Journal of the ISTE **Special Interest Group** A LOGO Educed A LOGO Educed A EXCHANGE for Logo-Using Educators

Summer 1993

Volume 11 Number 4



International Society for Technology in Education







Logo Exchange is published quarterly by the International Society for Technology in Education (ISTE), 1787 Agate Street, Eugene, OR 97403-1923, USA; 800/336-5191. This publication was produced using Aldus PageMaker®

Individual ISTE Members may join SIG/Logo for \$16.00. Dues include a subscription to Logo Exchange. Add \$10 for mailing outside the USA. Send membership dues to ISTE. Add \$2.50 for processing if payment does not accompany your dues. VISA, Mastercard, and Discover accepted.

Advertising space in Logo Exchange is limited. Please contact ISTE's advertising coordinator for space availability and details.

Logo Exchange solicits articles on all topics of interest to Logo-using educators. See the back cover of this issue for submission guidelines. Opinions expressed in this publication are those of the authors and do not necessarily represent or reflect the official policy of ISTE.

©All articles are copyright of ISTE unless otherwise specified. Reprint permission for nonprofit educational use can be obtained for a nominal charge through the Copyright Clearance Center, 27 Congress St., Salem, MA 01970; 508/744-3350; FAX 508/741-2318. ISTE members may apply directly to the ISTE office for free reprint permission.

POSTMASTER: Send address changes to Logo Exchange, ISTE, 1787 Agate St., Eugene, OR 97403-1923. ISTE is a nonprofit organization with its main offices housed at the University of Oregon. ISSN# 0888-6790

LOGO

Volume 11 Number 4 Journal of the ISTE Special Interest Group for Logo-Using Educators Summer 1993					
Contents					
From the Editor					
First There Was LogoSharon Yoder	2				
Quarterly Quantum					
Grandfather's Ax	4				
Beginner's Corner					
101 Ideas for Logo (less 98) Dorothy Fitch	5				
The LogoWriter World: The U.S.A. Map and Time ZonesOrlando Mihich	8				
Musings					
Let's Get Rich: A Study in Big Numbers and the Power of DoublingRobert Macdonald	14				
Logo Puts It All in "Perspective"Nancy Flynn	19				
Windows on Logo					
LEGO Robotics in a Macintosh EnvironmentGlen L. Bull and Gina L. Bull	23				
MathWorlds					
Journal Excerpts	28				
Logo: Search and Research					
A Little Light on LEGO-Logo	33				
Global Logo Comments					
Preparing Teachers to Do Logo Research	37				
SIGLogo Members and List of Subscribers	40				

First There Was Logo... by Sharon Yoder

And then there was *LogoWriter* followed by *Logo PLUS*, and then there was *Object Logo*, and now there is *MicroWorlds*[©]. We might even add *HyperCard* to the above list since so many Logo enthusiasts found a familiar environment in *HyperCard*.

As those of you who are loyal LX readers or Logo users know, Logo has gone through a long and varied evolution. The first version of Logo ran on large computers, before the days of the Apple IIs and the Radio Shack TRS-80s. This early version included only list processing—it didn't even *have* a turtle. In the early 1980s, versions of Logo for the first Apple II computers appeared and captured the imaginations of thousands of teachers. Logo was an absolutely amazing piece of software in those early days. It had capabilities that were far beyond most other kinds of software of the time.

As brands of microcomputers proliferated, so did versions of Logo. Nearly every kind of "personal" computer had at least one version of Logo available. However, other early software evolved as well. It wasn't long until word processors of the time were both cheap enough and powerful enough that using the Logo editor as a text processor no longer made sense. And using Logo wasn't simple—many of you remember struggling with management of workspaces, editing, and saving, no matter what version of Logo you were using. All of those Logos in the early '80s were based on very much the same model

Then, in 198? LogoWriter burst on to the scene. LogoWriter gave us a whole new interface for Logo. It had a "real"—if not powerful—word processor. It more closely followed what users expected it to do. Workspace management became a non-issue because graphics, text, and procedures were all saved as a single file. While not everyone preferred this new Logo environment, there was no question that it represented a significant change in the way we think about Logo. Over the next few years, we saw a number of LogoWriter features incorporated into other Logo versions.

While LogoWriter provided an easy entry point for novices, many users longed for a sophisticated, high-

end Logo. Those Logophiles found their needs met by *Object Logo*. *Object Logo* provided a "no ceiling" environment for those interested in object-oriented programming.

Yet other Logo users became enamored with *HyperCard*. In *HyperCard* they found an environment that made the creation of products easier and more user-friendly. In fact, there were so many Logo users moving into *HyperCard* that the issues surrounding *HyperCard* and Logo use not infrequently were addressed in the pages of this journal.

In recent months, we have seen a number of new Logos appear. Several of these Logos are free for the taking from the InterNet. They are labors of love by their authors and have particular features that appeal to certain types of Logo users. But most of these Logos are also not likely to find themselves commonly used in schools.

However, it appears that the very latest addition to the plethora of versions of Logo seems likely to radically change the way we think about Logo. LCSI will shortly have available a new product they are calling *MicroWorlds*. *MicroWorlds* will be aimed both at new Logo users and at the existing body of dedicated users. New users will be supported by print materials to help their students get started. Long-loyal Logo users will find the familiar Logo language enhanced by many new capabilities.

