that such development should take into account (a) computing activity currently taking place in Wyoming schools, (b) educators' opinions regarding possible instructional uses of computers, and (c) the implications of instructional computing with regard to teacher education.

The Wyoming Public School Computer Usage Survey was proposed as a means of sampling the status of these activities and opinions. It also was to be the basis of recommendations to professional organizations, public schools, the University of Wyoming, and the Wyoming State Department of Education regarding planning for and implementing computing activity in the schools.

Assumptions

The preparation for and execution of this survey of instructional computing was guided by six assumptions:

---

[3] Wyoming's only four-year postsecondary institution.

1. There is immediate need for a coordinated statewide effort to assist precollege educators to take full advantage of the instruction potential of computers.

2. Assessment of the opinions and expressed needs of precollege educators is prerequisite to the development of organized programs to facilitate the application of computers to instruction.

3. Many valuable instructional applications of computers do not require programming knowledge on the part of the user.

4. Significant applications of computers are to be found in every area of the school program (academic and extracurricular) and at every grade level (K-12).

5. Cooperation among all segments of the educational community (elementary and secondary schools, postsecondary institutions, professional associations, and governmental agencies) is necessary to the planning and implementation of instructional computing.

6. The opinions and needs expressed by Wyoming's precollege educators are not peculiar to Wyoming's educational environment and, hence, should be made available to other persons interested in developing instructional computing in Grades K-12.

These assumptions are the basis of four fundamental decisions relative to the execution, interpretation and publication of the survey.

1. The survey must sample the opinions of educators at all grade levels (K-12) and in as many subject disciplines as possible.

2. The survey must sample the opinions both of educators who have access to instructional computing facilities and educators who do not have such access.

3. Interpretation of survey data must be the responsibility of a group of educators which is broadly representative of the population sampled.

4. In the execution of this study, the appropriate roles for University and State Department personnel are those of consultants and facilitators.

5. The results of the survey should be transmitted to every school in Wyoming.

6. The results of the survey should be made available to educators outside of Wyoming.

An Inter-Agency Project

Three levels of Wyoming educational structure cooperated in the planning, execution, reporting and funding of this survey. This joint ownership evolved naturally from an overall plan to call upon the expertise of the group best qualified to perform a given task. It also was an expression of the commitment of each of the three groups -- the Wyoming public schools, the Science and Mathematics Teaching Center (SMTC) of the University of Wyoming, and the Wyoming State Department of Education -- to utilize survey results in aiding the development of instructional computing throughout the State.

This study is primarily a project of the public school educators of Wyoming. The study was called for by them at the Invitational Conference in September of 1979; they stated the questions to be answered by the study and participated in the design of the survey instrument. In September of 1980, twelve of the 54 Invitational Conference participants attended a Survey Analysis Conference at the request of State Superintendent Lynn Simons. Those twelve persons comprise the Wyoming Ad Hoc Committee on Instructional Applications of Computers (Appendix I) which was charged with the analysis of survey results and with the generation of recommendations based upon those results. The Committee also served as an editorial board in reviewing this report.

The SMTC organized, funded, and directed the Invitational Conference (1979), developed the survey instrument, and gathered the data. SMTC faculty planned and directed the Survey Analysis Conference (1980) and, with the editorial oversight of the members of that conference, prepared this report. It has since taken actions which have resulted in the implementation of certain of the recommendations proposed in the report.

The Wyoming State Department of Education (SDE) sent representatives to both the Invitational Conference and the Survey Analysis Conference. It served as host

for the Analysis Conference, paying the expenses of the twelve Committee members invited. The SDE also paid all mailing costs associated with the survey. Most important of all, the SDE endorsed the survey with a cover letter (Appendix II) from Wyoming's Science/Mathematics Education Coordinator. This endorsement made the study an official data-gathering activity of the SDE and thus assured a high response rate from the schools.

SECTION 2

DESIGN AND EXECUTION OF THE SURVEY

Questions to be Answered

The call for a status survey was anticipated at the time that the 1978 Invitation Conference was being planned. Members of the SMTC faculty met with the officers of the three Wyoming affiliate groups of the National Council of Teachers of Mathematics (NCTM)[4] to generate a list of questions that should be answered by such a survey. This was done on the understanding that these questions would be addressed in the design of a (draft) survey instrument to be presented at the Conference. The result of this activity was a set of principal questions which fell into four categories.

A. Questions about access to computers.
   1. What percent of elementary/secondary schools currently have access to computers?
   2. If a school has access to computers, what percent of the time-of-use is reserved for administrative applications? For instructional applications?

B. Questions about current uses of computers.
   1. If a school is making administrative uses of computers, what specific applications are being made?
   2. If a school is making instructional applications of computers, what specific applications are being made?

---

[4] In 1981, these three affiliates combined to form the Wyoming Council of Teachers of Mathematics.

C. Questions about equipment being used.

1. What kinds of equipment are being used and how much is available?
2. What computer languages are available?
3. What is the financial basis of the acquisition of computer services (e.g., purchase, lease)?

D. Opinions about instructional uses of computers.

1. What general instructional purposes support the use of computers in instruction?
2. What group(s) of teachers should have preservice instruction in the educational application of computers?
3. Should Wyoming create a certification standard in computer science?
4. What kind of inservice education should be provided regarding instructional applications of computers?

It was suggested that the data should be gathered in such a way that answers to all questions could be separated into gross grade-level categories (i.e., elementary and secondary). Furthermore, data collection should permit the separation of responses to questions from categories C and D along a dimension of computer availability (i.e., according to whether or not the respondent's school has access to computers).

Development of the Survey Instrument

Using the questions listed above, a first draft of a survey instrument was prepared during the Summer of 1979. This draft was reviewed by two groups of teachers: the officers of the NCTM affiliates and a group of 12 teachers attending a summer workshop on instructional computing. The instrument was revised based upon suggestions from the two groups; the new draft was reviewed and modified by a task force of the Invitational Conference. The resulting instrument was further modified as the result of suggestions of 22 experienced teachers of mathematics attending a conference at the SMTC in March of 1980.

The final version of the survey instrument (Appendix III) gives operational definitions of the two terms which are central to the study. First, it defines "computer" as follows.

> A *computer* is a machine that operates under the control of a stored program. The term *computer* includes the central processing unit, auxiliary storage, communication links, and all peripheral equipment.

The definition of "computer" goes on to exclude programmable desk top calculators and electronic accounting machines because they do not permit the broad range of applications suggested in the survey.

The second term requiring operational definition is "computer access." The term was meant to include a variety of means by which computer services can be made available for administrative or instructional use. It was decided to eschew a formal definition in favor of a definition by example.

> A school is said to have *computer access* if a computer is available to the school's faculty or administration in one or more of the following ways:
>
> - The computer is physically located in the school building.
> - The school has one or more terminals which are connected to a computer located outside the school building.
> - The computer is located near the school. Faculty/administration go to that location to use it.
> - Faculty/administrators do not personally interact with the computer, but computer services are provided by mail or phone by the school system, a bank, an industry, etc.

The items of the survey are then divided into four sections:

Section A: General information about the school

Section B: Opinions regarding instructional uses of the computer in the school

Section C: Current uses of computers by the school

Section D: Description of computer equipment being used by the school

Any school having access to a computer was asked to complete all four sections; any school not having access to a computer was asked to complete only Sections A and B.

Most of the items on the form called for one of three types of responses: checking one or more items in a list, checking one member of a dichotomy (yes/no),

or circling one of five numbers corresponding to an opinion. Items A.1-A.7 ask for simple descriptive information about the school; Items D.2-D.4 request descriptive information about computer hardware and its use. By design, written input from the respondent was kept to a minimum and was carefully structured. The directions invited but did not require the respondent to make comments.

