DOCUMENT RESUME

ED 031 937 24 EM 007 329

By-Ohlman, Herbert
Educational Computer Trends in the CEMREL Region Analysis and Recommendations.
Central Midwestern Regional Educational Lab., St. Ann, Mo.
Spons Agency-Office of Education (DHEW), Washington, D.C. Bureau of Research.
Bureau No-BR-6-2875
Pub Date May 69
Contract-OEC-3-7-062875-3056
Note-22p.
EDRS Price MF-$0.25 HC-$1.20
Descriptors-Computer Assisted Instruction, *Computer Oriented Programs, *Computers, Costs, *Data Processing, Dial Access Information Systems, Educational Administration, Educational Finance, *Educational Trends, *Electronic Data Processing, Expenditure Per Student, Federal Aid, Flexible Scheduling, Information Processing, Personnel Data, Research Tools, School District Autonomy, Student Records, Testing Problems, Test Scoring Machines

Central Midwestern Regional Educational Laboratory, Inc. (CEMREL) analyzed educational computer trends in the CEMREL region. Between 1967-68 and 1968-69, there was roughly a 50% increase in electronic data processing (EDP) installations. Computer and remote terminal installations also increased 50%, but the proportion of computers under school systems or district control decreased slightly. These computers are oriented primarily to administration needs: finance and pupil categories each account for about one-third of all computer application; research and planning and facilities each account for about 15%; instructional programs and personnel applications are only 5% each. The minimum cost reported for all operations performed by a particular installation was 10 cents per pupil per school year and the maximum was $12.26. Present trends indicate that the computer is being used in schools to solidify practices of questional educational value, such as testing, grading, and scheduling students by compartmentalization rather than by individualization. A strong recommendation is that federal support be given to foster a polycentric (many-centered) development of computer resources, rather than encouraging each school system to install its own equipment. (MM)

ED031937

EDUCATIONAL COMPUTER TRENDS IN THE CEMREL REGION

ANALYSIS AND RECOMMENDATIONS

EM007329

Central Midwestern Regional Educational Laboratory, Inc.

ERIC

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

EDUCATIONAL COMPUTER TRENDS IN THE CEMREL REGION

ANALYSIS AND RECOMMENDATIONS

by

Herbert Ohlman

Associate Director for Educational Information Systems

Published by

The Central Midwestern Regional Educational Laboratory, Inc. a private non-profit corporation supported in part as a regional educational laboratory by funds from the United States Office of Education, Department of Health, Education, and Welfare. The opinions expressed in this publication do not necessarily reflect the position or policy of the Office of Education, and no official endorsement by the Office of Education should be inferred.

Central Midwestern Regional Educational Laboratory, Inc.
10646 St. Charles Rock Road
St. Ann, Missouri 63074
314-429-3535
May 1969

TABLE OF CONTENTS

EDUCATIONAL COMPUTER TRENDS IN THE CEMREL REGION

ANALYSIS AND RECOMMENDATIONS

CEMREL, a private nonprofit educational organization, derives its main support from the U.S. Office of Education, under Title IV of the Elementary and Secondary Education Act of 1965. CEMREL is thus a national organization with a regional base, and both encourages the adoption of educational innovations developed elsewhere within its region*, and publicizes those developed here. As part of this information transfer effort, CEMREL has conducted annual surveys of educational data processing installations and uses in its region. After we analyze the results of these surveys, we will indicate possible trends and suggest some policies intended to optimize future educational computer developments in this region.

EDP Installations

A distinction is to be made between the general term "EDP (electronic data processing) installations," and "computer installations." EDP, as used by CEMREL, may or may not include any of the following:

1. unit record, EAM (electronic accounting machine), or (popularly) "tab" equipment

2. computer equipment

3. test scoring or mark reading equipment

4. data communications or remote terminal equipment

The following statistics have been compiled from information in the 1967 and 1968 editions of a "Directory of Educational Data Processing Installations," compiled by Mr. Andrew McCormick, head of data processing for CEMREL. In 1966-67, there were 452 returns from a mailing of 1069 questionnaires (42%); and in 1967-68, 489 returns out of 1124 (43.5%).+

Out of returns from within the CEMREL region, only 50 organizations reported any sort of data processing equipment in 1966-67, but 75 so reported in 1967-68; this is roughly a 50% increase in EDP installations in the region.

Computer and Remote Terminal Installations

Tables 1 and 2 summarize computer installations reported in the CEMREL region. In 1966-67, 33 organizations reported 61 computer installations; in 1967-68, 50 organizations reported 80 installations. This represents a 50%

---

* The region which CEMREL serves comprises portions of four states (see Fig. 1).

\+ The questionnaires used to compile these directories were mailed in March-April 1967, and May 1968, respectively. Therefore, we have chosen to call the reporting periods "1966-67" and "1967-68" because they most likely reflect installations in use as of about the middle of the academic year. Also, questionnaires were mailed to a number of institutions outside the region; their replies have not been included in the tabulations in this analysis.

increase in organizations reporting computers, and a 30% increase in number of installations.* However, the proportion of computers under school system or district control apparently declined from 10 out of 61 (16.5%) in 1966-67, to 12 out of 80 (15%) in 1967-68.

Tables 3 and 4 show that the use of educational remote terminals in the region increased 35% (from 36 terminals in 8 institutions in 1966-67, to 49 terminals in 14 institutions in 1967-68). However, of these totals, only one school system reported using remote terminals in 1966-67 (they had 7 devices), and four reported using them in 1967-68.

Computer Applications and Costs

Educational computers have tended to be acquired and run by administrative (rather than instructional) staff, so it is not surprising that most present uses are oriented to administrative needs.

Thus, applications (Tables 5 and 6) are organized by common administrative reporting categories (*finances, pupils, facilities, instructional programs,* and *personnel*) corresponding to the categories employed in the USOE Handbooks, and by the Midwestern States Educational Information Project (NSEIP), Oregon's project OTIS, and other school data processing efforts (see Table 7). To these five basic categories, we have added *research and planning* to accommodate the somewhat more diverse applications of colleges and universities, and to provide a more natural place for scheduling applications (which might otherwise be equally logically put in the *facilities, personnel, pupil,* or *instruction* categories).

Table 5 and Fig. 2B summarizes computer applications in colleges and universities, state departments of education, and school systems in the CEMREL region. It is seen that the *finance* and *pupil* categories dominate, each accounting for about a third of all applications; *research and planning* and *facilities* each account for about 15%; while *instructional programs* and *personnel* applications are only 5% each. While over-all applications (and most categories) doubled during the period, the greatest growth (more than triple) was in the *instructional programs* category. The most rapid growth within a state+ was experienced by Kentucky where, starting from a very small base, computer applications tripled in a year.

Table 6 extracts school systems applications from over-all computer applications (also see Figure 3A). School uses appear to have grown much less rapidly: about one-third compared to an over-all doubling. Some applications categories re-

---

* The most frequently reported digital computers used for education in 1966-67 were the IBM 1401, with 18 installations (30% or the total); and the IBM 1620, with 13 installations (21.5%). In 1967-68 (see Figure 2A), the IBM 1401 was again the most frequently reported equipment, with 19 installations (24%); but the IBM 360 series, with 13 installations (16.5%) displaced the IBM 1620, which dropped to third place, with 11 installations (14.5%). The IBM 1130 was fourth, with 8 installations (10%), and Honeywell tied Digital Equipment Corporation for fifth place (6 installations, or 7.5% each).