It is simply not possible to describe *MicroWorlds* in a few words. At its heart is the familiar *LogoWriter* dialect of Logo. *LogoWriter* users will feel quite comfortable with the Command Center, Page, and the language itself. *MicroWorlds* has added "Centers" to its immediate mode features. There's a Shapes Center for choosing, identifying, and editing shapes. There's a Drawing Center for working with the familiar Macintosh Paint tools. (*MicroWorlds* only runs on color Macintosh computers.) The Tool palette is reminiscent of *HyperCard*. You can make buttons and text boxes (fields). You can also make sliders, a fascinating feature that assists in making the concept of variables more transparent. As Marian Rosen said in a recent article about *LogoWriter*, "Butwait, there's more!" Shape sizes can be changed. Any number of turtles can be used. Turtles move about under mouse control. More importantly, parallel processing is now possible. That means you can play that song and draw that graphic at the same time—at last!

While Logo has been an important part of my life for many years now, I have to admit that I'm more excited about *MicroWorlds* than I have been about a new Logo product for a *long* time. It has the potential to expand the way we think about Logo, and it has the potential to compete with *HyperCard* in some contexts. If you get a chance, take a first-hand look at *MicroWorlds*. If not, stay tuned. We'll be having articles about *MicroWorlds* in *LX* in the coming months. If you want more information, contact LCSI (see ad on the inside back cover)

> Sharon Yoder Education 170C University of Oregon Eugene, OR 97403 503/346-2190 Internet: yoder@oregon.uoregon.edu

International Logo Conference

Place: Melbourne, Australia Dates: July 4-7, 1993

Mission: To create an opportunity for Australian educators and international guests to collaborate, share ideas, and celebrate Logo learning.

Conference Strands:

- Logo and computer science
- Professional development and teacher preparation
- Primary mathematics and Logo
- Secondary mathematics and Logo
- Language arts and Logo
- Logo across the curriculum
- Logo and robotics
- Languages other than English and Logo

Conference includes a free warm-up workshop.

For more information, contact: 1993 International Logo Conference MLC Community Education 207 Barkers Road Kew Victoria 3101 Australia Phone: (03) 274-6412 Fax: (03) 819-2345 Internet: K0331@applelink.apple.com

101 Ideas for Logo

101 Ideas for Logo is packed with classic Logo project ideas. There are simple ideas for beginners and complex ideas to challenge even the most experienced Logo programmer.

Explore graphics, multiple turtles, shapes and animation, words and lists, numbers, and music in five levels of Logo fun. Logo graphics and delightful illustrations will guide you along the way.

Some ideas contain helpful hints and strategies. Others are bare-bone ideas, letting students investigate different approaches and solutions. *Things to Try* sections extend project ideas even further. What fun your students will have making

quilts, designing T-shirts, creating whacky proverbs, drawing pyramids, constructing adventure games, playing duets, animating space

scenes, organizing road races, and much more! **101** Ideas for Logo will challenge and delight your students (grades 3-10) and send them on months of Logo adventures. Call to order your copy today!

Book: just **\$14.95** plus \$3.50 shipping and handling Book *plus* blackline masters for use within a single school building: **\$50.00** plus \$3.50 shipping

For all popular versions of Logo!

Terrapin Logo for the Macintosh • Logo PLUS • Terrapin Logo for the Apple • Object Logo • PC Logo LogoWriter • LogoEnsemble • Commodore Logo • LCSI LOGO II • Apple Logo • Apple Logo II

1-800-972-8200



Terrapin Software, Inc. 400 Riverside Street Portland, ME 04103

LogoExchange

LX114

3

Grandfather's Ax

by Tom Lough

Quarterly Quantum

I heard a story recently about a man who was chopping wood with an old ax. It wasn't just any ax he was using. It had belonged to his grandfather, and had been passed on to him by his own father some years ago. He was very proud to be using his grandfather's ax.

Suddenly, on one particular swing, the thin metal part on the head of the ax around the handle cracked. The man turned a sad situation into a happier one by replacing the cracked ax head with a brand new one.

Later, he told his elderly father about the incident and how sad it made him feel to have broken the ax. His dad replied, "Yep, Son, I sure know how you feel. Something like that happened to me, too. Once when I was chopping wood with that ax, I broke the handle. It really made me sad, but I felt better when I replaced the broken handle with a new one."

Is this still his grandfather's ax? If you asked the man, I'm sure he would say it is. Even though none of the components are original, the ax nevertheless gives him a connection with his grandfather. The "ax-ness" (for lack of a better word) bridges the gap in space and time.

It occurred to me that a Logo procedure (a tool) is like the grandfather's ax. It performs a useful task, but it might have been changed by the different students through whose hands (disks) it has passed.

For example, Lisa invented a new SQUARE procedure.

TO SQUARE REPEAT 4 [RT 45 FD 100 RT 45] END

Jason personalized it.

TO JASON REPEAT 4 [RT 45 FD 100 RT 45] END

Dana decided to make it variable, but liked the procedure name.

TO JASON :SIZE REPEAT 4 [RT 45 FD :SIZE RT 45] END

Is this still Lisa's procedure?

To be truthful, this question doesn't really matter. What does matter is that the tool procedure has been passed from one student to another and another because of its function (its SQUAREness). If one part "breaks" or does not function as a student wants, then he or she can just "repair" it so it operates in the way desired.

Why not pull out some of those student- and teacherwritten procedures from earlier times and take another look at them? Maybe they can be "repaired" so that they can do something surprisingly useful.

FD 100!

Tom Lough Founding Editor PO Box 394 Simsbury, CT 06070

Logo Robotics for the Macintosh

The official name of the Paradigm adapter that allows Apple II or IBM *LEGO-Logo* robotics kits to be used with a Macintosh is the "Pearl Controller." The price of the Pearl Controller at the time this was written was approximately \$200, but due to rapidly changing circumstances that can take place in technological settings, it may be advisable to check with Paradigm about current hardware and software configurations. The Paradigm Pearl Controller and the accompanying *LEGO-Logo* emulation for the Macintosh can be obtained from:

> Paradigm Software, Inc. PO Box 2995 Cambridge, MA 02238 Phone: 617/576-7675 FAX: 617/576-7680

The LEGO-Dacta Control Lab robotics system for the Macintosh should be available in the late summer or early fall. Those who wish to obtain more information about this system can call the following toll-free number:

> LEGO Phone: 800/527-5415

101 Ideas for Logo (less 98)

by Dorothy Fitch

© 1993, Terrapin Software, Inc.

