LOCAL MAY AFFILIATE WITH NESDEC

Then New England School Development Council (NESDEC) and the LOCAL Board of Directors are discussing the possibility of having NESDEC take over the sponsorship of LOCAL after federal funding expires this July. If this arrangement materializes, LOCAL will become a department of NESDEC in order to facilitate operations not easily carried out under Massachusetts laws governing education.

LOCAL would like to operate as a true education cooperative where one school system acts as a sponsor and fiscal agent. Under such an arrangement, member systems would contract with the sponsoring town to receive services and would contribute funds to a common account which the project staff and sponsor would manage. However, current state law does not allow one school system to disburse monies received from another system. This in turn requires that the sponsoring town raise through taxation the entire project budget, which of course is politically unattractive.

If LOCAL becomes a department of NESDEC, LOCAL's member schools and its time-sharing customers will contract with NESDEC for all services normally received from the LOCAL staff.

This is a publication of the Laboratory Program for Computer-Assisted Learning (Project LOCAL), 44 School Street, Westwood, Mass. 02090 Telephone (617) 326-3050.
In addition to the kind of affiliation just described, LOCAL also will work with NESDEC's Software Research Center in cooperative ventures to develop and disseminate innovations in educational uses of computers. (Bob Haven)

MEET THE ADMINISTRATIVE COMMITTEE

Many Link readers probably are not aware that LOCAL includes and always has included, a very important component called the Administrative Committee (even the members probably aren't aware of this title). The membership of the group consists of the School Coordinators from the five member towns:

Lexington - Walter Koetke . Needham - Karl West
Natick - Francis Collins . Wellesley - Henning Sahlberg
Westwood - James Pender

The purpose of the Administrative Committee, which meets monthly, is to assist the project staff in planning and implementing activities which will further project goals. More specifically, this means bringing to light needs and deficiencies, discussing the relative importance of the items at hand and suggesting ways of fulfilling or correcting them. So, if you have a gripe or suggestion to make, bend the ear of your Coordinator so he can take it to the next meeting.

In an effort to more effectively disseminate information throughout member schools about what is going on in the project, future editions of the Link will carry summaries of the minutes of the Administrative Committee.

As you are more likely to be aware, the School Coordinators also do other jobs for the Project other than serve on the Administrative Committee. In particular, these persons act as a liaison for operational matters between their respective school systems and other member schools and the project office. In this capacity, they serve as communication links to keep school and project personnel informed about what others are doing. These important individuals also supervise the operation, use, and do preventative maintenance of the computer and teletype equipment installed in their school systems. (Bob Haven)
NEW RESOURCE MATERIALS UNDER DEVELOPMENT

Teacher consultants and the LOCAL staff are in the process of developing several new resource materials aimed specifically at fulfilling particular needs of Project schools as identified by the Project Administrative Committee. Items under development include: guides for the teacher to use in applying the computer as a problem-solving tool in conjunction with standard math and science textbooks, computer-generated indices to a small library of resource materials to be placed in each school system, and a programmed text to teach FOCAL programming.

Teaching guides will be developed initially for all texts used by Project Schools in courses where the computer is applied commonly -- later will come guides for other courses. These guides are intended primarily to fill the needs of teachers who want to integrate the use of the computer into their courses on a limited basis but who are not familiar with the computer and/or do not want to take the time to do extensive preparation work. Each of these guides will provide, for about ten concepts covered in the text, a teaching strategy incorporating the computer, suggested assignments, and sample solutions.

Separate computer-generated indices are being developed for math and science departments. These indices will provide cross-referenced access to materials chosen especially for their quality and relevance to the types of computer-assisted teaching going on in LOCAL schools. They will provide teachers and students convenient access, by concept to be learned, to teaching strategies, drill programs, demonstration programs, and suggested assignments and projects. They clearly are intended for the teacher/student interested in "digging deeper" to enrich his applications of the computer. A copy of each library will reside permanently in each member school system.