+ However, because we do not have figures for the full states of Illinois, Missouri, or Tennessee, these statements are to be regarded as very tenuous.

mained static (*finances* and *instructional programs*); others increased by a third (*research and planning*); or a half (*pupils* and *facilities*); or two-thirds (*personnel*). Kentucky again led in growth, more than tripling in the year -- but Missouri apparently decreased its school system applications by a third.*

Within CEMREL's region, the state of Illinois+ has been one of the most active agencies in surveying educational data processing installations and applications. They use a more detailed applications breakdown than CEMREL's, identifying 129 distinct data processing operations, grouped into 14 categories. The Illinois survey similarly found most EDP uses (in terms of the categories identified in Table 7) to be for *pupils, research and planning, financial,* and *personnel,* with *instructional programs* far down the list.

In Figure 4, the annual data processing cost per pupil has been graphed against the number of data processing operations performed. The costs decrease as the number of operations increase, with the greatest economy of scale in the 50 to 58 operations-per-installation range. In unit-operation terms, the costs average 16-2/3¢ per operation in the ranges from 1 to 49 operations, but when more than 50 operations are performed, the cost apparently drops to about 12¢ per pupil per operation.

The minimum cost reported for *all* operations performed by a particular installation was 10¢ per pupil per school year, and the maximum $12.26, with an average of $3.50 and a median of $2.40 per pupil per school year. It is interesting to compare this school data processing cost experience with at least $17.00 per student per academic year in colleges and universities.**

A number of other studies and surveys of educational computer use have been made by various agencies++; one that is highly relevant was done by a sister regional educational laboratory, NWREL.

---

* However, because we do not have figures for the full states of Illinois, Missouri, or Tennessee, these statements are to be regarded as very tenuous.

+ "Survey: Educational Data Processing, Illinois Public Schools, 1967," Circular Series A, Number 205, Office of the Supt. of Public Instruction.

**John W. Hamblin, "Computers in Higher Education," Southern Regional Education Board, Aug. 1967 (the costs mentioned are $104 million for computer equipment and operation for "research and instruction" during 1964-65).

++Recent examples include Jack W. Hill's doctoral thesis, "An Investigation of the Utilization of Electronic Data Processing in the Teacher Employment Process," a survey of 135 large school systems (George Washington University, June 1968), and Irving C. Young's "1967 Computer Use Questionnaire," a summary of information from 28 large school systems (Omaha Public Schools, Jan. 1968). Also, many older studies are referenced in the chapter by H. F. Silberman and R. T. Filep, "Information Systems Application in Education," in the "Annual Review of Information Science and Technology," (C. Cuadra, editor), vol. 3, 1968, Encyclopedia Brittanica, Inc.

A Comparison of Computer Use in Two Regions

The Northwest Regional Educational Laboratory (NWREL), which serves the five-state region which includes Alaska, Idaho, Montana, Oregon, and Washington, recently published a survey entitled "Educational Computer Applications: A Northwest Directory 1968/69." NWREL attempted to contact all public and private elementary and secondary schools which made any use of computers.

With the exception of Alaska (which apparently does not have any school district computer applications) the Northwest Region shows a far greater number of school districts reporting computer applications than does CEMREL (207 versus 11) and a correspondingly greater number of applications (1316 versus 55). Table 8 shows NWREL applications broken down by state and by the six categories used in this report.

However, the NWREL survey includes school system applications on other organizations' computers*, while CEMREL's survey includes only those actually done on school system computers (see Table 6).

A quick run-through of the Northwest Directory to eliminate school systems served by other computers (whether commercial or non-commercial) takes out the great majority of installations and applications, but still leaves NWREL reporting approximately twice as many school districts using their own computer than in CEMREL's region. The contrast seemingly is heightened when we note that the Northwest Region (excluding Alaska) has only two-thirds the school population of the CEMREL region. However, NWREL schools expend about 20% more per student ($590 versus $480) than do CEMREL schools, and this higher expenditure undoubtedly encourages greater use of computers (as well as other educational innovations which require monetary support).

Nevertheless, over-all comparison of school computer use between the two regions shows a greater disparity than can be accounted for by these reasons. One explanation of why the NWREL region is much stronger in computer use may be found in the Title III projects, Oregon Total Information System (OTIS), and the computer Instruction Network (CIN). Also, in Oregon there are a number of intermediate education districts (IED) which own or lease computers to serve a number of schools. However, the reasons for the Washington strength cannot be explained in this manner; computer support is obtained about 40% from commercial data processing services, and 40% from cooperatives or other educational institutions. In the CEMREL region, there is no Title III project similar to OTIS; the only comparable computer installation to OTIS is run by (and supported by) the Memphis City Schools.

We have also compared the distribution of computer applications between CEMREL and NWREL (Figures 3A and 3B). The proportion going to pupil applications is surprisingly consistent in both cases, approximately 3/8 of the total. However, CEMREL schools seem to spend much less on financial applications than do NWREL schools, and considerably more on research and planning, facilities, and personnel. The proportion allotted to instructional programs is minimal in both regions.

---

* School systems surveyed in the NWREL directory owned or leased only about 10% of all the computer systems reported.

Trends in Educational Computer Use

Obviously, it is not possible to extrapolate from these figures to the country as a whole, particularly since either region cannot be said to be typical. However, the relative relationships among institutions in their computer use may be suggestive.

There is not the slightest doubt that the installation and use of EDP equipment and computers in educational organizations of the region has increased rapidly during the past few years. However, the great majority of this use has taken place in institutions of higher education rather than in school systems, while the potential of the computer to aid school systems is at least as great as that in higher education.*

Possible reasons for this imbalanced situation are not hard to find. For one thing, the relatively larger size of colleges and universities makes economy of scale possible. Even more telling is the fact that of $103 million spent on computer equipment and operations for "research and instruction" in institutions of higher education in 1965-77, $43 million, or 40%, came from the Federal Government (in addition, another $41 million was contributed by manufacturers in the form of educational allowances).+ Also, a strong case for widespread use of computers in higher education was given in a report of the President's Science

---

* A good case also can be made against present trends in computer use: "The computer is already being used in schools to solidify...practices of questionable educational value. Just when the whole area of testing and grading is coming into serious question, the computer lessens its clerical burden and silences the questioning." ... At a time when the size and complexity of school administration is reaching crisis proportions, and thus has the possibility of revolutionary change, the computer is introduced to assist in scheduling students to classes. Although the computer is supposed to support individualized scheduling, it can be used to compartmentalize, regiment, and stratify students more completely than current methods have done."
Barbara J. Schieffelin, "Pandora's Box, or the Tale of the Sleeping Giant," in "Some Essays on Computers in Education" by the "Students of B-60," New England School Development Council and Graduate School of Education, Harvard University, Spring 1967, pp. 14-23.

\+ John W. Hamblin, "Computers in Higher Education--Expenditures, Sources of Funds, and Utilization for Research and Instruction 1964-65 with Projections for 1968-69," Southern Regional Education Board, Aug. 1967 (ERIC Document ED 016-302). However, the Federal largess was not too student-oriented: of the $43 million "Federal contracts and grants," $25 million was designated as "primarily for computer activities," broken down as follows:

Rental or purchase of equipment and buildings:	$13 million
Operations:	$ 7 million
Computer time for R&D and graduate instruction:	$ 3 million
Computer science activities:	$ 1.5 million
Computer time for undergraduate instruction:	less than $.5 million

Furthermore, the latest figures show a decline in manufacturer's support to about 15% (testimony of Dr. Milton Rose, head of the National Science Foundation's Office of Computing Activities, to a subcommittee of the House Science and Astronautics Committee, reported in Datamation, May 1969, p. 140).