Do you ever run out of ideas for Logo projects? For some people, Logo inspires a never-ending supply of interesting projects and ideas. But others are always on the lookout for new things to try. With these folks in mind, Terrapin recently published **101** Ideas for Logo, a book full of projects for all levels of Logo fun. Almost all of the ideas will work with any version of Logo. The book doesn't teach Logo—instead, it offers project ideas. Some contain helpful tips, strategies, and explanations. Others are bare-bone ideas, letting the reader explore different approaches and solutions.

101 Ideas for Logo offers five areas of exploration— Graphics, Turtle Fun (shapes, animation, and multiple turtles), Word Play, Number Fun, and Music—with many ideas combining more than one area. The book challenges the reader to design a T-shirt, make a Logo jigsaw puzzle, create an adventure game, animate a space scene, play rounds and duets, choreograph a half-time show, invent new proverbs, computerize a restaurant menu, write a slot machine game, and much more.

The ideas are divided into five levels, each of which assumes a set of Logo skills. The 25 projects in Level I are great for beginners—they require no procedure writing. In the 35 ideas of Level II, the reader begins to write and combine simple procedures. Level III explores variables, words and lists, and reporters. Level IV incorporates tail recursion and decision making. The Level V ideas present complex problems, requiring sophisticated programming skills. The 101 ideas are designed for grades 3-10 in school or at home.

Here is a sampling of 3 of the 101 ideas to give you projects to try over the summer (and a peek at 101 Ideas for Logo). Like many of you, my inspiration for Logo ideas comes from all kinds of sources—Butterflies from my love of nature, Ye Olde Pyramid from a Nova program on PBS, and Word Changes from my curiosity about words.



Do you remember the Total Turtle Trip Theorem? It says:

For the turtle to draw a shape and end up right back where it started, heading in the same direction, it will turn a total of 360° (or a multiple of 360).

This works for squares, and it also works for circles. The sum of all the turns should equal 360°. How would you complete this instruction to draw a circle?

REPEAT 360 [FORWARD 1 RIGHT ____]

Could you can also draw a circle by starting with REPEAT 20? What would be the turn number?

REPEAT 20 [FORWARD 10 RIGHT ____]

The turtle will complete the shape if the turn number is 18. Why? Because 18 * 20 = 360. Since the shape has

5

many sides (20 to be exact), it looks quite round. It looks almost as round as the one drawn using the REPEAT 360 instruction. The turtle draws it much faster, too.

How could you draw a larger circle using a RE-PEAT20 instruction? How about a smaller circle? Which number would you change?

Practice drawing circles to the left and to the right. Which part of the REPEAT instruction list do you need to change?

Make circles of different colors and different sizes. Add a little circle for a head and maybe an antenna or two. Voila! You have a butterfly!

Ye Olde Pyramid (a Level II idea)

Egyptologists, architects, and stonemasons have tried to figure out how the pyramids were built. The largest pyramid contains over two million tons of stone. It was built by tens of thousands of workers in less than 30 years.

Research shows that heavy stone blocks were placed onto a square foundation. Then the pyramid was built up in layers as stones were added.



Triangular pieces were placed on the edges to form the pyramid shape. This was called the casing. These triangular blocks were carefully sized to make the pyramid grow at the right slope.



Can you build a Logo pyramid using building blocks? How many different shaped blocks will you need? How big should you make them? Then you can decorate your screen with hieroglyphics!



Word Changes (a Level III idea)

A prefix can change the meaning of a word. Happy becomes unhappy, agree becomes disagree, try becomes retry.

Think of all the prefixes you can use with "cooked": overcooked, undercooked, precooked, recooked, uncooked. How do you like your food?

It's fun to create new words by adding prefixes to words in Logo. How many prefixes can you think of? Keep your eyes and ears open for other prefixes as you read and listen. Write a procedure that reports a list of prefixes. (You can't use the name PREFIX if it is already the name of a Logo primitive. However, you could call it PFIX.)

The root word is the main part of the word. Think of root words that can use the prefixes in your list. Write a procedure that reports a list of root words.

Now, can you figure out how to combine a word part from each list? Use PICK and WORD with your two new procedure names. If PICK is not a primitive in your version of Logo, define the following procedure:

```
TO PICK :OBJECT
OUTPUT ITEM 1 + RANDOM COUNT :OBJECT
:OBJECT
```

END

PC Logo users should use this version of PICK:

```
TO PICK :OBJECT
OUTPUT ITEM RANDOM COUNT :OBJECT
:OBJECT
END
```

Here are some words that Logo might create. Some are not real words, but can you imagine what they might mean?

UNICYCLE COPORT RECYCLE RETOLD TRANSMISSION UNDERRUN REPORT SUPERCYCLE

A suffix is a syllable that comes at the end of a word. A suffix can also change the meaning of the word. Are you careful or careless? Write a procedure to add suffixes to a root word. Can a word have both a prefix and a suffix?

Soon you'll be adding new words to your vocabulary, like SUPERHAPPYFUL.

Happy Logo adventures!

101 Ideas for Logo is available from Terrapin Software, Inc. as a single-user book and as a site license, which includes the book and a set of reproducible black-line masters. For more information, see page 13. Dorothy Fitch has been director of product development at Terrapin since 1987. She is the author of *Logo Data Toolkit* and coauthor of *Kinderlogo*, a single-keystroke Logo curriculum for young learners. At Terrapin, she coordinates software development, edits curriculum materials, writes documentation, and presents sessions at regional and national conferences.