A new FOCAL programmed text to replace the small blue booklet Problem Solving with FOCAL - Part 1 is also on the drawing board. Unlike the old version, this one will include stored program writing, all inbbeded functions, and FOR, DO, and IF commands. Also, only part of the book will require access to a terminal. This text is designed especially for students where a teacher desires to teach programming basics via outside assignment rather than taking up class time for lectures. Of course, it will be useful also to both students and teachers who want to learn programming on their own time. (Bob Haven)
RESULTS OF LOCAL EVALUATION

As all teachers using LOCAL computers are aware, the project staff periodically has asked via questionnaire for a subjective evaluation of the impact of project activities. Some of the data received concerning the 1968-69 program are summarized here.

One item on the questionnaire asked the respondent to compare the results achieved using the computer with results obtained via non-computer teaching methods. Here is a tabulation of the responses to that item:

<table>
<thead>
<tr>
<th>Computerized Instruction Was:</th>
<th>Poorer</th>
<th>Same</th>
<th>Better</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Effectiveness in Improving: Attitude Toward Subject Matter</td>
<td>0</td>
<td>2</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>General Problem-Solving Skill</td>
<td>0</td>
<td>1</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>2. Effectiveness in Fulfilling Other Goals Which You Consider Important</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Awareness of Capabilities &amp; Limitations of Computer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Efficiency (Time required to achieve given level of learning)</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>7</td>
</tr>
</tbody>
</table>

Respondents also were asked to comment on their experiences. Here is a sampling of their comments categorized by related objective.

Subject Matter Achievement

In many cases I feel the computer strengthens the understanding. For instance, if a student can write a program which types out the radius and center of the circle defined by \( x^2 + 3x + y^2 - 4y = 135 \), he is bound to have an understanding of the circle.
(It takes the same amount of time to learn a particular thing) but they learn it better. I think the (computer) group was better to begin with. I think they are doing about what they would have without it.

The children . . . achieved various levels of success. Their teachers felt that their regular math work improved as a result of their interest in programming. (from resource teacher for sixth grade class)

In writing a program to solve a problem a student must think it through carefully and present logical steps for its solution. Thus, he must thoroughly understand the problem and not handle it mechanically and without thought. I found programming to be a most effective teaching tool.

One teacher mentioned as important side effect the carry-over to related science courses.

General Problem-Solving Skill

...I have every reason to believe that those who have done the most with the computer have increased their problem-solving skills.

Efficiency

Since using the computer, I have fallen behind in my usual time schedule. This is partly due to the fact that substantial class time is necessarily spent on computer instruction.

Awareness of Existence, Capabilities and Limitations

...I immediately sensed that these students have had some far out ideas of what a computer can do. Already these ideas are changing.
Attitude

In the class where I use the computer most, both attitude and achievement are at a high level. I have not observed any significant change in these areas.

... definitely motivational for some students, (not all) notably some students otherwise not operating productively. There is no doubt that the computer is a vehicle of motivation for the instruction of mathematics.

... there are some students who are weak mathematically who have been excited by the computer and have learned a lot of mathematics they might otherwise have missed. On the other hand, three or four very good students have not found the computer work very attractive and perhaps for them the time spent has not been productive.

Computer serves as a powerful motivating force for both good and poor students. During the summer, a number of students spent as much as 1 or 2 hours a day after class to complete programs they had started. This year ... a number of my students arrive early and remain late in order to be able to use the terminal.

Our computer (class) enrollment went from 30 to 200 when we obtained the use of a computer.

Not that many dedicated students willing to give up free time to spend on computer. (from teacher making very little use of computer)

The children were very enthusiastic about programming and achieved various levels of success.

( Bob Haven)
OTHER PROJECTS

A VISIT TO PROJECT PLAN IN A QUINCY ELEMENTARY SCHOOL

Costa Samar and I visited the Adams School in Quincy this morning to learn more about Project PLAN. This project "is an approach to individualized education currently being developed by the American Institutes for Research of Palo Alto, California, Westinghouse Learning Corporation and thirteen cooperating school districts." Quincy is the only district in New England that is in the project.