Simplicity-of-response was a major design concern for two reasons. First, it is generally recognized that open responses on a lengthy questionnaire "are burdensome to the respondent, are apt to induce respondent fatigue and hence response errors, refusals, and incomplete questionnaires, and may contribute to higher nonresponse rates in subsequent surveys involving the same respondents."[5] Since it is intended that the respondents will be called upon to complete future questionnaires which focus upon issues identified by this broad survey, maintenance of respondent goodwill was an important concern.

The second reason for the emphasis on simple responses was the understanding that the data would be summarized and analyzed without the aid of a computer. This apparent inconsistency of using hand labor to process a survey on instructional uses of computers was introduced by both circumstance and design. The circumstance was that the University was to undergo a total change of computers at the time (summer) at which the data would require processing; computing services were in doubt. The design consideration was in the fact that a select group of teachers was to be given the task of summarizing the data and interpreting the patterns observed. Since important decisions governing data summary would be made by that group and could not be anticipated, data reduction had to be postponed until the group had convened. That meeting was scheduled at a time and location which precluded the use of a computer.

A Two-Stage Study

The gathering and analysis of survey data took place in two stages. The first stage, operating under agreements made at the Invitational Conference, was under the control of the Science and Mathematics Teaching Center. It involved the

---

[5] Ferber, Robert et al., What is a Survey (Washington: American Statistical Association, 1980), p. 10.

selection of a population to be sampled, the final refinement of the survey instrument, the gathering of data using the instrument, and the analysis of data regarding (1) the nature of the sample (i.e., those schools providing usable responses) and (2) the general nature -- administrative or instructional -- of the use of computers by that sample.

The second stage of the analysis of survey data was under the control of the Wyoming Ad Hoc Committee on Instructional Applications of Computers. It made the final decisions regarding the manner in which the survey responses would be summarized, carried out that summarization, interpreted the results, and generated recommendations based upon those results.

The two-stage nature of this study is reflected in the reporting of the procedures and results.

SECTION 3

PROCEDURES AND RESULTS: STAGE 1

Defining the Survey Population

Wyoming's public schools were classified as being *elementary* or *secondary*. The operational definitions of those terms are as follows.

> A school is classified as *secondary* if it includes any grade level above Grade 7.
>
> A school is classified as *elementary* if it is not secondary.

Since Wyoming has a few K-8 and K-12 schools, these definitions resulted in non-disjoint classes. This was viewed as acceptable since, in all such situations, all students are housed in a single building. The small total enrollments make any computing equipment "accessible" to students and faculty at all levels.

Using the definitions given above, Wyoming was found to have 253 public elementary schools and 133 public secondary schools.[6] It was decided that the survey form would be sent to each of the 133 secondary schools and to the 157 elementary schools having a total student population of at least 100.

Executing the Survey

In an effort to secure a high response rate, a specific contact person known to the experimenter was identified wherever possible.[7] The survey form (Appendix III), its cover letter (Appendix II), and a stamped envelope for returning the survey form then were sent to each contact person (or, if no such person was

---

[6] Fall 1979 Report of Staff/Teachers/Pupils/Schools Enrollments. Cheyenne: Wyoming State Department of Education, 1979.

[7] Such persons were identified for all 133 secondary schools and for 38 of the 157 elementary schools.

identified, to the school's principal) on April 14, 1980. A follow-up letter was sent to any school which had not responded by May 5, 1980; the letter included an invitation to call the investigator (collect) in the event that the form had been lost or there was some question regarding its wording.

General Description of the Sample

Table 1 shows an overall response rate of 83 percent for the schools in the sample. Incomplete forms reduced the usable return to 78 percent overall, including 82 of the secondary schools in the sample and 67 percent of the elementary schools in the sample.

TABLE 1

Description of the Sample

School Type	Sample Size	Schools Responding		Schools Providing Usable Data	
		n	%	n	%
Elementary	157	119	76	105	67
Secondary	133	122	92	109	82
TOTALS	290	241	83	214	74

The 214 usable survey forms were partitioned into four response groups. These groups corresponded to the cells of a 2 by 2 matrix defined by the dimensions of School Type (elementary or secondary) and Computer Access (have or have not). Table 2 reports the results of this partitioning. It shows that about 2 out of 3 of the secondary schools responding had access to a computer whereas only 1 out of 3 of the elementary schools in the sample reported such access.

Administrative Use Versus Instructional Use

Using the data provided by Items C.1 and C.2 it was possible to describe the primary kind of tasks (instructional or administrative) to which the 96 computer-

TABLE 2

Distribution of Usable Survey Forms

(School Type X Computer Access)

School Type	Sample Size	Computer Access			
		Have		Have Not	
		n	%	n	%
Elementary	105	32	30	73	70
Secondary	109	64	59	45	41
TOTALS	214	96	45	118	55

using schools of the sample committed their equipment. Table 3 shows that 70 percent of the schools which have computers are making some instructional use of them. The percent of elementary schools making strictly administrative use of

TABLE 3

General Uses of Computers by Wyoming Schools

Use	Elementary Schools (n = 32)		Secondary Schools (n = 64)		All Schools (n = 96)	
	n	%	n	%	n	%
Administrative only	14	44	15	23	29	30
Instructional only	7	22	19	30	26	27
Both Administrative and Instructional	11	34	30	47	41	43
TOTALS	32	100	64	100	96	100

computers is about twice that of secondary schools; the percent of elementary schools making strictly instructional use of computers is about two-thirds that of secondary schools. About one-third of the computer-using schools at the elementary level are employing computers in both administrative and instructional modes whereas about half of the secondary schools make dual use of computers.

The apparent emphasis on administrative use at the elementary level and instructional use at the secondary level was confirmed by Item D.4 of the Survey Form. Table 4 indicates that the majority of the computer time is given administrative uses in elementary schools and to instructional uses in secondary schools.

TABLE 4

Time Distribution of Computer Use:
Administrative Versus Instructional

Type of Use	Percent of Computing Time Allocated	
	Elementary Schools (n = 32)	Secondary Schools (n = 64)
Administrative	59	36
Instructional	41	64

Respondents: Individual Versus Group

By design, the analysis of status and opinion data from the survey was to be done using the school as the unit of input. One copy of the survey instrument was sent to each of the 290 schools which comprised the population. Item B.1 recognized, however, that a given survey form might be completed by an individual faculty member, an administrator, or a group of persons. Table 5, which summarizes the data generated by Item B.1, indicates that about 75 percent of the survey

TABLE 5

Source of Survey Responses:

Individual Versus Group

Source	Percent of Responses Attributed to Source					
	Elementary Schools			Secondary Schools		
	With Computers (n = 32)	Without Computers (n = 73)	Total (n=105)	With Computers (n = 64)	Without Computers (n = 45)	Total (n=109)
Individual	75	77	76	61	69	64
Group	25	23	24	39	31	36

forms submitted by elementary schools were completed by individuals; the percentage was about the same for schools with computers and schools without computers. When combined with the information provided by Item A.4 (i.e., the name of the person taking primary responsibility for completing the instrument), it was found that about 75 percent of those elementary school individuals completing the form were principals. (This is consistent with the fact that only 38 non-administrators were used as contact persons when the 157 elementary school survey forms were mailed.)

Table 5 also shows that 64 percent of the survey forms submitted by secondary schools were completed by individuals. Again, this figure was affected little by whether or not the responding school had access to a computer. When combined with the data of Item A.4, it was found that about 90 percent of the secondary school individuals responding were teachers of mathematics.