> Dorothy Fitch Terrapin Software, Inc. 400 Riverside Street Portland, ME 04103-1068

CompuServe: 71760,366 Internet: 71760.366@COMPUSERVE.COM 800/972-8200

When You Are Really Serious About Logo...

Introducing PC Logo 4.0, a powerful new version of the Logo programming language designed for the IBM PC and compatibles. PC Logo 4.0 is versatile and flexible, suitable for novice as well as experienced programmers. With more than 300 built-in commands, PC Logo 4.0 supports all the functions you would expect from a full-featured Logo program.

New PC Logo 4.0 features include:

EGA/VGA screen support More than 80 new primitives On-line help system

■ Full mouse support

- More than 80 new print
 Fully integrated editor
- On-line help system
 Laser printing

There's also a growing list of Logo materials, books and curriculum from educators and Logo experts. Low-cost multiple-workstation licensing available, too.

For more information or to order PC Logo, call 800/776-4610



10 HOLWORTHY STREET CAMBRIDGE, MA 02138



The *LogoWriter* World: The U.S.A. Map and Time Zones

by Orlando Mihich

Introduction

My students always like to draw maps for their social studies classes. They particularly like, and are very proud of, their creations in *LogoWriter*. They add colors and text, so each map is unique—at times awkward-looking but clear in what it represents. The process is usually lengthy because students seek to create the "perfect map" by drawing and redrawing lines.

Students copy maps from their social studies books and from atlases. When the size of the map matches the size of the screen, they trace the map on a piece of transparent paper, paste the paper on the screen, and drive the turtle, following the traced lines. Recently, some of my students were drawing a map of the Mediterranean Sea and the Roman Empire. One student had the "boot" of the Italian peninsula looking east instead of west. The student had copied a very small map from the social studies book, a map that was too small to be traced on paper for transfer onto the screen, and had gotten lost in the process—a frustrating situation for everyone involved.

To help students generate more accurate drawings and avoid the map-size obstacle, using a grid—the "old masters technique"—is very helpful. For centuries before today's Xerox revolution, this technique was used for copying, enlarging, and reducing drawings of all kinds.

Logo Maps

Students first draw a grid on the computer screen and number each vertical and horizontal bar of squares. Here, a 6×9 grid is usually quite adequate. Next, on a piece of tracing paper they trace the state or continent. Next they draw a proportionaal 6×9 grid over the traced work. Now the map on the paper is broken down into squares and can be defined by the vertical and horizontal numbers. The students are ready to drive the turtle on the screen, from square to square, following the traced outline from the paper grid.

Before students start driving the turtle around the screen, we discuss ways to make the work easier and faster. Sooner or later they come up with a variation on Tom Lough's "forward and back," or fb, procedure:

```
to fb :size
ht
forward :size
wait 25
pe
back :size
pd
st
end
```

With this procedure, students can evaluate a line several times before accepting it. When satisfied with a specific line, they simply change the fb into an fd and retain the value for the line. Students are further challenged to incorporate the above procedure into new procedures to turn the turtle right or left, and draw a line:

```
to r :angle :size
right :angle
fb :size
left :angle
end
to l :angle :size
left :angle
fb :size
right :angle
end
```

Here, too, students retain the numeric values by adding a "t" to the "r" or "l" before the first number and an "fd" to the second number. The final result in creating a map of the U.S. should look something like this:



The starting procedures are as follows: to startup rg ht arid 30 numbers 30 usa.map end to grid :s pu setpos [-135 -89] pd rows :s end to square :s repeat 4[forward :s right 90] end to rows :s repeat 3[repeat 2[one.row :s forward :s * 2 right 180] forward :s * 2] end to one.row :s repeat 9[square :s right 90 forward :s left 90] end to numbers :s pu setpos [-132 -82] pd label.rows :s pu forward :s / 3 right 90 DU forward :s / 3 bα label.columns :s end to label.rows :s labe] [1] next :s label [2] next :s label [3] next :s label [4] next :s label [5] next :s label [6] end to label.columns :s label [1] next :s

labe] [2] next :s label [3] next :s label [4] next :s label [5] next :s label [6] next :s label [7] next :s label [8] next :s label [9] end to next :s pu forward :s pd end to usa.map pu setpos [85 -70] pd seth 0 Gulf.of.Mexico Mexican.border Pacific.West.Coast Canadian.border Atlantic.East.Coast setpos [85 -70] end to Gulf.of.Mexico left 40 forward 22 right 40 forward 5 left 40 forward 10 left 50 forward 25 left 90 forward 5 right 90 forward 22 left 45 forward 25 left 45 forward 7 end to Mexican.border right 90 forward 3 right 45 forward 30

9

left 45 forward 6 left 45 forward 4 right 80 forward 25 left 35 forward 6 1eft 90 forward 3 right 90 forward 10 right 35 forward 20 right 55 forward 3 left 90 forward 12 end to Pacific.West.Coast right 90 forward 3 left 45 forward 20 left 90 forward 3 right 120 forward 25 right 15 forward 25 right 10 forward 30 left 10 forward 10 right 110 forward 16 left 110 forward 7 end to Canadian.border right 100 forward 75 left 10 forward 35 right 10 forward 25 right 125 forward 15 left 125 forward 8 left 45 forward 8 right 90 forward 6

left 90 forward 6 right 90 forward 6 right 100 forward 15 left 65 forward 20 left 45 forward 5 left 90 forward 5 left 45 forward 18 right 45 forward 8 right 25 forward 3 right 80 forward 15 left 70 forward 20 left 10 forward 10 left 90 forward 8 right 55 forward 13 left 30 forward 20 right 60 forward 5 right 45 forward 15 end to Atlantic.East.Coast right 90 forward 20 1eft 40 forward 5 left 45 forward 5 right 110 forward 15 left 90 pu forward 4 left 100 pd forward 5 back 5 right 100 pu back 4 right 55



рd forward 25 right 90 forward 6 left 100 forward 6 left 90 forward 6 right 55 forward 12 right 80 forward 25 left 20 forward 16 left 60 forward 30 right 35 forward 8 end

The generated maps are still individual, personal maps, but they are more accurate and easier to make. By the end of the project, students are masters in spacial orientation and, in addition, have learned a technique they may find helpful in the future.