Advisory Committee (popularly known as the Pierce Report, after its chairman)*. The Pierce committee estimated that annual support for adequate computer capacity for *student* use will require approximately $340 million per year for four-year colleges, and $74 million for two-year colleges by 1971-72, or about $60 per student per year (4% of the over-all student cost).

Unfortunately, Federal subsidies, although common for computer support in higher education, are not usually made in support of school system computer use. What support there is from outside the school systems usually comes from the states (outstanding examples are New York and California). Furthermore, the Pierce Report singled out the Federal Government as the key element in expanding educational computer utilization for higher education; its help is even more essential for the development and support of computing resources for school systems.+

However, we believe that this support should be designed to foster a *polycentric***

---

* "Computers in Higher Education," Report of the President's Science Advisory Committee, Feb. 1967.

\+ The U.S. Office of Education's major effort in this area has been CUES (Computer Utility for Educational System), a study to explore the feasibility of creating a single large central computer system which would serve 100,000 students in 50 secondary schools and junior colleges with a 100-mile radius, for administrative and instructional applications. Total costs per student per year were estimated to be $16 (if hardware were purchased) or $19 (if hardware were leased), which would drop to $11 to $12, respectively, if the student population served were to be doubled. However, CUES does not give much consideration to the possibilities for cooperation with institutions of higher education.

For a general account of this work, see "USOE Launches Research, Designs CAI Centers," by Robert M. Morgan, Nation's Schools, 82, #4, Oct. 1968, pp. 65-57. For more detail, see "Interim Report: Functional Analysis and Preliminary specifications for a Single Integrated Central Computer System for Secondary Schools and Junior Colleges, A Feasibility and Preliminary Design Study Performed for the U.S. Office of Education," Computation Planning, Inc., Bethesda, Maryland, May 1968, p. 11.

** This term has been adopted from Rudolf Bićanić's "Problems of Planning: East and West," published by Mouton & Company, The Hague, 1967. Bićanić notes that "many people who think of the computer as a centralizing force in society have in mind that all relevant planning decisions can be made at a single center," which he calls a monocentric planning mechanism. In contrast to this conception, he says that "a polycentric planning mechanism consists of many planning centers and so requires many computer centers also. Such computer centers must be intertied into one computer information system, just as the planning centers in polycentric planning are interconnected into one planning mechanism." (p. 105). A very ambitious proposal for a polycentric "educational communications system" for colleges and universities is described in "Edunet: Report of the Summer Study on Information Networks" by the Interuniversity Communications Council (EDUCOM), George Brown, James Miller, and Thomas Keenan, authors and editors, Wiley, 1967.

(many-centered) development of computer resources, rather than encouraging each school system to install its own equipment. As we have seen, the computer activities of school systems in the Northwest Region, particularly in Oregon, are largely based on the polycentric concept. This concept has a number of advantages -- technically, economically, and politically -- for the development of computer power in this region. First of all, development can be based on existing centers of economical computer power, which are generally found in the larger universities. Many of these institutions would like to obtain larger computer systems, but cannot justify them solely for their own applications. However, if a number of school systems were persuaded to tie in by means of remote-batch or time-sharing terminals, a much larger (and hopefully, more economical*) installation could be achieved, which should be of mutual benefit to the institution and to surrounding schools (and ultimately to the state and Federal governments).+

Secondly, school systems should derive by-product benefits (planning and simulation help, for example) from the rich banks of research and technical information developed by universities, while the latter institutions could tap detailed empirical and operational information from the "places where it is happening" -- the schools.

To sum up, we believe that the recommendations of the Pierce Report should extend to elementary and secondary education, and that the best mechanism for accomplishing this should be a *joint* effort by those agencies traditionally responsible for higher education (National Science Foundation), and for elementary and secondary education (U.S. Office of Education).

---

* There is an economy of scale "law" in the computer field (called "Grosch's law", after Dr. Herbert Grosch, who is presently director of the National Bureau of Standards' Center for Computer Science and Technology) which claims that the power of a computing system goes up as the square of its cost.

\+ The Pierce Report stated that: "The argument for obtaining service from a time-shared computer system is even stronger in the case of secondary schools than it is in the case of small colleges." (p. 45; also see pages 26 and 27 for more information on computers and secondary education).

TABLE 1: 1966-67 SUMMARY OF EDUCATIONAL COMPUTER EQUIPMENT IN CEMREL REGION

DIGITAL EQUIPMENT CORP.
- PDP-5
  - Washington University (Mo.)
- PDP-8
  - Kirksville (Mo.) Col. of Ost. & Surg.
- LINC
  - Washington University (4)(Mo.)

HONEYWELL
- 00
  - *Jefferson County Public Schools (Ky.)
  - Morehead State University (Ky.)
- H1200
  - Middle Tennessee State University

IBM
- IBM 360
  - Model 20
    - University of Missouri
    - David Lipscomb College (Tenn.)
  - Model 30
    - University of Missouri
  - Model 40
    - University of Missouri at Rolla
    - * Memphis City Schools (Tenn.)
  - Model 50
    - Washington University (Mo.)
- IBM 704
  - University of Louisville (Ky.)
- IBM 705
  - University of the South (Tenn.)
- IBM 1130
  - Murray State University (Ky.)
  - Missouri
    - Moberly Junior College
    - University of Missouri
- IBM 1401
  - Illinois
    - Office of Supt. of Public Instruction
    - *School Dist. #186 (Springfield)
    - Southern Illinois University (2)
  - Kentucky
    - University of Louisville
    - Western Kentucky University
  - Missouri
    - *St. Louis Public Schools (2)
    - State Teachers College
    - Washington University (2)
  - Tennessee
    - Austin Peay State College
    - *Memphis City Schools
    - Memphis State University
    - *Metro. Board of Education (Nashville)
    - *Shelby County Board of Education
    - Tenn. A & I State University
    - Vanderbilt University
- IBM 1440
  - St. Louis University (Mo.)
- IBM 1620
  - Southern Illinois University
  - University of Louisville (Ky.)
  - Missouri
    - *Jefferson City Public Schools
    - SE Missouri State College
    - *Special School Dist. of St. Louis Co.
    - University of Missouri
    - University of Missouri at Rolla
    - Westminister College
  - Tennessee
    - Christian Brothers College
    - Fisk University
    - Tenn. A & I State University
    - University of Chattanooga
    - University of the South
- IBM 1710
  - Washington University (Mo.)
- IBM 1800
  - Vanderbilt University (Tenn.)
- IBM 7040
  - Southern Illinois University
  - University of Missouri
- IBM 7072
  - Vanderbilt University (Tenn.)
  - Washington University (Mo.)

OTHERS
- AUTONETICS RECOMP II (North American Rockwell)
  - Middle Tennessee State University
- RCA 110A
  - Vanderbilt University (Tenn.)
- SCC 650-2 (Scientific Control Corp.)
  - Vanderbilt University (Tenn.)