SECTION 4

PROCEDURES AND RESULTS: STAGE 2

A Committee Responsibility

The Ad Hoc Committee on Instructional Applications of Computers (Appendix I) was appointed by Wyoming Superintendent of Public Instruction Lynn Simons. The twelve voting members of the Committee were selected from among the public school personnel who participated in the 1979 Invitational Conference on Instructional Applications of Computers. The Committee met on September 18-20, 1980, for the purposes of viewing the information presented in Tables 1-5, summarizing and interpreting other data from the survey, and formulating recommendations regarding future instructional computing activity in Wyoming.

Dimensions of the Analysis

The Committee considered breaking down the survey data along four dimensions.

1. School Type. The two classes of this dimension were *elementary* and *secondary* (as previously defined).
2. Computer Access. This dimension would be comprised of two classes: the class of schools having access to a computer (to be denoted by *have*) and the class schools not having access to a computer (to be denoted by *have not*).
3. School Size. This criterion would subdivide the secondary group into four subgroups using the definitions of an earlier study[8] and would divide the elementary group into two groups based upon the number of classes at the various grade levels.

---

[8] Kansky, Bob and Melfried Olson. Mathematical Preparation Versus Career Aspirations: A Study of Wyoming's 1978 High School Seniors. Center for Research Services and Publications: Laramie, 1979. (ERIC: ED 168 263).

4. Survey Data Source. This would separate data into two classes (*individual* and *group*) based upon the responses to Item B.1 as summarized in Table 5.

Dimensions 1 and 2 were retained; they had been called for by the teacher groups which had participated in the design of study. Dimension 3 was rejected because of the small size of the classes it would create. (The earlier study had used school size to classify responses from 2010 students; this study would be classifying only 214 school responses.) Dimension 4 was accepted initially, but was eliminated when the figures obtained lead to the conclusion that the source of the data had no recognizable effects.[9]

Data from Sections B and C of the Survey Form was summarized using the four classes defined by Dimensions 1 and 2. The information of Section D was provided by schools with access to computers and, hence, was separated along Dimension 1 only. Discussion of the results will be presented in three parts, each corresponding to a section of items on the Survey Form. The sections will not be discussed in the order that they appear on the Survey Form but, rather, in an order which best fits the examination of the issues.

Description of Computer Equipment in Use

Educators' uses of computers and opinions regarding their use are, at least in part, a function of the equipment available or known. Thus, in viewing the survey data submitted by schools which do have access to a computer, there is some value in being familiar with the hardware frame of reference being used.

There are three principal ways in which Wyoming schools have access to computer facilities. In 80 percent of the cases, the district owns the computer or computers. In 13 percent of the cases, computers are being rented. About 10 percent of the schools contract computer services (data processing) and uses a phone or the mail to transmit data. Several schools use a combination of these methods of access.

---

[9] This dimension was explored fully subsequent to the September 18-20 meeting by Committee Member Richard Kean. His work confirmed that survey results were consistent across Dimension 4.

Because of the number of computer-using schools in the study is small (96) relative to the kinds of equipment available, the data obtained from Items D.2 and D.3 was of little value. If one discards the details, however, a few general items can be mentioned.

Of the 29 schools using computers for administrative computing only, none was making use of a microcomputer. Of the 67 schools doing at least some instructional computing, 60 percent were using microcomputers only, 30 percent were using time-sharing minicomputers only, and 10 percent were using both minicomputers and microcomputers. Some version of the BASIC language was available to all but 2 of the 67 schools doing instructional computing.

Current Uses of Computers in Wyoming Schools

Section C of the Survey Form deals with how computers were being used in Wyoming schools in April of 1980. Of the 214 schools responding, 70 schools (25 elementary and 34 secondary) reported one or more administrative uses of computers. The figures of Table 6 show that principal administrative use of computers in the elementary schools is Resource Management and Planning (e.g., maintaining personnel and financial records, projecting enrollments, inventory control, scheduling student transportation, payroll). At the secondary level, Student Accounting and

TABLE 6

Administrative Uses of Computers

Type of Use	Percent of Schools Making that Use	
	Elementary (n = 25)	Secondary (n = 45)
Resource Management and Planning	92	64
Student Accounting	24	67
Standardized Test Grading and Reporting	16	16
Research and Evaluation	4	7
Other (or no information)	32	13

Resource Management are about equally popular administrative applications; each was listed as a use by about two-thirds of the secondary schools doing administrative computing. Generally speaking, Standardized Test Grading/Reporting and Research/Evaluation were uncommon administrative applications. The application most frequently listed under "Other" was the generation of mailing labels.

Although Section C.2 made use of examples in an attempt to define various instructional uses of computers, it is recognized that such classification is difficult. Pilot work in teaching preservice and inservice teachers to make consistent use of such classes for describing instructional use revealed the need for careful definitions which are augmented by examples and discussion.[10]

It follows that some figures of Table 7 are suspect.

TABLE 7

Instructional Uses of Computers

Type of Use	Percent of Schools Making that Use	
	Elementary (n = 18)	Secondary (n = 49)
Teaching Programming	39	98
Instructional Games	56	61
Problem Solving	39	59
Drill and Practice	39	49
Tutorial	28	39
Simulation	33	31
Teacher-Aide Services	28	18
Word Processing	17	8
Instructional Management	11	6
Career Selection	11	6
Test Construction	6	4
Other (or no information)	11	8

[10] Kansky, Bob, William Heck and Jerry Johnson. Guidelines for Evaluating Computerized Instructional Materials. Reston, VA: National Council of Teachers of Mathematics, 1981.

Table 7 reports the various instructional uses of computers in Wyoming schools in April of 1980. It indicates the relative popularity of a type of use across schools but does not provide information regarding the portion of instructional computing time which schools allot to a particular type of use. Thus, while Table 7 indicates that Teaching Programming, Problem Solving, and Drill/Practice are used by the same percentage of elementary schools, one cannot infer that those schools devote equal portions of computing time to those three uses.

There is good reason to believe the Table 7 report that 98 percent of the secondary schools are using their computers to teach programming. While somewhat higher than the rates reported in similar studies by Dennis[11] (81 percent) and by Gawronski[12] (82 percent), the higher rate probably reflects the limited understanding of the range of applications which characterizes the early stages of instructional computing. The broadening of instructional uses is seen in the comparison of the 1970 and 1975 surveys by AIR[13] which showed a national decline (from 29 to 25.8 percent) in the use of computers in the teaching of computer science. (While the decline reported by AIR is relevant to the Wyoming study, most AIR rates are not since the data collection of the AIR studies predates the microcomputer revolution.[14])

The Table 7 figures for Instructional Drill and Practice are decidedly lower than the 89 percent reported by Gawronski.[15] On the other hand, the figures

---

[11] Dennis, J. Richard, Clifford Dillhunt and Vicktors Muizneks, "Computer Activities in Illinois Secondary Schools," 1977. (ISEAC Paper No. 24, Department of Secondary Education, University of Illinois, Urbana, Illinois 61801.) Mimeographed.

[12] Gawronski, J.D. "Microcomputer Use in San Diego School Districts," 1980. (A research study by the Department of Education of San Diego County, 6401 Linda Vista Road, San Diego, California 92111.)

[13] Bukowski, William J. and Arthur L. Korotkin, "Computing Activities in Secondary Education," Educational Technology (January, 1976), p. 15.

[14] Ibid, pp. 18-19.

[15] Gawronski, op cit, p. 9.

reported for Problem Solving are surprisingly high (since there are few problem-solving programs available). It is not unlikely that some persons completing the Wyoming Survey Form classified any problem-presenting program (i.e., drill work on multiplication) as Problem Solving.