In my social studies classes, students usually add to the completed maps the country's major cities, mineral deposits, dominant land use, flag, national anthem, and so on. The earth science curriculum is enriched by students creating their own weather maps, positioning weather fronts, and indicating temperatures and areas of high and low pressure. Students exchange their weather maps and make educated guesses to predict the movement of air masses and the next day's weather.

N.B. In his paper "Easy Map Drawing with LogoWriter" (Logo Exchange, Dec./Jan. 1990), Professor Francisco Quesada of the Universidad deCosta Rica in San Jose, Costa Rica, introduces map-making procedures that automatically collect the list of instructions in the Command Center and carry them onto the flip side.

Standard Time Zones

The earth's surface is divided into 24 standard time zones. In each zone, noon is set as the time when the the sun is highest over the center of that zone. The time in each zone is one hour earlier than the time in the zone to the east, e.g., at nine o'clock in New York City, it is eight o'clock in Houston, and six o'clock in Los Angeles.

My eighth-grade students divide the U.S. map into the four time zones and add several cities around the country. Positioning the turtle in a starting city, they direct the turtle-plane to "set the heading toward" the destination city and fly to that city. In addition, they add a quiz asking the viewer to type the arrival time and to adjust his / her watch to the local time for the time difference. At the end of all flights, the program gives the number of correct and incorrect answers. My students are very creative, and every year they change the program, enriching it with new ideas in screen design and programming.

The quiz given below was written by Antonio Colondres on an Apple IIGS. Antonio created five aeroplane shapes and had the turtle flying from New York to four cities in the U.S. At each stop, the viewer is asked to type the local time or to adjust his/her watch to the local time. If the answer is correct, the clocks on the screens change accordingly. At the end of the quiz, the program gives the number of correct and incorrect answers and the percentage of correct answers.



The procedures for the quiz, which include one flight and one change of time, are as follows:

to startup rg ht ct CC usa.map time.zones cities time0 introduction end to time0 setc 1 pu setpos [95 -85] setsh 52 pd stamp pu setpos [25 -85] setsh 51

pd stamp DU setpos [-45 -85] setsh 50 pd stamp pu setpos [-115 -85] setsh 49 pd stamp end to introduction make "correct 0 make "total O make "wrong 0 СС type[Hi, my name is Antonio and your name is?1 type char 13 make "name readlistcc CC type sentence [Type a key] :name type sentence ", [and get ready for a tour of the United States and some questions.] make "key readchar question1 🐳 end to go if colorunder = 2 [stop] pu forward 1 **9**0 end to ny.sf pu setpos [98 36] setc 2 setsh 2 st seth towards [-118 13] pu forward 5 go end to question1 СС type [Your plane leaves New York at 11 am and will reach San Francisco in 5 hours. What is the local time in San Francisco?]

type char 13 tell 0 nv.sf make "answer first readlistcc ifelse :answer = 1 [correct1][sorry1] end to correct1 00 type [Quite correct! The local time in San Francisco is 1 pm. Type a key to continue.] tell 1 time1 type char 13 make "key readchar make "correct :correct + 1 make "total :total + 1 СС question2 end to sorryl CC type (sentence "Sorry, :name [. Your answer is incorrect. Type a key to continue and try again.]) make "wrong :wrong + 1 make "total :total + 1 make "key readchar CC guestion1r end to question1r tel1 0 DU setpos [98 36] CC type [Your plane leaves New York at 11 am and will reach San Francisco in 5 hours. What is the local time in San Francisco?] type char 13 nv.sf make "answer first readlistcc ifelse :answer - 1 [correct1][sorry2] end to sorry.2 СС type (sentence "Sorry, :name [. Your answer is incorrect. The time in San Francisco is 1 pm. Type a key to continue.])

```
12 LOGOEXCHANGE
```

```
tell 1
time1
make "wrong :wrong + 1
make "total :total + 1
make "key readchar
CC
question2
end
to time1
pu
setpos [95 -85]
setsh 52
pe
stamp
setsh 45
pd
stamp
pu
setpos [25 -85]
setsh 51
pe
stamp
setsh 44
рd
stamp
pu
setpos [-45 -85]
setsh 50
рe
stamp
setsh 43
pd
stamp
pu
setpos [-115 -85]
setsh 49
pe
stamp
setsh 42
pd
stamp
end
to ending
сс
```

```
type (se [You have] :correct [cor-
   rect answers and] :wrong [wrong.]
   :name ".)
type char 13
type [Type a key.]
make "key readchar
cc type (se [Your score is] :correct
   / :total * 100 "%!)
type char 13
type [Type a key.]
make "key readchar
CC
type [If you want to restart the
   program type R otherwise press
   any other key.]
type char 13
ifelse readchar = "R [time7 gues-
   tion1] [leavepage]
end
```

Time7 restores the clocks to the initial time0.