Westinghouse builds the curriculum, and has built the learning aids. Quincy buys the product at a cost of $100 per pupil. The program started in grades 1, 5 and 9 and is gradually being phased into a twelve-year program.

The students work at their own capabilities with a teacher in attendance for help. The pupil-teacher ratio is about 27 to 1. The program is offered in language arts, mathematics, social studies and science. They have modules (workbooks), tapes, film loops, texts and film strips. After working on their modules, the students take a test which is recorded on an IBM card. A fifth or sixth grade student feeds this card into a reader and the next day a corrected printout and tally come back to them from Iowa City.

We felt there were distinct advantages to this plan in that material was available and did not have to be prepared the previous summer. A running total of the students' accomplishments were available. The program was written by a large group and definitely had organization. The pupils were in a relaxed, friendly atmosphere. The pupils worked in small groups and continually helped each other and did not rely on the teachers to help them with their problems. The results showed the students did at least as well as students in a structured program. The pupils moved at their own speed. In one room different students were working on addition of fractions, addition of whole numbers and multiplication of whole numbers.

We felt there were distinct disadvantages to this plan, also. We found that there were some slow readers who could not take part in the program. In a couple of rooms there seemed to be an artificial enthusiasm when everyone became busy with their
TIU's as we walked in. Students who were supposed to operate their own multimedia devices in the media center didn't always know what to do. The materials available seemed to be very formal and structured for a non-structured program. Visual aids and motivational materials were not in evidence to the extent that I expected them. Students moving into or out of this neighborhood school district could be severely handicapped. Students waiting for corrections from Iowa City often go on to the next lesson and later find they should be doing additional work on the previous lesson. This was in great evidence on printout sheets that we saw.

All in all, it was a valuable experience for us to visit the school, along with eight others from outer towns. It gave us a different view of individualized instruction, but we both felt that what we saw was not the answer to the best educational approach. (Karl H. West, Jr.)

Note: Detailed information about Project PLAN is available from the Project LOCAL office.

TEACHING CHILDREN THINKING

On Saturday, April 11, a lecture and panel discussion were held at the Artificial Intelligence Laboratory of the Massachusetts Institute of Technology. The purpose of the meeting was to attempt to answer the question, "Is it possible to make a more direct attack on teaching children to think?"

Dr. Seymour Papert of M.I.T. presented in his morning lecture a survey of current educational practices as a background for his approach to the problem. Too often children are told what to do in the learning process rather than given a chance to do themselves.

Papert believes that cybernetic or informational technology is the key. Technology is the source of truly changing the content and view of education.

"Children learn by doing and by thinking about what they do," he stated. He described the computer as a highly suitable device for achieving the desired results. Through interacting with teaching programs which establish models,
children will then be able to create teaching programs of their own. The aim here is to teach the child clear critical thinking rather than a single discipline such as mathematics. The programming language used by Dr. Papert and his colleagues is LOGO, which was developed at Bolt, Beranek, and Newman with National Science Foundation support. This language has been used with some seventh graders at Muzzey Jr. High School in Lexington since September, 1968. Last year an investigation also was undertaken with a group of second and third graders in Lexington.1

Students using LOGO are taught "computer mathematics" on a DEC PDP-1 computer. They first are shown programs which establish models. The students then go on to modify these programs, making increasingly greater changes in the original programs. Students are encouraged to write teaching programs of their own in a very short period of time.

The striking feature of the philosophy behind LOGO is that Dr. Papert and his colleagues are not concentrating on teaching a particular subject but rather on developing the child's thinking processes. Programming is an excellent tool for stimulating rigorous and critical thinking. It can be used to teach specific concepts as well as to provide models for heuristic concepts such as the relation of formal procedures to intuitive understanding of problems. A child can discern between a plan of attack on a problem and the details of solution. As an integral part of programming activities, debugging enables the student to interact with the computer. Programming enables a student to generalize and to better understand the whole process of problem solving.