Educators' Opinions Regarding Instructional Computing

Section B.2 sampled the opinions of all respondents, whether with or without access to a computer, regarding eleven proposed instructional bases for justifying computers in the schools. The respondent was asked to indicate a level of agreement with each proposed basis by choosing a point on the five-point scale:

5 = Strongly Agree
4 = Agree
3 = No Opinion
2 = Disagree
1 = Strongly Disagree

The respondent was asked to record a judgment "with respect to instructional uses of computers in general (and not just in your particular school)."

In summarizing the data from Section B.2, the members of the Ad Hoc Committee decided to record responses on a three-point scale: the two categories 'Strongly Agree' and 'Agree' were collapsed into the category 'Agree' and the two categories 'Strongly Disagree' and 'Disagree' were collapsed into the category 'Agree.' The resulting three classes and their single-letter abbreviations (used in Tables 8-9) are:

A = Agree
N = No Opinion
D = Disagree

While the Committee acknowledged developmental efforts to provide survey items that were simply and clearly stated, it found itself arguing ambiguities identified in several of the items of Sections B.2 and B.3. Since the figures were intended only to provide guidance for the Committee's recommendations, it decided that small numerical differences in the opinions of the subgroups determined by Dimensions 1 and 2 would be ignored. It established the "rule of thumb"

that any difference less than ten percent would be viewed as educationally insignificant.

Table 8 summarizes the data for eight items of Section B.2 -- eight items which all relate to the question "What computing experiences should be provided for which students?" When viewed under the Committee's ten-percent rule, the figures suggest some homogeneity of opinion across both School Type (elementary/secondary) and Computer Access (have/have not). Whenever differences of opinion across one of these dimensions or an item does not exceed the ten-percent rule, the row of 'combined' percents shown in Tables 11 and 12 will be viewed as group opinion on that item.

For Item B.2(a) the differences across both dimensions are small enough to permit characterization of the educators' opinion in terms of the combined figures for all schools. Thus, the Committee concluded that about two-thirds of the sample favored teaching every student about computers and their role in society.

In Items B.2(h) and B.2(i), opinions differed across the dimension of School Type but were not significantly different across the dimension of Computer Access. Thus, 60 percent of the elementary school respondents feel that computers should be used as a learning resource for handicapped students, and a sizable minority (29 percent) has no opinion regarding such use. Secondary respondents are more strongly in favor (74 percent) of this application, with 18 percent having no opinion. Both elementary and secondary respondents give their strongest support to the use of computers with all gifted children; they differ only in the magnitude of that agreement, with secondary endorsement (96 percent) being higher than elementary (81 percent).

Irrespective of Computer Access, secondary respondents have similar opinions with regard to Items B.2(b), B.2(c), and B.2(d). Eighty percent disagree with the assertion that every student should be taught to program a computer. (In retrospect, the Committee regretted that this item used 'every student' rather than 'almost every student' or 'most students.' Indeed, the universal generalization was not intended; the wording was poor.) In Items B.2(c) and B.2(d), over 60 percent of the secondary respondents disagreed with the assertions that computer experiences should be provided for college-bound students only and that programming

TABLE 8

Opinions Regarding Instructional Computing:
Survey Items B.2(a) - B.2(d) and B.2(h) - B.2(k)

Item	Access to Computer	Percent Agreement with Item								
		Elementary			Secondary			All Schools		
		A	N	D	A	N	D	A	N	D
B.2(a)	Have	66	12	22	70	8	22	69	9	22
	Have Not	63	10	27	66	11	23	64	10	26
	Combined	64	10	26	69	9	22	66	10	24
B.2(b)	Have	3	9	88	8	6	86	6	7	87
	Have Not	9	25	66	7	14	79	8	21	71
	Combined	8	20	72	8	9	83	7	15	78
B.2(c)	Have	16	9	75	34	8	58	28	8	64
	Have Not	27	29	44	20	13	67	24	23	53
	Combined	24	23	53	29	10	61	25	16	59
B.2(d)	Have	16	12	72	26	8	66	23	9	68
	Have Not	29	29	45	20	13	67	24	23	53
	Combined	23	24	53	24	10	66	23	17	60
B.2(h)	Have	65	22	13	72	17	11	70	19	11
	Have Not	57	32	11	78	18	4	65	26	9
	Combined	60	29	11	74	18	8	67	23	10
B.2(i)	Have	88	3	9	98	2	0	95	2	3
	Have Not	78	11	11	93	7	0	84	9	7
	Combined	81	9	10	96	4	0	89	6	5
B.2(j)	Have	84	3	13	91	9	0	89	7	4
	Have Not	68	16	16	80	20	0	72	18	10
	Combined	73	12	15	86	14	0	79	13	8
B.2(k)	Have	75	16	9	77	14	9	76	15	9
	Have Not	67	21	12	64	25	11	66	22	12
	Combined	70	19	11	71	19	10	70	19	11

experience should be restricted to those students entering the mathematical or natural sciences. However, about one-fourth of the secondary respondents support each of those restricted uses.

Regardless of their present status with respect to Computer Access, elementary respondents to Item B.2(k) favor (70 percent) the teaching of computer programming as a vocational/technical skill for noncollege-bound students. Secondary respondents with access to computers are more supportive (77 percent) of such vocational/technical training than are secondary respondents without access (64 percent).

Elementary respondents disagree among themselves most sharply on Items B.2(b), B.2(c), and B.2(d). Those who have Computer Access are in favor of using computers to teach programming to every student (88 percent), to provide programming experience for all college-bound students only (75 percent), and to provide computer programming experience only to college-bound students interested in the mathematical sciences (72 percent). Since these three positions are made mutually exclusive by the word 'only,' it is difficult to interpret the positions taken. The Committee concluded that the respondents felt that any one of the three assertions was "acceptable," but that programming experience for every student was preferred.

The three items reported in Table 9 relate to the general question "What

TABLE 9

Opinions Regarding Instructional Computing:

Survey Items B.2(e) - B.2(g)

Item	Access To Computer	Percent Agreement With Item								
		Elementary			Secondary			All Schools		
		A	N	D	A	N	D	A	N	D
B.2(e)	Have	84	3	13	95	2	3	92	2	6
	Have Not	70	18	12	89	9	2	77	15	8
	Combined	77	14	9	92	5	3	83	9	8
B.2(f)	Have	84	3	13	94	6	0	91	5	4
	Have Not	72	18	10	91	7	2	79	14	7
	Combined	76	13	11	93	6	1	84	10	6
B.2(g)	Have	78	9	13	81	8	11	80	8	12
	Have Not	72	18	10	84	7	9	77	14	9
	Combined	74	15	11	82	8	10	78	11	11

computing services should be provided for teachers?" The responses suggest a high level of acceptance of the computer. By again invoking the ten-percent rule, the Committee found that respondents shared this opinion in a manner independent of School Type or Computer Access considerations. Specifically, neither dimension reveals an educationally significant difference in the responses to Item B.2(g). Hence, it can be said that about 78 percent of the respondents agree that one instructional function of the computer should be to provide instructional services (test grading, etc.) for all teachers.

Irrespective of Computer Access, secondary school respondents strongly agree that any teacher should be permitted to use computers as a classroom instructional tool (92 percent) and that all teachers should be given the opportunity to learn how to program the school's computer (93 percent). Elementary school respondents favor these positions at somewhat lower levels. Classroom use of the computer by all teachers is supported by 84 percent of the elementary respondents who have access to computers and 70 percent of those who do not have access; instructional programming privileges for all teachers is supported by these two groups with figures of 84 and 72 percent, respectively. While these opinions are "permissive" in nature, they suggest that planning for instructional computing activities should include attention to the needs of teachers -- all teachers -- as well as students.