ANALOG COMPUTERS
- Goodyear GEDA
  - Middle Tennessee State University

TOTALS: 61 digital (& 1 analog) computers in 33 institutions (including 10 digital computers in 8 school systems which are preceded by an asterisk)

TABLE 2: 1967-68 SUMMARY OF EDUCATIONAL COMPUTER EQUIPMENT IN CEMREL REGION

DIGITAL EQUIPMENT CORP.

PDP-5
- Washington University (Mo.)

PDP-8
- Kirksville (Mo.) Col. of Ost.& Surg.

LINC
- Washington University (4)(Mo.)

HONEYWELL

H200
- Illinois Supt. Public Instruction
- Kentucky
  - Eastern Kentucky University
  - *Jefferson Co. Public Schools
  - Kentucky State Dept. Education
  - Morehead State University

H1200
- Middle Tennessee State University

IBM

IBM 360

Model 20
- David Lipscomb College (Tenn.)
- Kirksville Col. of Ost.& Surg.(Mo.)
- Moberly Jr. College (Mo.)
- Murray State University (Ky.)
- University of Missouri (Columbia)

Model 30
- Tenn. State Dept. Education
- University of Missouri (Columbia)

Model 40
- Junior College Dist. of St. Louis
- *Memphis City Schools
- SE Missouri State College

Model 50
- University of Kentucky
- University of Missouri at Rolla
- Washington University (Mo.)

IBM 704
- University of Louisville (Ky.)

IBM 705
- University of the South (Tenn.)

IBM 1130
- University of Kentucky
- University of Louisville (Ky.)
- Berea College (Mo.)
- Moberly Junior College (Mo.)
- Tennessee
  - Christian Brothers College
  - *Clarksville-Montgomery Bd. of Ed.
  - Lambuth College
  - Southern College of Optometry

IBM 1401
- Illinois
  - *Alton School District #2
  - *School Dist. #186 (Springfield)
  - Southern Illinois University (2)
- Kentucky
  - University of Louisville
  - Western Kentucky University
- Missouri
  - *St. Louis Public Schools (2)
  - State Teachers College (Kirksville)
  - Washington University (2)
- Tennessee
  - Peay State College
  - *Memphis City Schools
  - Memphis State University
  - *Metro. Board of Education (Nashville)
  - *Shelby County Board of Education
  - University of Chattanooga
  - Univ. Tenn. Medical Units (Memphis)
  - Vanderbilt University

IBM 1440
- Missouri State Dept. of Education
- St. Louis University
- University of Kentucky

IBM 1620
- Southern Illinois University
- University of Louisville (Ky.)
- Missouri
  - *Jefferson City Public Schools
  - Lincoln University
  - *Special School Dist. of St. Louis Co.
  - University of Missouri (Columbia)
  - Westminster College
- Tennessee
  - Fisk University
  - Southwestern at Memphis
  - Tenn. A & I State University
  - University of the South

OTHERS

AUTONETICS RECOMP II (North American Rockwell)
- Middle Tennessee State University

NCR 500
- Georgetown College (Ky.)
- *Normandy School Dist.(St. Louis Co.)

RCA 110A
- Vanderbilt University (Tenn.)

SCC 650-2 (Scientific Control Corp.)
- Vanderbilt University (Tenn.)

ANALOG COMPUTERS

EAI TR-20
- Parks College (Illinois)

GEDA
- Middle Tennessee State University

TOTALS: 80 digital (& 2 analog) computers in 40 institutions including 13 digital computers in 11 school systems which are preceded by

TABLE 3: EDUCATIONAL REMOTE TERMINALS IN CEMREL REGION

1966-67

ASR 33 Teletype
- Kirksville College of Ost. & Surg. (Mo.)(2)

IBM 066 Data Transceivers (Remote card reader & printing card punch)
- Metro. Board of Education (Tenn.)(7)

IBM 1050 Remote Terminal
- Junior College District (St. Louis Co.)(2)
- Meramec Community College (System consists of 1055 card reader, 1058 printing card punch and 1052 printer-keyboard)
- Parks College (Illinois)
- University of Missouri (Columbia)(System consists of 1051 control unit and 1052 printer-keyboard)(2)
- Washington University (Mo.)(5)

IBM 1052 Printer Keyboard
- Centre College of Kentucky

IBM 2260 Visual Display
- Washington University (Mo.)(8)

IBM 2740 Remote Terminals
- Washington University (Mo.)(2)

Programmed Consoles*
- Washington University (Mo.)(6)

TOTALS: 36 terminals in 8 institutions

---

* These unique terminals were designed and built at Washington University's Computer Systems Lab. Each includes: an input keyboard, an analog-to-digital converter, 4000 12-bit words for on-line storage and local processing, a digitally-adapted "Language Master" for off-line program and data storage on magnetic cards, a storage scope display, and a communications data set.

TABLE 4: EDUCATIONAL REMOTE TERMINALS IN CEMREL REGION

1967-68

ASR-33 Teletype
- CEMREL (Mo.)
- Clayton School District (Mo.)
- Kirksville College of Ost. & Surg. (Mo.)(2)

IBM 1050 Remote Terminal
- Junior College District (St. Louis Co.,Mo.)(3)
- Meramec Community College (Mo.)(System consists of 1055 card reader, 1058 printing card punch and 1052 printer-keyboard)
- Parks College (Illinois)
- University of Missouri (Columbia)(System consists of 1051 control unit and 1052 printer-keyboard)(2)

IBM 1052 Printer-Keyboard
- Centre College of Kentucky
- School District of City of Ladue (Mo.)
- University of Kentucky (3)

IBM 1080 Laboratory Data Acquisition System
- University of Tennessee Medical Units

IBM 1092 Programmed Keyboard*
- University of Tennessee Medical Units (10)

IBM 2260 Visual Display
- University of Kentucky (2)
- University of Missouri at Rolla (2)
- Washington University (Mo.)(8)

IBM 2740 Communications Terminal
- Memphis City Schools (2)

IBM 2741 Communications Terminal
- School District of City of Ladue (Mo.)

Programmed Consoles
- Washington University (Mo.)(6)

Tektronix Visual Display
- Parks College (Illinois)(2)

TOTALS: 49 terminals in 14 institutions

---

* This is a flexible input-only component of the 1050 system.

TABLE 5: EDUCATIONAL COMPUTER APPLICATIONS IN THE CEMREL REGION, 1966-67 & 1967-68*

(in rough rank order by applications categories)