LOGO was created because the existing programming languages have too much mathematical machinery built into them and require a certain degree of mathematical sophistication. LOGO is a language suitable for children who have not learned the elements of mathematical thinking. A familiarity with

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1 A detailed report of these activities is available from the Project LOCAL library.
counting numbers and the ability to read at second-grade level constitute the only background required. It is a direct, natural-seeming tool by which children may express procedures for tasks both mathematical and non-mathematical.

Some of the non-mathematical tasks which can be performed were illustrated by Dr. Papert. These included the generation of computer poetry and electronic music and the programming of an electronically controlled "turtle" which responds to LOGO commands. Dr. Papert's talk was liberally illustrated with LOGO programs to demonstrate the effectiveness of the language as a teaching device.

The afternoon session consisted of a panel discussion in which the LOGO language, the justification for its creation and the feasibility of its implementation were examined in some detail in response to questions from the audience. Panel members were Dr. Papert, Marvin Minsky of M.I.T., Robert Davis of Syracuse University, and Patrick Suppes of Stanford University.

(Ellen Santis)
ASSIGN A REAL COMPUTER PROBLEM

Many of the problems assigned to students for a variety of good reasons are not really computer problems. A computer problem is here used to mean a problem in which use of a computer is really an essential step in the solution. Solving a quadratic equation is not really a computer problem because one can solve the equation by hand much of the time, with mathematics tables most of the time, and with a desk calculator all of the time. Use of a computer can certainly be helpful, but is not necessary as the problem can be solved in several other ways within a reasonable period of time. Similar assignments include programs like generating the first 500 primes (several table books contain the first 10,000 primes), telling whether numbers are even or odd (this can be done by anyone who recognizes numbers even if they can't count), and finding the greatest common divisor of two or more numbers (a very easy hand or calculator problem, particularly if the Euclidean Algorithm is used). Note that these problems DO have a purpose as assignments. I have used these as assignments and will continue to do so.

Students should, however, frequently encounter problems that DO require a computer to obtain a reasonable solution. A problem like "Is 7,000,000,001 a prime number?" indeed requires a computer for solution, but it is also quite difficult and requires mathematical analysis that is beyond the ability of most ninth or tenth grade students. The following problem, however, involves mathematics well within the ability of most ninth graders and probably most eighth graders as well.

Consider the following table of fractions:

```
1/1
1/2
1/3 2/3 
1/4 3/4
1/5 2/5 3/5 4/5 
1/6 5/6 
1/7 2/7 3/7 4/7 5/7 6/7 
1/8 3/8 5/8 7/8 
1/9 2/9 4/9 5/9 7/9 8/9
```
If this table is considered to represent an infinite matrix of fractions, it contains ALL proper fractions reduced to lowest terms. Because this is a complete table, many interesting questions might be asked about the entries. Several of these questions are related to the sequence number that can be associated with each fraction. For example -- the 1st term (sequence number 1) is 1/1, the 7th term (sequence number 7) is 1/5, the 15th term is 3/7, and the 31st term (not shown) is 7/10. We might now ask questions like---Is there a pattern to the sequence numbers of those terms that occur at the beginning of each row?-- Is there a pattern to the sequence numbers of those terms that occur last in each row?---Do the fractions associated with prime sequence numbers have a distinguishable characteristic?--etc. Clearly the first step in answering these and other questions is to find a way of easily associating the correct fraction with each sequence number.

Write and run a program that will allow a user to input a sequence number, then compute and output the fraction associated with this sequence number. Your program should work for all input numbers less than 10000. You will probably discover, however, that your program works with much larger sequence numbers as well. The fractional output should have the numerator and denominator as well. The fractional output should have the numerator and denominator expressed as integers rather than being expressed in decimal form.

Clearly this is a real computer problem. Finding the 9000th term requires computing and ignoring the first 8999th terms, certainly not a feasible problem for solution by hand or even for a small desk calculator. The magnitude of the computation involved gets even larger as terms associated with higher sequence numbers are requested. The 437467th term is 1/2000.