Orlando Mihich Science and Computer Teacher 339 Pacific Avenue Jersey City, NJ 07304

Logo keeps getting better with WIN-LOGO

WIN-LOGO is one of the most advanced Logo language products available today. It represents a new generation of Logo language products using a *Windows*-like graphical user interface and easy-to-use pull-down menus with mouse and printer support. Features include:



- 12 turtles with color, shape, thickness, ar different font styles for graphics writing -supports import of PCX images s, and
- Over 300 predefined commands allows the user defined functions in either C or Assembly language
- Flexible text editor with copying, erasing, search/replace, and interpreting functions
- Interactive debug tool can set rate and breakpoints for visual analysis
- Supports industry standard color graphics cards CGA, EGA, VGA 16 OR 256, and MCGA

SOFTEAST ® CORP 2352 Main Street Concord. MA 01742

For more information or to order. please call 508-897-3172





LOGOEXCHANGE

Let's Get Rich: A Study in Big Numbers and the Power of Doubling

by Robert Macdonald

There are many ways of creating educational microworlds. Teachers have been doing it for many years. This article will attempt to describe a few of them. All of them center around developing concepts for recognizing the immensity of large numbers. Given the size of our national debt, it is an area of mathematics that many Americans believe their national leaders have never learned about.

A Concrete Microworld

Ten years ago Ms. Arlene Rebeshini, a fellow teacher at the elementary school at which I then taught, came up with a CAP-tivating idea. She wanted to demonstrate to her students just what a million of something looked like. She had her class begin the endless task of collecting one million bottle caps.

This seemed more practical than corraling 100 elephants, then weighing them to discover how much they would weigh collectively; or, perhaps, counting all of the hairs on the heads of ten students to see if the sum would equal one million. In eight years, she was able to fill 40 2' x 2' boxes, plus other sundry containers, with caps. However, of these, 700,000 were donated by a Dr. Pepper warehouse. That donation made collecting too easy. So the students decided to go on for two million.

Everyone collected: students, parents, grandparents and other relatives, school personnel, and community friends.

To tally posed a problem. For years, Friday was tally day. Each Friday, the count was close to 5,000. Now bottle caps in such vast quantities pose another problem—weight. One day, a large container on a counter gave way from the pressure of weight. Cascading bottle caps create a lot of noise.

After eight years, Ms. Rebischini had to do something with her two million bottle caps. She wanted to recycle some of them, if possible. She thought about encasing a million of them in sculptured blocks of clear acrylic as a permanent art object on the playground of the school. However, this brought up other problems: Would the acrylic withstand Michigan weather? How costly would it be to lay a foundation and mount the art piece? As it turned out, costs would be high. Funding for the project was never realized. A permanent record of the achievement had to be abandoned.

Yet for eight years those bottle caps provided inspiration for a constantly changing group of elementary students. In addition to valuable lessons in math, the caps were used in some of Ms. Rebischini's art projects. Even the music teacher became involved: color-coded caps became solfege syllables when placed on a staff. The collection frequently inspired budding writers.

Alas, without funding, the collection had to be recycled, if for no other reason than that storage had become a critical problem. But there *was* one last encounter: my colleague decided to let the students frolic in one million unsoiled bottle caps. So one million of the caps were poured onto the floor of the school's multimedia center.



Students pour a sea of one million bottle caps on the floor.

Students and staff cavorted in a sea of bottle caps. It truly was a CAP-tivating experience.

LOGOEXCHANGE 14



David Pellegrino (left), Nicholas Weise, Kristin Pugsley, and Leslie Variot are up to their necks in bottle caps.

Continuing Work With Large Numbers

Entering the fourth grade after their bottle cap encounter, the students I inherited from Ms. Robischini's class were eager to expand their horizons. I suggested using the computer to investigate large numbers. Little did I know that by the time we had finished our investigations in the late fall of 1989, the class would have involved Sharon Yoder, Eadie Adamson, Michael Temple, and the technical staff of the LCSI in Montreal (Adamson, 1989).

The class first suggested that we see how long it would take a computer to count to a million. Hopefully, I thought, it would take less than eight years. So I somewhat ineptly wrote the following *LogoWriter* program. (It's important for students to realize that teachers aren't always infallible. It keeps the teacher humble and may very well stimulate the students to greater effort.)

```
to count.up :input
if :input = 1000000 [stop]
insert :input
insert char 32
count.up :input + 1
end
```

Off we went with the program. In a short time the output slowed to a crawl. The class rushed a letter off to Sharon while I addressed one to Eadie. Together we penned a letter to the LCSI. (The letters were necessary because the telephone system that serviced our island elementary school would not tolerate a modem. The equipment was in place before this was discovered.)

Meanwhile, if I may be forgiven, I resorted to a BASIC program utilizing a simple FOR..NEXT loop: 10 FOR X = 1 TO 1000000 20 PRINT X, 30 NEXT

40 END

This worked with alacrity. And what was of visual importance—numbers scrolled off the screen in multiple columns. One student suggested we have a race with the three computers we then had in the room. One Apple IIe won the race in 3 hours and 25 minutes. The other IIe completed its task in 3 hours, 52 minutes, 30 seconds, followed by a IIc in 15 more seconds. This discrepancy in time, as Eadie noted in her reply to our letter, puzzled some technicians.

Help Arrives

Within a short time we received a reply from Sharon. She suggested the following changes to my LogoWriter program:

```
to count.and.clear :input :lines
if :input = 1000000 [stop]
if :lines = 18 [make "lines 0 ct]
print :input
count.and.clear :input + 1 :lines +
1
end
```

Sharon's solution set up a counter that caused the text to clear. Her solution is also psychologically apt because it creates the illusion that numbers are scrolling off the screen. Her technical explanation of why my program failed was of interest to me but not to the average fourth grader:

Different versions of Logo parse or translate the Logo code differently. So the procedure that you sent me is parsed by LogoWriter as if it were embedded recursion—which it is not. That implies that a "pointer" is put on a stack in memory each time the procedure is called. It doesn't take long to fill up the memory this way.