Educators' Opinions Regarding Teacher Education

The eight items of Section B.3 deal with inservice education, preservice education, certification, and classroom-unit funding as related to instructional computing. Survey results for these items are summarized in Table 10.

Items B.3(a) and B.3(b) solicit opinions regarding inservice education about computing; the items differ in that B.3(a) explicitly excludes any programming from such inservice whereas B.3(b) explicitly includes programming. Together the responses to these items suggest that "if inservice opportunities are provided then such opportunities should include an introduction to programming." Regardless of School Type (elementary/secondary), respondents having access to a computer favored an inservice course which included programming (65 percent) over one which excluded programming (40 percent); at least 26 percent were opposed to offering either course. Elementary respondents having no computer access prefer

TABLE 10

Opinions Regarding Teacher Education:

Survey Items B.3(a) - B.3(h)

Item	Access To Computer	Percent Agreement With Item								
		Elementary			Secondary			All Schools		
		A	N	D	A	N	D	A	N	D
B.3(a)	Have	37	16	47	42	14	44	40	15	45
	Have Not	32	19	49	49	13	38	39	17	44
	Combined	34	18	48	45	14	41	39	16	45
B.3(b)	Have	65	13	22	64	8	28	65	9	26
	Have Not	43	24	33	56	22	22	48	23	29
	Combined	50	20	30	60	14	26	55	17	28
B.3(c)	Have	34	28	38	42	34	24	40	32	28
	Have Not	49	22	29	49	27	24	49	24	27
	Combined	44	24	32	45	31	24	44	28	28
B.3(d)	Have	44	28	28	76	24	0	57	23	20
	Have Not	48	26	26	69	13	18	56	21	23
	Combined	46	27	27	66	17	17	56	22	22
B.3(e)	Have	81	6	13	94	3	3	90	4	6
	Have Not	76	17	7	96	2	2	84	11	5
	Combined	78	13	9	94	3	3	86	8	6
B.3(f)	Have	78	19	3	94	6	0	89	10	1
	Have Not	64	30	6	98	2	0	72	25	3
	Combined	68	27	5	90	10	0	79	18	3
B.3(g)	Have	40	44	16	64	23	13	56	30	14
	Have Not	35	36	29	60	27	13	45	32	23
	Combined	37	38	25	62	25	13	50	31	19
B.3(h)	Have	66	25	9	78	19	3	74	21	5
	Have Not	46	43	11	71	20	9	56	34	10
	Combined	52	37	11	75	19	6	64	28	8

inservice with programming (43 percent) to inservice without programming (32 percent), but at least 33 percent endorse neither form of inservice. Secondary school respondents having no access to a computer show no educationally significant difference in their responses to the choices of inservice with (56 percent) or without (49 percent) a computer, and at least 22 percent disagree with either proposal.

Items B.3(c) - B.3(e) are concerned with preservice education of teachers. A split decision regarding the inclusion of computer work in the preservice education of elementary school teachers (Item B.3(c)) holds across the dimensions of School Type and Computer Access. Of the 214 respondents, 44 percent agree with the need for such training, 28 percent disagree with that need, and 28 percent have no opinion.

Opinions regarding the inclusion of computer work in the preservice education of all secondary school teachers is a function of School Type. Elementary school respondents reassert the position they took with respect to the preservice education of elementary teachers, with 46 percent approving the proposal, 27 percent opposed to it and 27 percent having no opinion. By contrast, 66 percent of the secondary respondents endorse such preservice education for all secondary teachers, 17 percent oppose it, and 17 percent have no opinion.

Secondary school respondents strongly support (94 percent) the inclusion of computer work in the preservice programs of all mathematics and science teachers. Elementary respondents to Item B.3(e) endorsed this position at a somewhat lower level (78 percent) with 13 percent (as opposed to 3 percent of the secondary respondents) having no opinion.

While 90 percent of the secondary respondents agreed (and none disagreed) that there is a need for secondary school teachers of computer science (Item B.3(f)), they showed enthusiasm for State certification requirements in the area. Specifically, 62 percent of the secondary persons responding to Item B.3(g) favored such certification, 13 percent opposed it, and 25 percent had no opinion. While 68 percent of the elementary school respondents agreed with the need for secondary school computer science teachers, 27 percent had no opinion. Moreover, elementary respondents split on the issue of certification standards for such teachers, with 37

percent in favor, 25 percent opposed, and 38 percent having no opinion.[16]

The designation of 'a vocational classroom funding unit for computer science' (Item B.3(h)) is a technical funding issue in Wyoming. Such designation carries with it double funding (needed to purchase special equipment) but also requires certification standards for the unit. Some respondents may not have realized that certification standards in computer science would be a prerequisite to such funding. About 75 percent of the secondary respondents favored such designation. Elementary respondents were less supportive, with 68 percent of those having computer access being in favor of such designation and 25 percent having no opinion. Only 46 percent of the elementary respondents without computer access favored the designation, a figure nearly matched by 43 percent who had no opinion.

Observations Regarding 'No Opinion'

The Committee felt that the percentages recorded for 'No Opinion' deserved special note. In the case of the Section B.2, 'No-Opinion' response rates exceeding 10 percent are characteristic of the No-Access subgroups (with Items B.2(h) and B.2(k) being notable exceptions). The Committee hypothesized that such assertions of 'No Opinion' might be equated with 'I don't know enough to offer an opinion.'

By contrast with the responses to Section B.2, the figures of Table 10 show much larger 'No-Opinion' rates. Rates below 10 percent are found in only three items (B.3(b), B.3(e), B.3(f)) and they are restricted to subgroups of respondents. Since the issues of Section B.3 dealt with specific matters of teacher education and certification, the educators responding probably were even less inclined to express opinions in the absence of further information. In short, they were not willing to purchase "a pig in a poke."

---

[16] The issue of certification standards was pursued subsequent to the examination of survey results. Conversations with 22 secondary teachers, 7 elementary teachers, and 4 elementary principals who opposed such standards revealed the concern that the lack of a supply of teachers meeting those standards would halt current instructional computing activities. They supported the inclusion of appropriate computer coursework at all levels and in many subject matter areas with the idea (for the present) of broadening rather than specializing the use of computers in the schools.

SECTION 5

CONCLUSIONS AND RECOMMENDATIONS

A Matter of Interpretation

Having completed the detailed examination of Survey responses which is reported in Sections 3-5, the Committee (Appendix I) here turns to the task of translating those details into general conclusions and recommendations. The reader is reminded of the "ten-percent rule" (pp. 24-25) used by the Committee in examining the data of Sections B and C of the Survey Form.[17] That rule was in keeping with a general decision to eschew formal statistical analysis of data which was gathered from such intent and which deals with matters which are in a state of flux.

While the conclusions which follow are generalizations based upon the results discussion in Sections 3-5, most[18] will be made without specific reference to figures found in the tables of those sections. The Committee chooses to paint a picture of educators' opinions in broad strokes. To quote the details of the tables would suggest a level of precision which is not intended. It follows that the conclusions given are those for which the Committee found substantive support. Detailed observations, however interesting, will be sacrificed in order to give emphasis to the larger issues.

The report concludes with the Committee's recommendations regarding actions suggested by this study. While the Committee feels that these recommendations are firmly rooted in the results of this Survey, it has not dismissed its responsibility to interpret those results in terms of its understanding of the issues, of national activity in instructional computing, of the need to anticipate change, of programs now in development within the State, and of financial reality.

---

[17] The "ten-percent rule" was an agreement that any numerical difference in the opinions of the subgroups determined by Dimensions 1 and 2 (defined on p. 19) must be at least ten percent in order to be viewed as educationally significant.