Numbers in parentheses are percentages of 1967-68 ALL APPLICATIONS

	APPLICATIONS & APPLICATION CATEGORIES	CEMREL Region		Southern Illinois		Kentucky		Eastern Missouri		West & Central Tennessee	
		66-67	67-68	66-67	67-68	66-67	67-68	66-67	67-68	66-67	67-68
I	Accounting, financial records	26	54	3	5	4	14	9	17	10	18
	Payroll	26	44	3	5	4	11	7	13	12	15
	Lunch, cafeteria accounting	1	3		1					1	2
	Other	3	6	1			3			2	3
	FINANCES	56	107(32.8)	7	11	8	28	16	30	25	38
II	Student records	24	50	2	6	3	9	9	17	10	18
	Grading, test scoring	20	34	2	4	3	8	9	11	6	11
	Attendance, census, roll, rosters	8	19	2	3		4	4	6	2	6
	Graduate reports, alumni records	1	3		1		1			1	1
	Other		2						1		1
	PUPILS	53	108(33.1)	6	14	6	22	22	35	19	37
III	Scheduling, course programming	13	27	3	3		5	7	10	3	9
	Research, education res'h, inventory res'h	5	11		1	1	3	3	4	1	3
	Statistics, stat'l data, stat'l rep.	1	3					1	3		
	Other	2	4					2	2		2
	RESEARCH & PLANNING	21	45(13.7)	3	4	1	8	13	19	4	14
IV	Facilities	7	10	2	2	1	3	4	4		1
	Ordering	5	7					3	4	2	3
	Addressing, mailing	2	5		1		1	1	2	1	1
	Inventory, equip. inventory, art inventory, equip. records	2	5		1			1	1	1	3
	Library, lib'y acq., lib'y mat'ls	3	3	1		1	1		1	1	1
	Other	1	2					1	1		1
	FACILITIES	20	32(9.8)	3	4	2	5	10	13	5	10
V	Instruction, classroom instruction	2	6		1			2	4		1
	Education(al)	2	3					2	2		1
	Student programs		2		1		1				
	Teaching, training	1	2							1	2
	Other		5		1		1		3		
	INSTRUCTIONAL PROGRAMS	5	18(5.5)		3		2	4	9	1	4
VI	PERSONNEL	9	17(5.2)	3	3		3	5	8	1	3
	ALL APPLICATIONS	164	326	22	39(11.7)	17	68(20.9)	70	114(35.0)	52	106(32.5

* Totals include all institutions reporting (including colleges and universities, state departments of education, and school systems). These applications include only those actually done on a computer actually owned or leased by a school system or district.

TABLE 6: SCHOOL SYSTEM COMPUTER APPLICATIONS IN THE CEMREL REGION*, 1966-67 & 1967-68

(in rank order by 1967-68 figures)

Numbers in parentheses are percentages of 1967-68 ALL APPLICATIONS

	APPLICATIONS & APPLICATION CATEGORIES	CEMREL Region		Southern Illinois		Kentucky		Eastern Missouri		West & Central Tennessee	
		66-67	67-68	66-67	67-68	66-67	67-68	66-67	67-68	66-67	67-68
	Student records	5	7	1	2			2	2	2	3
	Grading, test scoring	4	5	1	2			2	1	1	2
	Attendance, census, roll, rosters	5	9	1	2		2	2	2	2	3
	PUPILS	14	21(38.2)	3	6		2	6	5	5	8
II	Accounting, financial records	6	5	1	1	1	1	2	1	2	2
	Payroll	6	6	1		1	2	1	1	3	3
	Lunch, cafeteria accounting	1	2		1					1	1
	FINANCES	13	13(23.6)	2	2	2	3	3	2	6	6
III	Scheduling, course programming	6	8	1	2		1	3	2	2	3
	RESEARCH & PLANNING	6	8(14.5)	1	2		1	3	2	2	4
IV	Ordering	2	2					1		1	2
	Inventory, equip. inventory, art inventory, equip. records	1	3		1			1	1		1
	Library, lib'y acq., lib'y mat'ls	1	1							1	1
	FACILITIES	4	6(10.9)		1			2	1	2	4
V	PERSONNEL	3	5(9.1)	1	1		1	1		1	3
VI	Instruction, classroom instruction	1	1					1	1		
	Education(al)	1	1					1	1		
	INSTRUCTIONAL PROGRAMS	2	2(3.6)					2	2		
	ALL APPLICATIONS	42	55	7	12(21.8)	2	7(12.7)	17	12(21.8)	16	25(45.4

* These applications include only those actually done on a computer actually owned or leased by a school system or district.

TABLE 7: CATEGORIZATIONS OF EDUCATIONAL DATA PROCESSING APPLICATIONS

Hand-Book No.	State Educational Records & Reports Service (USOE Handbooks)[1]	Midwestern States Educational Information Project (MSEIP)[2]	Oregon Total Information System (OTIS)[3]	Actual EDP Applications[4]				APPLICATIONS CATEGORIES USED IN THIS REPORT
				NWREL Region School System Computer 1968	Illinois Public School EDP 1967	CEMREL Region Educational Computer 1967-68		
						All	School Systems	
II	financial accounting	finances	fiscal(5)	1.5	3	1.5	2	FINANCES
III	property accounting	facilities	property(4)	6	5	4	4	FACILITIES
IV	staff accounting	personnel	staff(2)	4	4	5.5	5	PERSONNEL
V	pupil accounting	pupils	student(1)	1.5	1	1.5	1	PUPILS
VI	instruction	instructional programs	curriculum(3)	5	6	5.5	6	INSTRUCTIONAL PROGRAMS
—	—	—	—	3	2	3	3	RESEARCH & PLANNING

[1] Handbook No. 1 is concerned with "state educational information."

[2] Uses alphabetical order.

[3] Numbers in parentheses are OTIS' category ordering (but do not necessarily represent any ranking based on actual usage).

[4] Ranking by categories listed in right column (where actual frequencies were very close, tied ranks have been used).

TABLE 8: SCHOOL SYSTEM COMPUTER APPLICATIONS IN THE NWREL REGION*
(in rank order by Fall 1968 figures)
Numbers in parentheses are percentages of ALL APPLICATIONS

		NWREL Region	Idaho	Montana	Oregon	Washington
I	Payroll		4	1	43	52
	Expendit. acct'ng.		5	1	21	66
	Revenue acct'ng.		5	1	18	65
	Encumbrance acct'ng.		5		19	52
	Budget preparation		2	1	14	57
	Construction fund		2		10	36
	Other				6	12
	FINANCES	498(37.8)	23	4	131	340
II	Grade reporting		3	8	70	48
	Class listing		4	9	36	44
	Attendance		4	4	42	25
	Permanent records		1	2	41	27
	Test scoring				45	15
	Transcript preparation		1		15	12
	Census			2	15	2
	Other				11	4
	PUPILS	490(37.2)	13	25	275	177
III	Student scheduling		4	12	69	46
	Other				2	3
	RESEARCH & PLANNING	137(10.4)	4	12	72	49
IV	Pension-retirement		1		29	25
	Prof'l. personnel records		1		8	13
	PERSONNEL	77(5.9)	2		37	38
V	Math		4	1	15	3
	Data processing		1	2	5	7
	Business education				9	5
	Programming			3	6	3
	Other				2	
	INSTRUCTIONAL PROGRAMS	66(5.1)	5	6	37	18
VI	Inventory-equipment				11	9
	Inventory-supplies				9	8
	Library		1		1	3
	Transportation routing				1	4
	District mailing lists				1	
	FACILITIES	48(3.6)	1		23	24
	ALL APPLICATIONS	1316	48 (3.7)	47 (3.6)	575 (43.7)	646 (49.1)

* Summarized from "Educational Computer Applications: A Northwest Directory, 1968/69," Computer Div. Staff, Northwest Regional Educational Laboratory, Feb. 1969. Applications include both those done on school-system-owned or leased equipment and those contracted for elsewhere by the school system.