Sharon's program took us 47 hours, 3 minutes to finish the count.

Further Aid

At about the same time Eadie's letter arrived. Her solution was: Keep Things Simple! The fewer demands made on the program the swifter it will move. She suggested the following:

LOGOEXCHANGE

```
to countup :number
print :number
ct
countup :number + 1
end
```

15

On an Apple IIGS the time of the output improved. One of Eadie's articles (Adamson, 1989) goes into detail on the varying solutions to problems such as this and is well worth looking through. The class did try out Eadie's and Michael Temple's suggestions. However, I found difficult to accept the thought of not producing output on the screen to hasten action. Constant visual proof of counting was necessary.

A reply from the technical staff of LCSI was an added plus for us. Each staff member had signed the letter, just as we had each signed ours. One student, Andy, had his day made. He recognized among the signatures the name of the author of his favorite program, the Phantom Fish Tank. The class presented him with letter as a memento. He deserved it for the work he was able to save them with his acute observations, which are detailed below.

In their letter, the LCSI staff recalled for us the tale of the tortoise and the hare, with a graphic picture of the outcome of that classic race. Granted, LogoWriter isn't speedy. But a race is a race, and a race between a tortoise and a hare doesn't happen every day. And a constant output on the screen for all of us in the fourth grade is a necessity. We're skeptics. (I also prefered to keep the class focused on the same software. The programs were never written in other Logo dialects.)

How Far Can We Go?

So LogoWriter can count to a million with the reliability of the tortoise. From there we wanted to discover the biggest number that LogoWriter could handle. I suggested that students start multiplying large numbers together with a print statement. For example:

print 76545678 * 25

I cautioned the students to develop some strategies to carry out their experiments.

Someone wanted the computer to print out each of the numbers that *LogoWriter* was able to handle. We knew it could handle one million. So let's go on. Thus, we created this slightly familiar program:

But our friend Andy didn't think we should tie up one of the computers for all of that time. He remembered the output of a palindrome program we had tried a few weeks before. (Good memory!) He had saved a printed listing. (I don't think I can attribute this to foresight. Few fourth graders like to clean out their desks.) When we attempted to make a palindrome of 89, it went through 23 generations and ran out of space with:

```
955594506548
+ <u>845605495559</u>
```

Andy theorized that we should use the **go.big program** and input 99999999900. He suspected that the computer wouldn't go to one quadrillion. He was right. The Apple IIe stopped at 999999999999999.

While the students were experimenting with larger and larger numbers, I went to work on a computer program to turn them all into millionaires through the power of doubling (Bloster, 1983).

The Problem—Becoming a Millionaire

How long would it take you to become a millionaire if I were to give each of you one dollar on Day 1, and then double that amount each day thereafter? You are to save all of your money.

A worksheet was necessary to keep track of the students' finances (see the worksheet at the end of this article).

DAY	SAVINGS	TOTAL SAVED
1	\$1	\$1
2	2	3
3	4	7
4	8	

Students should be permitted to use calculators. It is important to underline the importance of the doubling under the column of savings. The constant tally that takes place in the third column is essential.

A computer program that outputs the solution is provided below. I suggest that the class itself take care of gathering information and checking their work on assignments of this sort. Fourth graders can easily organize their material and carry out this work with little or no teacher intervention. Teachers are busy enough.

```
to get.rich
introduction
initialize
set.up
save
end
to introduction
clearpage
print []
tab
tab
print [LET'S GET RICH]
print []
print []
```

wait 30 print [How many days would it take you tol wait 50 print [save \$1,000,000 if you were to start] wait 50 print [on day one with one dollar and were] wait 50 print [to double your savings each day?] wait 50 print [] print [You are not expected to spend anvl wait 50 print [of your savings. Be certain that wait 50 print [you total everything.] wait 50 wait 50 print [] print [] tab print [GOOD LUCK! HAPPY SAVINGS!] end to clearpage if not front? [flip] rg ct ht сc end to initialize clearpage make "savings 1 make "total 1 make "days 1 end to set.up print [] tab insert [DAY] tab insert [Savings] tab print [TOTAL] print [] print [] tab insert :days tab insert :savings tab

```
tab
print :total
end
to save
if :total > 1000000 [stop]
make "savings :savings * 2
make "total :total + :savings
make "days :day + 1
tab
insert :days
tab
insert :savings
tab
tab
print :total
save
end
```

The command to operate the program is **get.rich**. What could be simpler?

References

- Adamson, E. (1989). Time, numbers, and other things. Logo Exchange, 8(4), 5-8.
- Adamson, E. (1991). Counting to a million. Logo Exchange, 9(7), 4-7.
- Bolster, L. C., et al. (1983). *Mathematics. Fourth grade.* Glenview, IL: Scott, Foresman.

101 Ideas for Logo

Terrapin Software, Inc. announces a new publication, 101 Ideas for Logo. This collection of classic and new Logo project ideas is suitable for use in the classroom or at home. The projects are organized into five skill levels and involve all areas of the Logo language. Compatible with all popular versions of Logo, these ideas range from beginning explorations to challenging programming problems.

101 Ideas for Logo is available as a book or in combination with reproducible black-line masters as a school site-license.

For more information, contact: Terrapin Software, Inc. 400 Riverside Street Portland, ME 04103 800/972-8200 207/878-8200

LogoExchange



LX Copy-Me Page!

Work Sheet

How many days would it take to save one million dollars if you were to start on Day 1 with one dollar and were to double your savings each day? You are not expected to spend any of your savings.