[18] The exceptions deal with the description of the sample.

Conclusions: Instructional Computing in Wyoming

The following conclusions are based upon the information of Sections 3-5. The conclusions have been numbered for convenience in referencing; the order is not meant to suggest relative importance of the conclusions.

1. About 30 percent of Wyoming's elementary schools[19] and 59 percent of its secondary schools[20] have access to a computer.

2. Computers are available to the schools most frequently through district ownership (80 percent), rental (13 percent), or contracts for services (10 percent). Many schools used a combination of such methods of access.

3. At present, no administrative computing is done on microcomputers. Of the schools involved in instructional computing, 60 percent use microcomputers only, 30 percent use time-sharing systems only, and 10 percent use a combination of the two types.

4. A form of the BASIC language is available to almost every school involved in instructional computing. The exceptions were schools using hand-me-down computers which they were seeking to augment or replace.

5. In terms of time allocation, 59 percent of elementary school uses of computers are administrative and 41 percent are instructional. Time allocations at the secondary school level are reversed, with 36 percent being administrative and 64 percent being instructional.

6. The most common administrative use of computers is in resource management and planning (e.g., financial and personnel records, inventory control, enrollment projection, payroll, transportation scheduling). A second common use at the secondary level is student accounting (e.g., class scheduling, student records, attendance records, report cards).

---

[19] All references to 'elementary schools' are restricted to elementary schools with total enrollments of at least 100 students.

[20] The term 'secondary school' refers to any school which includes a grade level above Grade 7.

7. The four most popular instructional uses of computers in the secondary school are, in order of popularity, teaching programming, instructional gaming, problem solving, and drill/practice. The chief use reported for elementary schools is instructional gaming; it is followed by a three-way tie among teaching programming, problem solving, and drill/practice. The rates for problem solving at both levels are questioned; there is a strong possibility that respondents did not distinguish problem solving from drill/practice.

8. Elementary and secondary educators agree that computers should be used to provide any teacher with instructional services (e.g., test grading and analysis, record keeping, inventory management, objective-referenced test generation, form-letter generation, etc.) At present, few schools report such applications.

In reporting the following conclusions regarding Wyoming educators' opinions on issues of computer applications, teacher education, and certification, a group will be said to *support* or *favor* a position if at least 66 percent of the group's respondents agreed with the position. In effect, a response of 'No Opinion' on an issue is viewed as nonsupportive of that issue since it is interpreted as an indication that the respondent lacked sufficient information to make a decision to agree or disagree.

9. Both elementary and secondary educators support the use of computers as a special learning resource for the gifted and to provide <u>every</u> student with experiences (not necessarily programming) in applying computers in his area of subject matter interest.

10. Both elementary and secondary educators support the use of computers by all teachers to learn programming, as an instructional tool in his subject area, and to provide instructional services (as described in Conclusion 8).

11. Both elementary and secondary educators favor the inclusion of computer work in the preservice college education of all mathematics and science teachers. They support the assertion that there is a need for secondary teachers who are qualified to teach computer science (i.e., computer

literacy, computer programming, data processing, etc.) but do not support the establishment of State certification standards for such teachers.

12. Elementary and secondary educators who have access to a computer support using the computer to teach every student about computers and their role in society, as a special learning resource for handicapped students, and to provide technical/vocational skills for students who are not college bound.

13. Both elementary and secondary educators are opposed to using computers to teach every student how to program. Neither do they support the restriction of such programming instruction to college-bound students in general or to college-bound students intending to enter the natural or mathematical sciences.

14. Educators' opinions regarding the inservice and preservice computer education of elementary teachers and of secondary teachers of subjects other than mathematics or science are split. Large No-Opinion response rates indicate the need for more information before a decision can be made. It is also conjectured that respondents feared that desired inservice may become mandatory inservice. Recent recertification mandates regarding coursework in teaching exceptional children and in teaching reading in the content areas may have made respondents reticent in identifying a new inservice need.

In general, educators do wish to learn about computers and wish to use them with their students. Secondary educators and educators who have access to computers are more supportive of the positions (changes) suggested by the Survey. Far from being possessive, computer-using educators appear both eager to encourage other educators to use computers and eager to explore new ways to use computers to serve students and teachers.

Recommendations: Instructional Computing in Wyoming

The Ad Hoc Committee on Instructional Applications of Computers makes the following recommendations to the Wyoming Legislature, the Wyoming State Department of Education, the University of Wyoming, and the Wyoming public schools. Some

recommendations are related directly to conclusions just stated and some were influenced by details in the discussions of Sections 3-5; all are subject to the Committee's composite knowledge of instructional computing and to its belief that knowledge about and use of computers soon will be basic skills[21] for teachers and students.

RECOMMENDATION 1: A program of computer awareness for *all* students should be implemented in Grades K-12 as soon as possible.

Comment. *Every* student must learn about computers and their role in society. Instruction should include interaction with a computer, but that interaction need not be an experience in computer programming; in any case, instruction should not be restricted to computer programming. Experience at the secondary level should include opportunities to apply the computer as a tool within the student's area(s) of subject matter interest. Elementary school experience should include work with a typewriter keyboard.

RECOMMENDATION 2: Every student who is interested in learning how to program a computer should have the appropriate instruction and machinery available to him.

Comment: The opportunity to study programming should not be a function of postsecondary plans, subject-area interest, or previous academic achievement. The extent of such experience should be limited only by the student's performance in this area.

RECOMMENDATION 3: Planning for the instructional use of computers should include consideration of a wide variety of educational applications other than the teaching of computer programming.

Comment. Careful planning must precede the purchase of computing equipment to ensure that the system acquired will support a broad range of uses by students and teachers. The teaching of computer programming

---

[21] Wyoming educators listed "Computer Awareness" as minimal mathematical competency in the study The Wyoming Educational Needs Assessment Project in Mathematics. This study was published by the Wyoming State Department of Education in 1977.

should take its place as one application of computers. Planning also should consider such applications as problem solving, word processing, teacher-support services, test generation and analysis, instructional management, and career planning.

RECOMMENDATION 4: In planning for educational computing, instructional applications should take priority over administrative applications. Separate computing facilities should be considered.

Comment. Systems designed to perform a broad range of instructional computing tasks are, generally speaking, capable of performing administrative tasks as well. The assumption of administrative functions may require additional storage capability or higher printing speeds. The modification of administrative systems to meet instructional specifications is more complex because of the diversity of instructional applications.

RECOMMENDATION 5: The Wyoming State Department of Education and the University of Wyoming should cooperate in the development and execution of short workshops aimed at Statewide "awareness" of the instructional uses of computers.

Comment. The large No-Opinion response rates on many Survey items suggest a general lack of understanding of the instructional possibilities offered by computers. The Committee feels that one-day or half-day workshops for teachers and administrators would go far in encouraging more detailed exploration of those possibilities, in preventing the purchase of inappropriate computer systems, and in helping schools identify sources of assistance within the State.

RECOMMENDATION 6: All teachers and administrators should be required to acquire instruction relative to computer literacy.

Comment. Such literacy would include an understanding of the capabilities (and limitations) of computers, knowledge of the major components of a computer and their functions, the skills necessary for operation (exclusive of programming) of a computer, the concept of a computer program, a broad view of the applications of computers both in education and in society as a whole, and skill in evaluating computerized instructional materials. Such instruction should include interaction with a computer.

It also should include a brief introduction to programming.

RECOMMENDATION 7: All teachers and administrators should be encouraged to study and implement instructional uses of computers.

Comment. *Without* pursuing expertise in computer programming, educators must learn how to use the computer in its many roles as teacher, student, and partner in classroom instruction.