Many different algorithms can be discussed for varying range of sequence numbers. Knowledge of just the Euclidean Algorithm for finding GCD is enough for the assignment as stated, but an even better algorithm would be needed if the first 100000 sequence numbers were to be accommodated. There is no single solution to this open ended problem. If there is a best way, we will probably have it explained to us by one of our students.

The particular problem discussed here is one of many real computer problems that are well within the grasp of high school students. When assigning problems like these,
remember what is becoming a fundamental rule at many computer installations: NEVER UNDERESTIMATE YOUR STUDENTS.

(Note: This problem was suggested by an article in the project LOCAL floating library, Document F-233) (Walter Koetke)

TEACHING STRATEGIES - SCIENCE

DICHOTOMOUS KEYING AS APPLIED TO TAXONOMY

This particular computer strategy was developed by Mr. David Wilson of the Lexington High School Biology Department and introduced in a second-year biology course for a specific learning situation. Such a situation occurs when the teacher desires to bring about a breakdown in concept, as from general to specific case, for students who are practicing identification of microorganisms for a BSCS laboratory block.

For study in taxonomy, high school biology texts generally use keys with pictures, and there is no good way for the teacher to be certain a student understands how a dichotomous key is to be implemented and learned. The computer can aid the teacher with this task by asking certain questions and demanding a "yes" or "no" answer.

The easiest way of identifying living things is by means of a key which contrasts the characteristics of two organisms, or of groups of organisms, in a logical sequence that leads one to their names. A form of key that is frequently used offers a choice between pairs of opposing characteristics. At each step of the way you are presented with two alternatives which, when properly chosen, help to identify the microbe under study. For example, consider the following key to microbial groups:

1a. Cells colored .............. 2
1b. Cells not colored ......... 6

2a. Cells larger than 3µ in width; with chloroplasts and defined nucleus .............. 3
2b. Cells smaller than 3µ in width; lacking chloroplasts and defined nucleus .............. 5
3a. Chlorophyll-green in color ........ green algae

3b. Other than chlorophyll-green
   in color ....................... 4

   4a. Red, or dull purple-green;
       multicellular .............. Red algae

   4b. Yellow, or golden-brown;
       unicellular or in chains ... Diatoms

etc.

At laboratory time a data sheet is provided each student and
he is directed to collect information of the type required
by the stored program. Other characteristics might be color,
size, motility, etc. After students examine the specimens,
they are assigned to the computer terminal in the science
building and must interact with the program previously prepared
and stored by the teacher. Here is a typical sample of a student's
interaction:

THIS IS A PROGRAM TO PRACTICE IDENTIFYING
MICROORGANISMS
WHICH YOU WILL ANSWER 1 IF YES;
AND 2 IF NO
DO THE CELLS HAVE COLOR?
?1
ARE THE CELLS LARGER THAN 3 MICRONS IN WIDTH;
AND WITH WELL DEFINED CHLOROPLASTS?
?2
IS THE COLOR BLUE-GREEN OR BLUE
OFTEN FILAMENTOUS AND SOMETIMES GELATINOUS?
?1
BLUE-GREEN ALGAE

READY

THIS IS A PROGRAM TO PRACTICE IDENTIFYING
MICROORGANISMS
WHICH YOU WILL ANSWER 1 IF YES;
AND 2 IF NO
DO THE CELLS HAVE COLOR?
?2
ARE THE CELLS GREATER THAN 3 MICRONS IN WIDTH?
?2
THE RETAINING PART OF THIS PROGRAM GOES INTO THE
IDENTIFYING THE BACTERIA IN GENERAL
WALL YOU LIKE TO CONTINUE?
?1
ARE THE CELLS SPHERICAL?
?1
ARE THE CELLS IRREGULARLY ARRANGED?
?2
ARE THE CELLS REGULARLY ARRANGED?
STREPTOCOCUS