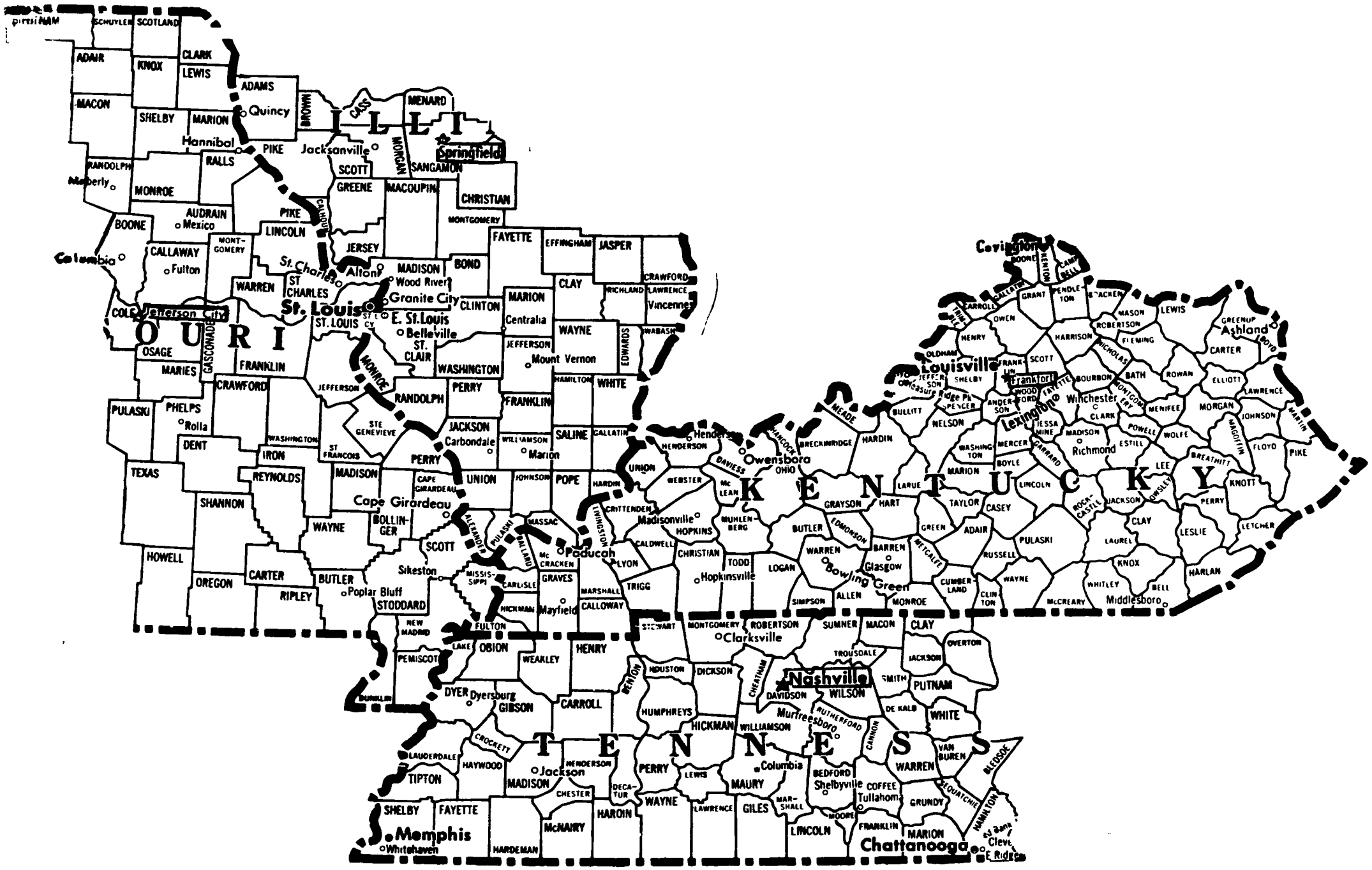


Figure 1: CEMREL Region

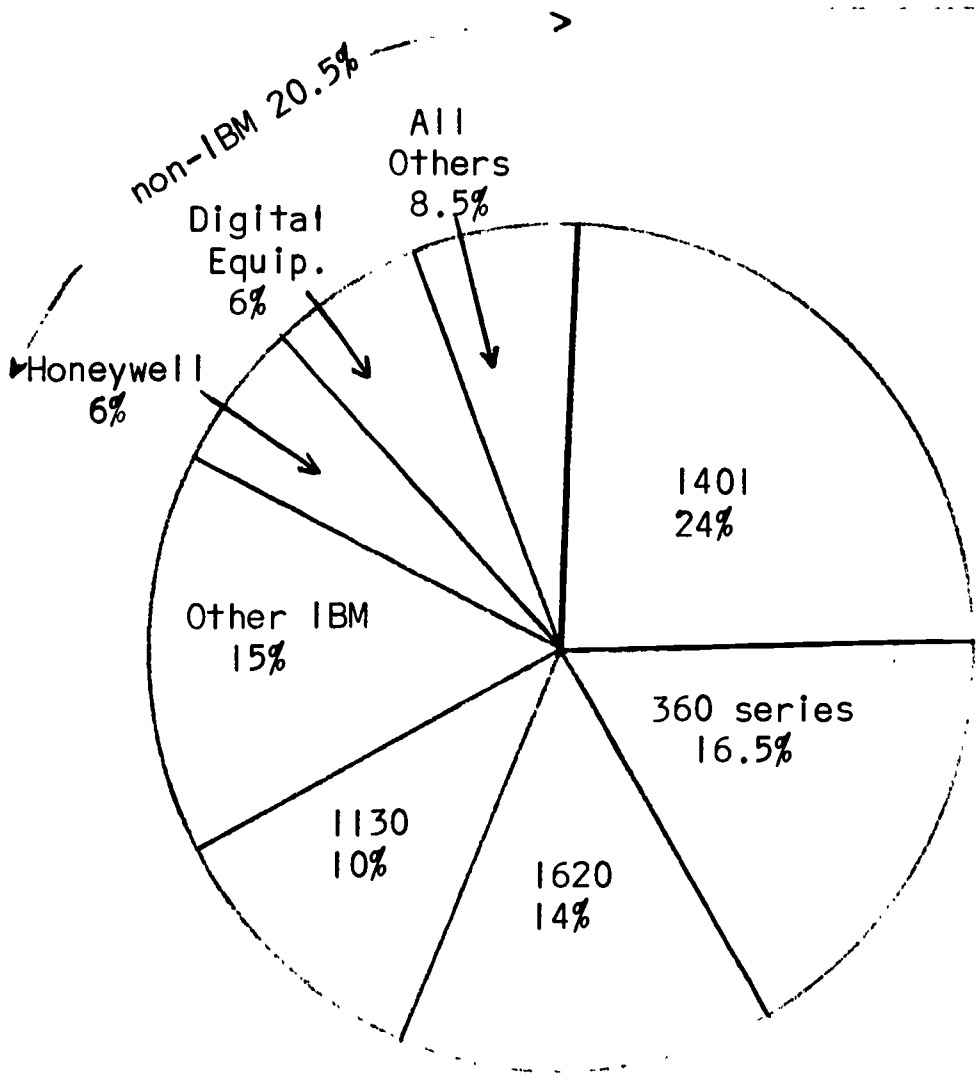


Figure 2A: Distribution of 80 Educational Computers by Manufacturer
CEMREL Region, 1967-68