RECOMMENDATION 8: All teachers should be encouraged to develop skills in designing and evaluating instructional computer programs.

Comment. While the actual writing of such programs might be an objective of such work, the focus should be upon program design and evaluation. The teacher must know how to specify program components in terms which take advantage of the computer's most advanced capabilities and to evaluate programs in terms of pedagogical expectations vis-a-vis computer technology. Actual program writing could be assigned to specialists.

RECOMMENDATION 9: All subject-area professional organizations should review their certification standards and propose changes that would comprise subject-related competence in instructional computing.

Comment. The use of computers and their services is the right of every teacher. Qualification by field is necessary to ensure every teacher the access to computers and to an understanding of the use of computers relative to his teaching area.

RECOMMENDATION 10: Certification standards for teachers of computer science should be proposed only after careful review by public school personnel.

Comment. Certification of computer science teachers must not effect the exclusion of computer use or programming instruction by qualified teachers with other certification specialties. Certification must serve to create teachers who can serve as consultants in promoting computer usage by all educators; it must not create a privileged class which holds exclusive rights to instructional computing.

RECOMMENDATION 11: School districts should establish a formal policy of seeking to hire teachers and administrators who have coursework or experience in computer use.

Comment. In choosing among candidates whose academic and teaching/administrative experiences are nearly equivalent, hiring preference should go to candidates with computing knowledge. This policy should be stated and should apply to all grade levels (K-12) and certification areas.

RECOMMENDATION 12: The University of Wyoming should design courses in instructional computing which are appropriate for teachers and administrators from all grade levels and all certification areas.

Comment. A variety of courses, open to preservice and inservice teachers, should provide instruction in three areas: computer literacy, computer programming, instructional applications of computers. A delivery system such as the Portal School System of the Science & Mathematics Teaching Center should be developed to take these courses to inservice educators.

RECOMMENDATION 13: The College of Education of the University of Wyoming should evaluate its present teacher-education programs with the objective of replacing some of the current degree requirements with courses in instructional computing. It also should revise other course offerings to include the use of computers in instruction.

Comment. The public schools are requested to look upon computer literacy as a basic skill and to use computers to improve instruction. It follows that future teachers should be educated in such a way that this request may be fulfilled.

RECOMMENDATION 14: The leadership of Wyoming's professional education organizations should cooperate in defining "computer literacy" as an object of study in Grades K-12.

Comment. The Wyoming Council of Teachers of Mathematics is asked to prepare a draft of such a definition. To ensure its applicability across grade levels and subject areas, that draft must be refined by professionals from other areas of instruction.

RECOMMENDATION 15: The Wyoming State Department of Education, the University of Wyoming and the public schools should cooperate in establishing a Wyoming Instructional Computing Exchange.

Comment. While the detailed activities of the Exchange should be set by a task force which includes members from each of the educational agencies noted, the principal charge of the Exchange would be to promote communication among computer-using educators throughout Wyoming.

RECOMMENDATION 16: The Wyoming State Department of Education should urge and assist the Wyoming Legislature to develop legislation providing for the adequate funding of instructional computing at all grade levels and all certification areas.

Comment. Computers are instructional tools whose use should not be bounded by grade level or subject area. Neither should funding be a function of certification of computer science specialists.

In summary, the Committee is recommending actions which will facilitate the use of computers by teachers and students throughout the educational system. In doing so, it finds that it must call for the cooperative efforts of the State Department of Education, the University of Wyoming, and the professional leadership at all levels within the schools of Wyoming.

A P P E N D I C E S

I. Wyoming Ad Hoc Committee on Instructional Applications of Computers

II. Survey Cover Letter

III. Computer-Usage Survey Form

APPENDIX I

Wyoming Ad Hoc Committee on Instructional

Applications of Computers

Committee Members (Voting Participants)

Barbara Babbitt, secondary teacher, math and computer science, Cheyenne

Richard Kean, secondary teacher, sociology, Cheyenne

Robert M. Krisko, middle school principal, Thermopolis

Patricia Lang, elementary teacher, Cheyenne

Rita Livingston, secondary teacher, physics and computer programming, Casper

Walter H. Miner, secondary teacher, English, Cheyenne

Robert L. Morissette, Coordinator of Mathematics, Laramie County School District #1, Cheyenne

Burl A. Parker, secondary teacher, math and computer science, Cody

Barbara Robb, middle and secondary teacher, math, Big Piney

Emma Jo Spiegelberg, secondary teacher, business, Laramie

Joe Stepans, secondary teacher, science, math and computer science, Pinedale

Charles J. Wing, Director of Instruction, Laramie County School District #1, Cheyenne

Consultants (Non-voting Participants)

William Futrell, mathematics/science consultant, State Department of Education

Patricia Gavagan

Bob Kansky

A. Duane Porter

Melfried Olson

John Russell

} Science & Mathematics Teaching Center, University of Wyoming, Laramie

APPENDIX II

Survey Cover Letter

The State of Wyoming
Department of Education
Hathaway Building
Lynn Simons
Superintendent of Public Instruction
Cheyenne Wyoming 82002

April 14, 1980

In response to numerous requests from Wyoming teachers and administrators, this department is cooperating with the Science and Mathematics Teaching Center (SMTC) of the University of Wyoming in gathering data regarding the instructional uses of computers in grades K-12. We need information from every Wyoming school regardless of whether or not the school makes use of a computer. I am requesting that you take responsibility for completing the enclosed survey form for your school.

The enclosed survey form is divided into four sections. If your school does not use a computer (see general instructions), please complete Sections A and B only. If your school does use a computer, please complete all four sections. (Note that the survey form is printed on both sides of each sheet.) Please return the completed form using the enclosed self-addressed stamped envelope to Bob Kansky, Computing Survey, University Station, Box 3992, Laramie, Wyoming 82071, by May 1, 1980.

When the data has been compiled, it will be reviewed by a statewide committee of public school teachers and administrators. A report will then be prepared by the SMTC, and you will be provided with a copy. The report should provide your school with valuable information regarding the locations and uses of computers in Wyoming's schools.

Should you have any questions regarding this survey, please call Bob Kansky (collect and person-to-person) at 766-6381.

Thank you for helping us better serve the schools of Wyoming.

Sincerely,

Bill

Bill Futrell
Science/Mathematics/Environmental
Education Coordinator
Phone: 777-7411

WMF:jmw

Enclosures - Survey Form
Stamped Envelope

APPENDIX III

Computer-Usage Survey Form

General Instructions

The purpose of this survey is twofold: (1) to determine the nature and extent of computer usage in Wyoming's schools and (2) to obtain the opinion of Wyoming educators regarding the potential uses of computers in the schools. To ensure that decision-makers have the best possible data from which to draw conclusions, your response is urgently needed WHETHER OR NOT YOUR SCHOOL USES COMPUTERS.

This survey is divided into four sections:

Section A: General information about your school
Section B: Opinions regarding instructional uses of the computer in the school
Section C: Current uses of computers by your school
Section D: Description of computer equipment being used by your school.

Please follow the following guidelines in completing this questionnaire.

I. If your school does NOT use a computer (see definitions below), complete Sections A and B only.
II. If your school uses a computer for administrative or instructional purposes, complete all four sections (A-D).

Although this survey has been sent to you as the school's representative, you may wish to complete it by assigning each section to the staff member most knowledgeable/interested in the area addressed. One person could then coordinate the completion of the questionnaire and be responsible for its return.

In responding to the items of this survey, feel free to write qualifying comments directly on the survey pages.

Definitions

1. Computer. For the purpose of this survey, a computer is a machine that operates under the control of a stored program. The term computer includes the central processing unit, auxiliary storage, communication links, and all peripheral equipment.