The great flexibility of the computer in this learning
situation allows many directions to be followed. The results
are based wholly on the student's observations (input data),
but at least the teacher can be sure that some careful thought
had to be given for the student's response. The program
prepared by Mr. Wilson was adapted from a dichotomous key
found in Microbes: Their Growth, Nutrition and Interaction
by A. Sussman (ESCS), D. C. Heath, 1964 (Neil Soule)

PROGRAM OF THE MONTH-MATH

Plotting Equalities and Inequalities on the Number Line

This program is an adaptation of the program written
by Walter Koetke and described in his book, Computers in the
Classroom. It is suitable both for students of general
mathematics and for students of elementary and intermediate
algebra. It is a program which may be used as an aid in
teaching general mathematics students order relationships
on the number line and the solution of simple equations and
inequalities.

Here is a FOCAL version of the program:

1.1 TYPE "USING YOUR CONDITIONS, THE NUMBER LINE APPEARS AS: "!!"
1.2 FOR N= -8, -2, 5; DO 2
1.3 TYPE "8 -7 -6 -5 -4 -3 -2 -1 1 2 3 4 5"
1.4 TYPE " 8 7 6"!!; QUIT

2.1 IF (X-3) 3, 1, 4, 1, 4, 1
3.1 TYPE "; CONTINUE
4.1 TYPE "x"; CONTINUE

---

1 Koetke, Walter, Computers in the Classroom, Digital Equipment
   Corporation, 1968, p.9
The program will run as follows:

**USING YOUR CONDITIONS, THE NUMBER LINE APPEARS AS:**

```
8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8
```

Here the technique was used to graph the inequality
X > 3. The expression X-3 was examined and a dot was typed
when X-3 was negative and X was typed when X-3 was zero or
positive.

A variety of equations and inequalities may be examined
in this manner by making appropriate changes in line 2.1.
For example, to graph X < 4, the following changes would be
made:

```
2.1 IF (X-4)4,1,3,1,3,1
```

In this case if X is less than 4 (that is, X-4 is less than
zero) an X will be typed. Otherwise a dot will be typed.

By making simple program modifications algebra students
may perform more sophisticated tasks such as testing their
understanding of AND/OR statements like -2 < X < 3. Students
of intermediate algebra may examine the roots of quadratic
equations or study quadratic inequalities to determine, for
what values of X the expression X^2 - X - 6 will be negative. To
drive home the connection between roots of a quadratic
equation and crossing of the X axis, part 2 of the program could be
modified as follows:

```
2.1 IF (X+2-X-6) 3,1,4,1,5,1
3.1 TYPE "H"; CONTINUE
4.1 TYPE "O"; CONTINUE
5.1 TYPE "P"; CONTINUE
```

The results would appear as follows:

**USING YOUR CONDITIONS, THE NUMBER LINE APPEARS AS:**

```
PFFFFPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP
-8 7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8
```

The above graph indicates the roots of "zeros" of the equation
Y = X^2 - X - 6 and shows for the indicated domain -8 through +8 what
portion of the parabola would lie above the X axis (P for POSITIVE Y)
and what portion would lie below the X axis (N for NEGATIVE Y).
The same technique could be used equally well with equations of higher degree such as \( y = x^3 - x^2 - 4x + 4 \) by simply changing line 2.1 above, e.g.,

\[
2.1 \text{ IF } (x^3 - x^2 - 4x + 4) = 3.1, 4.1, 5.1
\]

Using your conditions, the number line appears as follows:

-8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8

Note: As the program is structured, roots would have to be multiples of .25 between -F and F. The program could be modified, however, to meet other specifications. (Ellen Santis).

**PROGRAM OF THE MONTH - SCIENCE**

**QUALITATIVE ANALYSIS**

Contained in the CHEN Study Course are laboratories on qualitative analysis (see February, 1970 issue of LOCAL Link). This FOCAL program deals with the specific lab "Qualitative Analysis of Group II Metals." In this lab the student is required to do a series of pretests to develop a scheme for determination of an unknown, and this program is actually the results of those pretests. By observing the reactions of an unknown solution with known reagents a student is able to determine the contents of the unknown.