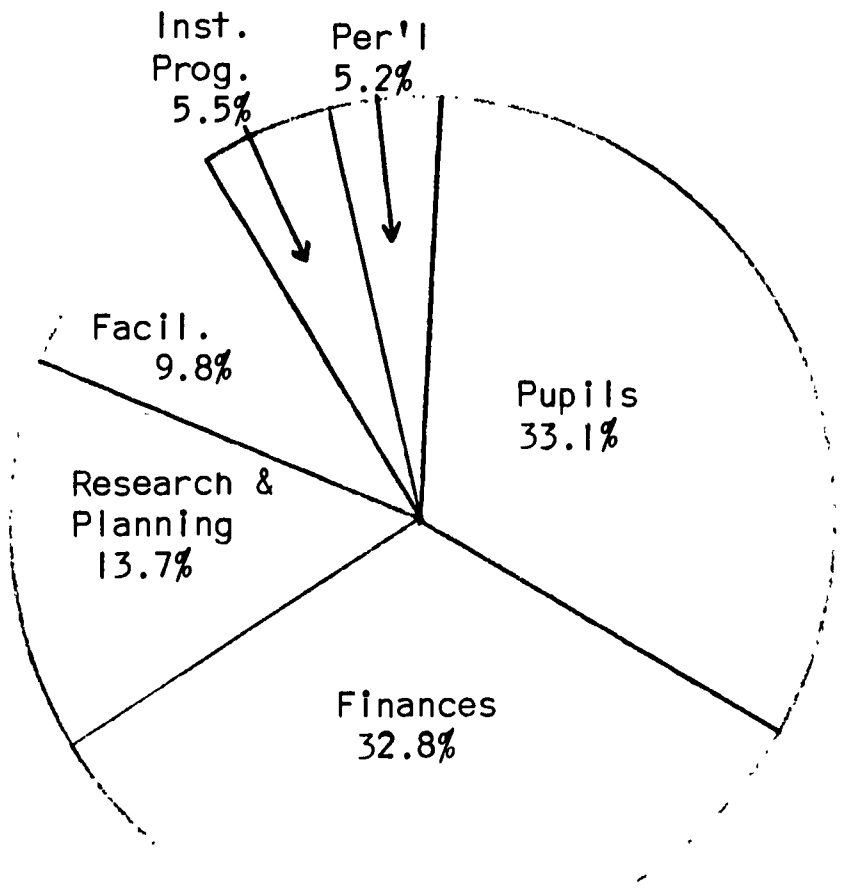


Figure 2B: Distribution of 326 Educational Computer Applications
CEMREL Region, 1967-68

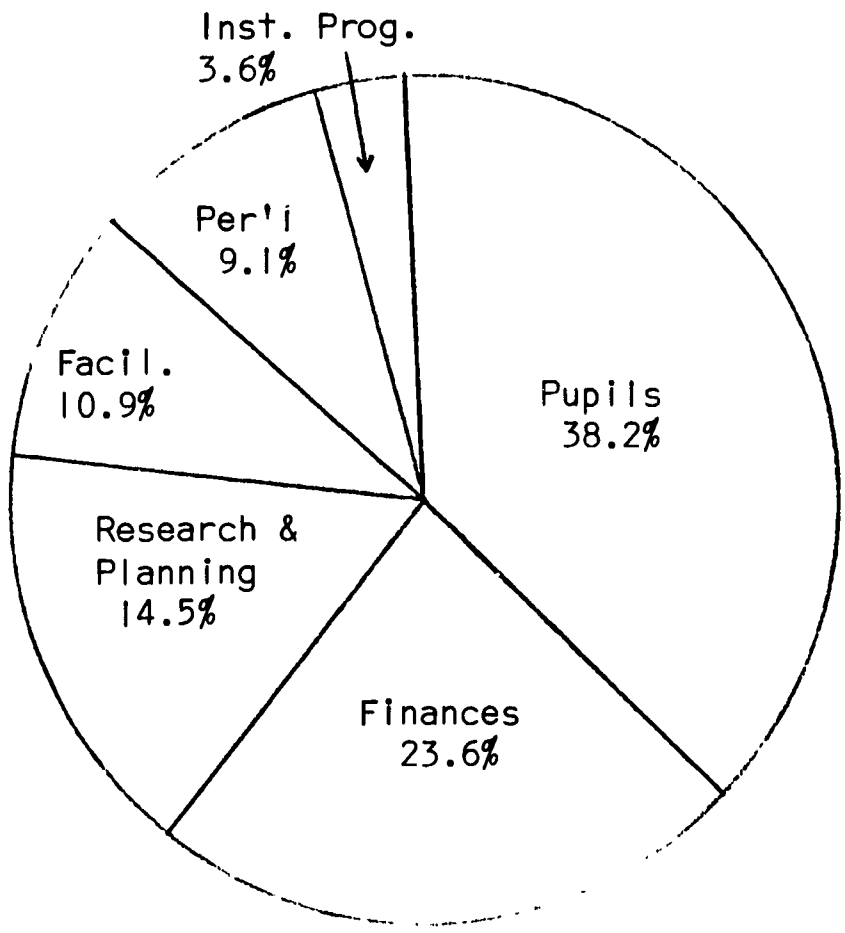


Figure 3A: Distribution of 55 School System Computer Applications
CEMREL Region, 1967-68