   Programmable desk top calculators and electronic accounting machines are specifically excluded from this definition.

2. Computer access. A school is said to have computer access if a computer is available to the school's faculty or administration in one or more of the following ways:

   - The computer is physically located in the school building.
   - The school has one or more terminals which are connected to a computer located outside the school building.
   - The computer is located near the school. Faculty/administration go to that location to use it.
   - Faculty/administrators do not personally interact with the computer, but computer services are provided by mail or phone by the school system, a bank, an industry, etc.

SECTION A: GENERAL INFORMATION

A.1 School name: _____

A.2 School telephone number: _____

A.3 County in which school is located: _____

A.4 Name of the person in your school who took the primary responsibility for completing this questionnaire:

_____

A.5. What grade levels are included in your school: _____ through _____

A.6 Number of full-time teachers in your school: _____

A.7 Current enrollment in your school

_____ Under 50

_____ 50-100

_____ 100-199

_____ 200-399

_____ 400- 599

_____ 600- 999

_____ 1000-1499

_____ 1500+ (specify number here:) _____

A.8 Does your school currently have access to a computer for either administrative or instructional purposes?

_____ yes _____ no

A.9 If you responded "no" to Item A.8, is your school now planning to obtain access to a computer for administrative purposes?

_____ yes _____ no

A.10 If you responded "no" to Item A.8, is your school now planning to obtain access to a computer for instructional purposes?

_____ yes _____ no

Please go to SECTION B.

SECTION B: OPINIONS ABOUT INSTRUCTIONAL USE

NOTE: In completing this section, you may wish to record the collective opinion of all (or some group) of the faculty in your school.

B.1 The opinions recorded below are those of

____ one person

____ the entire school faculty

____ a subgroup of faculty (indicate number here:) _____

B.2 Indicate your level of agreement with each of the following possible educational uses of computers in the school by circling the appropriate number. The opinion should be with respect to instructional uses of computers in general (and not just in your particular school).

Strongly Agree
Agree
No Opinion
Disagree
Strongly Disagree

5 4 3 2 1	(a)	To teach every student about computers and their role in society.
5 4 3 2 1	(b)	To teach every student to program a computer.
5 4 3 2 1	(c)	To provide computer experiences (including programming) for all potentially college-bound students (but to college-bound students only).
5 4 3 2 1	(d)	To teach programming to only those potentially college-bound students who might enter programs in mathematics or the natural sciences.
5 4 3 2 1	(e)	To allow any teacher who so wishes to utilize the computer as an instructional tool in teaching courses in his area.
5 4 3 2 1	(f)	To permit any teacher to learn to program a computer.
5 4 3 2 1	(g)	To provide instructional services (e.g., test grading, test analysis, record keeping, inventory management, objective-referenced test generation, form-letter generation, etc.) to any teacher requesting such services.
5 4 3 2 1	(h)	As a special learning resource for handicapped students.
5 4 3 2 1	(i)	As a special learning resource for gifted students (regardless of subject area of that giftedness).
5 4 3 2 1	(j)	To permit each student to have experiences with computer applications (not necessarily programming) in his area of subject matter interest.
5 4 3 2 1	(k)	To provide computer programming as a vocational/technical training skill for students who are not potentially college bound.

OVER PLEASE →

B.3 Indicate your opinion regarding the training of teachers with respect to computers and their uses.

Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree		
5	4	3	2	1	(a)	Inservice opportunities should be provided for <u>all</u> teachers to learn about computers and their uses, but no programming should be included in that inservice.
5	4	3	2	1	(b)	Inservice opportunities should be provided for <u>all</u> teachers and should include an introduction to programming.
5	4	3	2	1	(c)	Work with computers should be included in the preservice college education of all elementary school teachers.
5	4	3	2	1	(d)	Work with computers should be included in the preservice college training of all secondary school teachers.
5	4	3	2	1	(e)	Work with computers should be included in the preservice college training of all mathematics and science teachers.
5	4	3	2	1	(f)	There is a need for secondary school teachers who are qualified to teach computer science (i.e., computer literacy, computer programming, data processing, etc.).
5	4	3	2	1	(g)	The Wyoming State Department of Education should establish certification requirements in the area of computer science.
5	4	3	2	1	(h)	A vocational classroom funding unit for computer science should be authorized at the secondary level.

If your school now uses a computer, please go on to SECTION C.

If your school does not now use a computer (and you have completed SECTIONS A and B of this survey), please return this form to Bob Kansky using the envelope enclosed.

SECTION C: CURRENT USES OF COMPUTERS BY YOUR SCHOOL

C.1 If your school uses a computer for <u>administrative</u> applications, check each of the following which describes an administrative usage by your school.

_____ Student accounting (such as student scheduling, student records, attendance records, report cards, etc.)

_____ Research and evaluation of teaching methods, curriculum materials, etc.

_____ Resource management and planning (such as maintaining personnel and financial records, inventory control, projection of enrollments, transportation scheduling, payroll, etc.)

_____ Standardized test grading/reporting

_____ Other administrative uses (please specify) _____

_____

C.2 If your school uses a computer for <u>instructional</u> applications, check each of the following which describes an instructional use of computers in your school.

_____ Tutorial (The student learns concepts through active involvement in a dialogue with the computer regarding content in some subject matter area.)

_____ Problem solving (The computer is used as a computational aid for solving complex problems in science, mathematics, business, social studies, etc.)

_____ Teaching computer programming (or data processing)

_____ Simulation (The instructional programs represent some real-life task such as decision-making in the social sciences, genetics experiments in biology, pest control, crop management, etc.)

_____ Career selection (The programs provide counseling in career selection and preparation.)

_____ Instructional games (The games have specific educational goals to develop, extend or reinforce specific skills.)

_____ Drill and practice (The programs provide practice in using skills or concepts which were developed in earlier lessons.)

_____ Test construction (The computer constructs tailored tests from a stored file of objective-referenced items.)

_____ Instructional management (The computer provides students with individualized assignments and provides the teacher with a record of each student's progress on individualized contracts.)

_____ Word processing (The computer is used to improve writing skills by permitting the "massaging" of draft forms.)

_____ Teacher-aide services such as keeping inventories of resources, storing annotated bibliographies, generating individualized form letters to parents, etc.

_____ Other instructional uses (please specify) _____

_____

Please go to SECTION D →

SECTION D: DESCRIPTION OF COMPUTER EQUIPMENT USED

D.1 Check each of the following ways in which computer facilities are now available to your school.

_____ Ownership by the school district.

_____ Lease with an option to buy.

_____ A rental agreement.

_____ Mailing or phoning of data to a computer service.

_____ Other (please specify) _____

_____

D.2 Please provide the following information about the computer(s) used.

Manufacturer	Model	How Many	Bytes of Memory[1]	Type of Mass Storage[2]

_____ Total number of CRT-type terminals available

_____ Total number of teletype terminals available

_____ Number of printers (other than teletype terminals)

_____ Number of modems (cradles for phone hookup)

_____ Number of TV monitors (other than those serving as terminals)

_____ Number of card readers

D.3 Please check the computer languages available.

_____BASIC _____Pascal _____COBOL _____FORTRAN

_____ Other(s). Please specify. _____

D.4 Please make the following estimates regarding the percent of time that your equipment is devoted to the uses indicated.

_____ Percent of time for administrative uses[3]

_____ Percent of time for instructional uses[4]

---

[1] The number of bytes of RAM available for programming.

[2] Cassette tape? Floppy disk? Hard disk?

[3] For examples, see Item C.1 of this survey.

[4] For examples, see Item C.2 of this survey.