This FOCAL program demands the results of the unknown solution-reagent reactions in a slightly coded form. The code is explained in the instructions contained in the program. After the data input the computer will type out the contents of the unknown solution. It is started by typing "GO".

This program was developed by James Storer, a chemistry student at Lexington High School.
QUALITATIVE ANALYSIS""THIS PROGRAM WILL"

DETERMINE THE IDENTITY OF AN UNKNOWN""CATION OR MIXT"
URE OF TWO CATIONS OF THE GROUP TWO METALS""GIVEN THE"
LAB DATA. DATA SHOULD BE TYPED IN""ACCORDING"
TO THE FOLLOWING KEY:""1JD 13JT "H" IF PPT IS HEAVY""1JD 13
L' IF PPT IS LIGHT OR SLIGHT""1JD 13JT "NONE" IF NO PPT"
D 13JT "D" 13JT "ORANGE" 1JD 13JT "R" 1JD 14JT "RED" 1JD 13JT "G"
D 14JT "GREEN" 1JD 13JT "G" 1JD 14JT "FIRST ORANGE, THEN RED"
D 13JT "G" 1JD 14JT "FIRST ORANGE, THEN GREEN" 1JD 13JT "GR" 1JD 14
D 13JT "FIRST GREEN, THEN RED""

"CARBONATE RESULT IS?"A, "CHROMATE RESULT IS?"B, !
"OXALATE RESULT IS?"C, "SULFATE RESULT IS?"D, !
"HYDROXIDE RESULT IS?"E, !"FLAME TEST RESULT IS?"G, !
Z=A+B+C+D+S L=Z-1588+B/2-782

(Z=6256) 4, 6, 1
(Z=3144+A+D-16) 4, 3, 6, 3
L=4, 6, 5
L=4, 5, 6, 7
L=4, 3, 6, 9
L+4, 7, 7, 2
L+4, 8, 7, 4
L+4, 9, 7, 6
L+4, 9, 7, 8
(Z-32) 5, 2, 7, 91
(Z-32) 6, 7, 93, 9, 2
(E+6-1576+E-12) 4, 2, 8, 23, 4, 2
(E+6-1579+E-15) 4, 3, 8, 1, 4, 3
(E+6-1582+E-18) 4, 8, 2, 4, 4
(E+6-1571+E-7) 4, 5, 8, 3, 4, 5
(E+6-27+E-15) 4, 6, 8, 4, 4, 6
(E+6-30+E-18) 4, 7, 8, 5, 4, 7
(E+6-19+E-7) 4, 8, 8, 6, 4, 8
(E+6-1732+E-168) 4, 9, 8, 7, 4, 9
(E+6-1721+E-157) 5, 1, 8, 6, 5, 1
(E+6-1652+E-88) 5, 2, 8, 9, 5, 2
(E+6-3128) 9, 2, 9, 1, 9, 2
SEVERAL RUNS OF THIS PROGRAM APPEAR BELOW:

QUALITATIVE ANALYSIS

THIS PROGRAM WILL DETERMINE THE IDENTITY OF AN UNKNOWN CATION OR MIXTURE OF TWO CATIONS OF THE GROUP TWO METALS GIVEN THE LAB DATA. DATA SHOULD BE TYPED IN ACCORDING TO THE FOLLOWING KEY:

TYPE 'H' IF PPT IS HEAVY
TYPE 'L' IF PPT IS LIGHT OR SLIGHT
TYPE 'NONE' IF NO PPT
TYPE 'O' IF FLAME TEST SHOWS ORANGE
TYPE 'R' IF FLAME TEST SHOWS RED
TYPE 'G' IF FLAME TEST SHOWS GREEN
TYPE 'OR' IF FLAME TEST SHOWS FIRST ORANGE, THEN RED
TYPE 'GOR' IF FLAME TEST SHOWS FIRST ORANGE, THEN GREEN
TYPE 'GR' IF FLAME TEST SHOWS FIRST GREEN, THEN RED
CARBONATE RESULT IS?: H,
CHROMATE RESULT IS?: NONE,
OXALATE RESULT IS?: NONE,
SULFATE RESULT IS?: H,
HYDROXIDE RESULT IS?: NONE,
FLAME TEST RESULT IS?: O;
The unknown is the cation calcium

TRY AGAIN?-(ANS. YES OR NO):YES

CARBONATE RESULT IS?: H,
CHROMATE RESULT IS?: H,
OXALATE RESULT IS?: H,
SULFATE RESULT IS?: H,
HYDROXIDE RESULT IS?: L,
FLAME TEST RESULT IS?: G.
The unknown is a mixture of magnesium and barium

TRY AGAIN?-(ANS. YES OR NO):YES

CARBONATE RESULT IS?: NONE,
CHROMATE RESULT IS?: NONE,
OXALATE RESULT IS?: NONE,
SULFATE RESULT IS?: NONE,
HYDROXIDE RESULT IS?: NONE,
FLAME TEST RESULT IS?: NONE,
The unknown must be water!

TRY AGAIN?-(ANS. YES OR NO):YES

CARBONATE RESULT IS?: H,
CHROMATE RESULT IS?: NONE,
OXALATE RESULT IS?: NONE,
SULFATE RESULT IS?: NONE,
HYDROXIDE RESULT IS?: L,
FLAME TEST RESULT IS?: G,
INCORRECT DATA GIVEN.

TRY AGAIN?-(ANS. YES OR NO): NO
BYE

*(Neil Soule)*
NEW ADDITIONS TO LOCAL LIBRARY

Computer-Based Vocational Guidance System
(conference proceedings - 168 pages)
U.S. Dept. of HEW, U.S. Government Printing
Office, Washington, D. C. 20202

S-127

Damaskos, Nickander, Smyth, Michael, You And
Technology (student text - 409 pages)
PMC Colleges, Chester, Pann., August, 1969

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Damaskos, Nickander, Smyth, Michael, You And
Technology (teacher's guide - 216 pages)
PMC Colleges, Chester, Penn.

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Data Processing Courses at Colleges and
Universities (national catalog - 82 pages)
Data Processing Management Association,

S-131

Feurzeig, W., Papert, S., Bloom, M., Grant, R.,
Solomon, C., Programming Languages as a Conceptual
Framework for Teaching Mathematics (project report-
125 pages), Holt, Rinehart, & Newman, Cambridge,
Mass. Submitted to National Science Foundation,

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Goddard, William, and Pregler, H. B., Projects
on Computers (student/teacher resource materials -
51 pages), Promath Systems, Ltd. 3-110 Lonsdale Avenue,
North Vancouver, B.C.

F-271

Flow Chart Machine Mathematics (student text -
155 pages), Course 2 Victor Comptometer Corporation, Educational
Dept., Chicago, Illinois.

S-129

Martin, Francis F., Computer Modeling and Simulation
(textbook - 300 pages), John Wiley & Sons, New York,
N. Y.

S-124

Principles of Automatic Data Processing (textbook -
93 pages), Data Processing Management Association,
Park Ridge, Illinois.

S-130
RCA Instructional Systems Instructional 70  
(summary description - 6 pages), RCA Instructional Systems, 530 University Avenue, Palo Alto, California.


Charm, Sylvia, Computers in General Education (teacher resource materials and student text - 39 pages), Pennsylvania Dept. of Public Instruction, Harrisburg, Pa. 1967

DATES TO REMEMBER

May 28 - 30  
Creative Education Fair  
At Boston City Hall, sponsored by Mass. PACE (association of Title III projects and the Mass. Dept. of Education;)
LOCAL will exhibit.

June 5  
Schools return Mini-Libraries to Project LOCAL office.