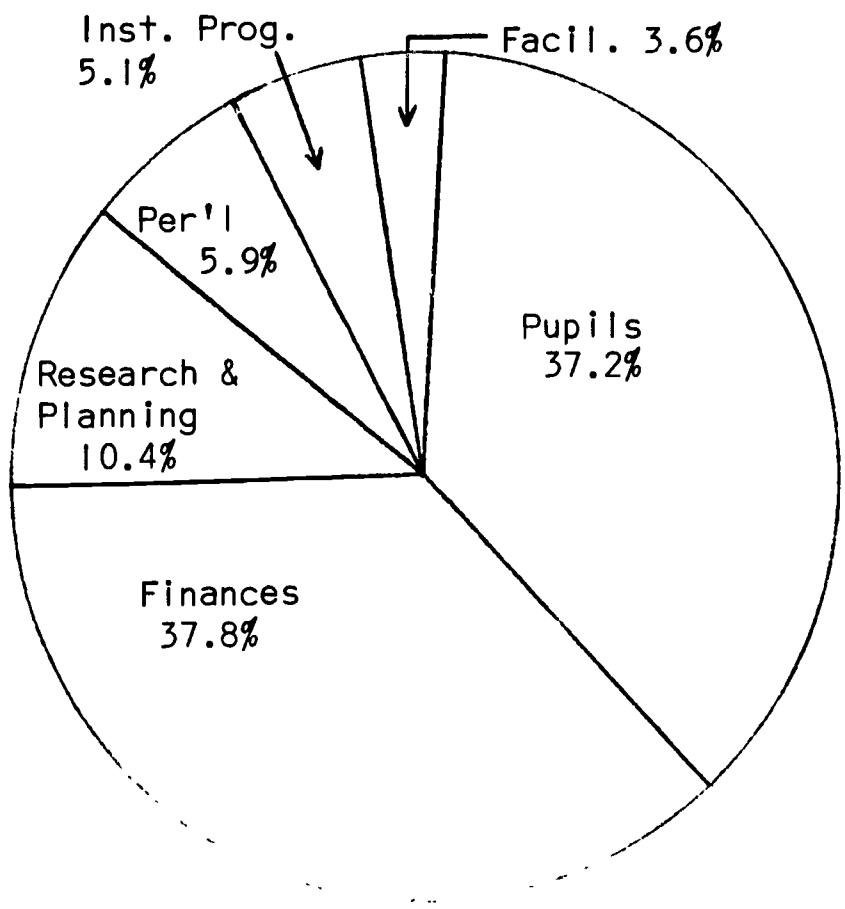
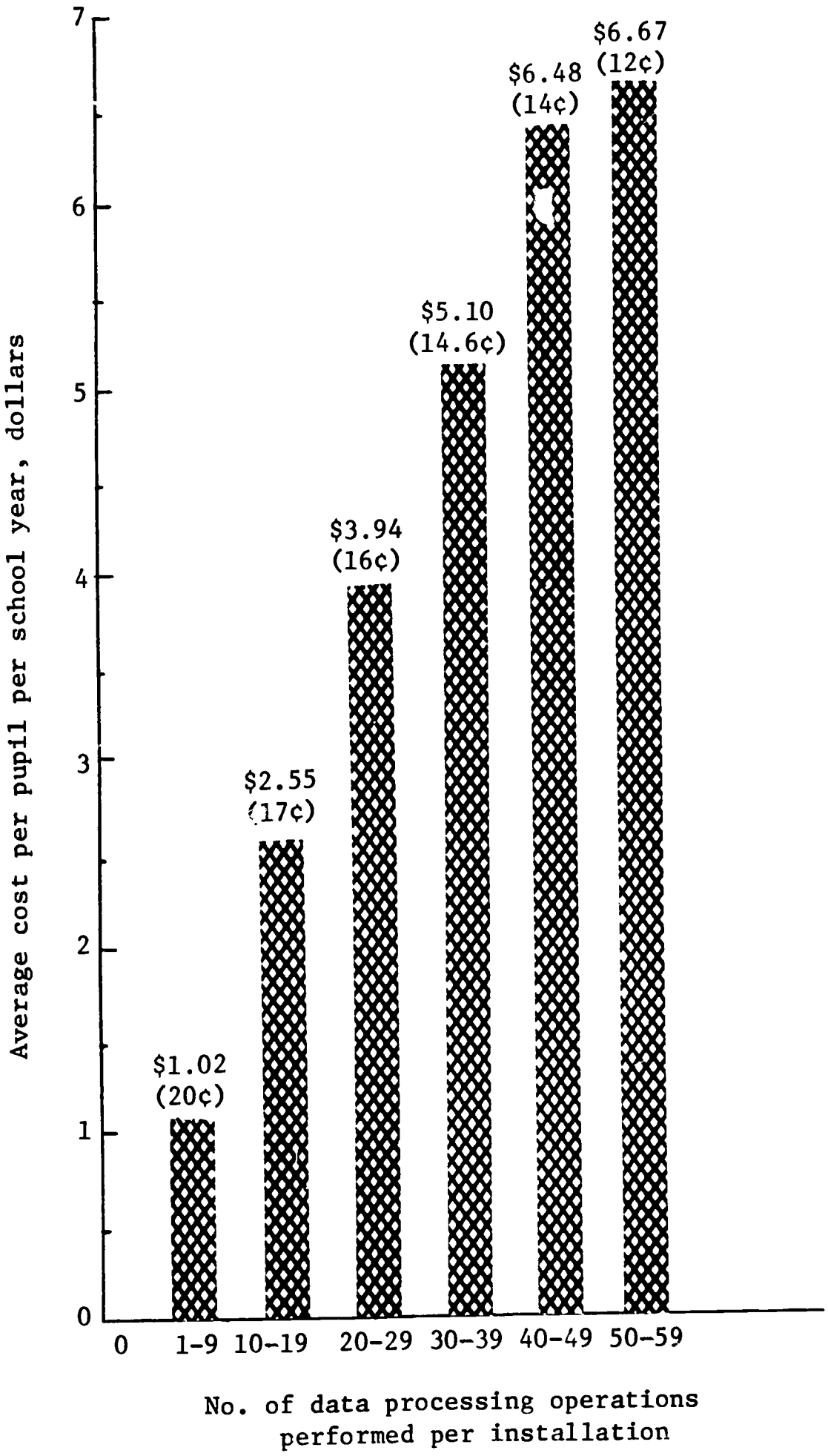


Figure 3B: Distribution of 1316 School System Computer Applications
NWREL Region, 1968



(numbers in parentheses are rough costs per operation, using a median no. of operations for each range)

Fig. 4: EDP Costs in Illinois Public Schools, 1966-67

TABLE 2: 1967-68 SUMMARY OF EDUCATIONAL COMPUTER EQUIPMENT IN CEMREL REGION

DIGITAL EQUIPMENT CORP.

- PDP-5
  - Washington University (Mo.)
- PDP-8
  - Kirksville (Mo.) Col. of Ost.& Surg.
- LINC
  - Washington University (4)(Mo.)

HONEYWELL

- H200
  - Illinois Supt. Public Instruction
  - Kentucky
    - Eastern Kentucky University
    - *Jefferson Co. Public Schools
    - Kentucky State Dept. Education
    - Morehead State University
- H1200
  - Middle Tennessee State University

IBM

- IBM 360
  - Model 20
    - David Lipscomb College (Tenn.)
    - Kirksville Col. of Ost.& Surg.(Mo.)
    - Moberly Jr. College (Mo.)
    - Murray State University (Ky.)
    - University of Missouri (Columbia)
  - Model 30
    - Tenn. State Dept. Education
    - University of Missouri (Columbia)
  - Model 40
    - Junior College Dist. of St. Louis
    - *Memphis City Schools
    - SE Missouri State College
  - Model 50
    - University of Kentucky
    - University of Missouri at Rolla
    - Washington University (Mo.)
- IBM 704
  - University of Louisville (Ky.)
- IBM 705
  - University of the South (Tenn.)
- IBM 1130
  - University of Kentucky
  - University of Louisville (Ky.)
  - Berea College (Mo.)
  - Moberly Junior College (Mo.)
  - Tennessee
    - Christian Brothers College
    - *Clarksville-Montgomery Bd. of Ed.
    - Lambuth College
    - Southern College of Optometry
- IBM 1401
  - Illinois
    - *Alton School District #2
    - *School Dist. #186 (Springfield)
    - Southern Illinois University (2)
  - Kentucky
    - University of Louisville
    - Western Kentucky University
  - Missouri
    - *St. Louis Public Schools (2)
    - State Teachers College (Kirksville)
    - Washington University (2)
  - Tennessee
    - Peay State College
    - *Memphis City Schools
    - Memphis State University
    - *Metro. Board of Education (Nashville)
    - *Shelby County Board of Education
    - University of Chattanooga
    - Univ. Tenn. Medical Units (Memphis)
    - Vanderbilt University
- IBM 1440
  - Missouri State Dept. of Education
  - St. Louis University
  - University of Kentucky
- IBM 1620
  - Southern Illinois University
  - University of Louisville (Ky.)
  - Missouri
    - *Jefferson City Public Schools
    - Lincoln University
    - *Special School Dist. of St. Louis Co.
    - University of Missouri (Columbia)
    - Westminster College
  - Tennessee
    - Fisk University
    - Southwestern at Memphis
    - Tenn. A & I State University
    - University of the South

OTHERS

- AUTONETICS RECOMP II (North American Rockwell)
  - Middle Tennessee State University
- NCR 500
  - Georgetown College (Ky.)
  - *Normandy School Dist.(St. Louis Co.)
- RCA 110A
  - Vanderbilt University (Tenn.)
- SCC 650-2 (Scientific Control Corp.)
  - Vanderbilt University (Tenn.)

ANALOG COMPUTERS

- EAI TR-20
  - Parks College (Illinois)
- GEDA
  - Middle Tennessee State University

TOTALS: 80 digital (& 2 analog) computers in 40 institutions including 13 digital computers in 11 school systems which are preceded by