Day	Savings (dollars)	Total Saved
1	1	1
2	2	3
3	4	7
4	8	
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

If you need more space, continue on the back of this sheet.

Logo Puts It All in "Perspective"

by Nancy Flynn

"There's something wrong with this picture" probably sounds familiar to many art teachers. One reason why the student artist may feel this way is thathe or she has not yet learned how to draw in perspective and does not realize that proper perspective makes a drawing look more realistic. Perspective is generally a difficult concept for students to grasp, and equally difficult for teachers to teach. Students traditionally learn about perspective by trying to reproduce on paper what they see in real life or by copying a picture that has already been done correctly.

A unique approach to teaching students about perspective is to introduce them to turtle geometry and the way in which Logo can help students visualize the concept of drawing in perspective. As students experiment with the turtle and geometric shapes, the concept of perspective will emerge as a more natural process as the students see the relationships between what they can draw with the turtle and how they can transfer their new knowledge of perspective to paper and pencil.

Perspective in general has to do with where the artist is looking as he or she is drawing. For example, look at this drawing.



The horizon and vanishing point (the point at which all parallel lines converge) are at the center of the picture, right at eye level. When the artist is drawing from the perspective of eye level, it is called one-point perspective, which is what will be emphasized in this article because it is the most basic and easiest to understand. One-point perspective will be demonstrated by using triangles, rectangles, and cubes. The above figure started with a straight line to represent the horizon and the top angle of an equilateral triangle as the vanishing point.

```
to horizon
pu
setpos [-115 85]
seth 90
pd
forward 220
end
to triangle.1
pu
setpos [80 -85]
seth 270
pd
repeat 3 [forward 195 right 120]
end
```

To demonstrate the concept of the vanishing point with the turtle, draw another triangle inside the larger one. To do this, it is easiest to either imagine or draw a line bisecting the first triangle so that you have two right triangles.



This is helpful in figuring out lengths of the sides and the angles of the two isosceles triangles that have been created.



Once the triangles and the horizon have been created, you can experiment with equal spacing in perspective. Think of the isosceles triangle as railroad tracks. How would the railroad ties be placed so that they were spaced accurately as they vanish into the horizon? Using rectangles as railroad ties, place the first tie on the tracks and then place a second tie any distance from the first one.

```
to rectangle.1 :side1 :side2
pd
repeat 2 [forward :side1 left 90
   forward :side2 left 90]
end
to rectangle.2 :side1 :side2
pd
repeat 2 [forward :side1 right 90
   forward :side2 right 90]
end
```

To accurately space the rest of the ties, begin by setting the position of the turtle at the left short side of the first rectangle and have the turtle draw a 45-degree line from the top of the first tie on through the second tie to the track. That is where the third tie will be placed. Then set the heading of the turtle to 270 degrees and begin the process again. Draw a 45-degree line from the third rectangle through where the fourth tie would be placed and on until the line reaches the track. That is where the fifth tie would be placed. Continue this process until the line reaches the horizon. (These procedures werer tested on the IBM version of *LogoWriter* ans may not work as precisely in other versions.)



to tracks tie.1 tie.2 tie.3 tie.4 tie.5 tie.6 tie.7&8 end to tie.1 seth 90 rectangle.1 93 20 left 75 DU forward 40 right 75 end to tie.2 rectangle.1 72 16 right 105 pu forward 40 seth 0 forward 8 right 45 рd forward 100 left 75 pu back 5.5 seth 270 end

to tie.3 rectangle.2 55 12 seth 0 DU forward 5.5 left 45 pd forward 60 pu setpos [-37 15] seth 90 end to tie.4 rectangle.1 40 9 left 75 DU forward 20 seth 90 end to tie.5 rectangle.1 30 7 left 45 pd forward 30 seth 270 right 75 DU back 10 seth 270 end to tie.6 rectangle.2 20 4 right 75 pu forward 8 seth 270 pd end to tie.7&8 rectangle.2 16 3 right 45 forward 16 right 135 forward 8 left 135 forward 8 right 135 forward 5 end to equal.spacing horizon triangle.1 triangle.2

There are three concepts being demonstrated in this article. The first is the horizon along with the triangles, which demonstrates the vanishing point. For this, the user can type **horizon**, then **triangle.1** and then **triangle.2**. to see the process build. Note that **triangle.2** cannot be built by itself—it must follow **triangle.1**.

The second demonstration is that of equal spacing. This, too, is a building process. The user can start by typing horizon and then triangle.1 and then triangle.2. The user can next type tracks to see the whole process. Or the user can simply type equal.spacing and get the same result with fewer steps.

The third demonstration on on-point perspective using Logo involves inscribing a cube inside the same triangles used earlier. This will show students how the perspective of a three-dimensional object looks when drawn at eye level.

to 1.point horizon triangle.1 triangle.2 3.D end to 3.D seth 0 repeat 4 [forward 92 right 90] pu forward 90 right 90 forward 10 left 90 forward 18 right 90 pd repeat 4 [forward 72 right 90] end



21

Once the cube is inscribed inside the isosceles triangle shown below, it is easier to visualize the cube if certain lines of the triangle are erased.

to cube 1.point erase.the.lines end to erase.the.lines pu forward 19 right 105 pe forward 70 seth 90 DU forward 70 left 105 pe forward 70 seth 270 DU forward 53 left 90 pe forward 16 DU left 90 forward 72 left 90 pe forward 16 ht end



This third demonstration shows the perspective of a three-dimensional object when drawn at eye level. For this the user can once again start with horizon, triangle.1, triangle.2, 3.D, and then erase.the.lines, or the user can save several steps by typing cube. The approach the user takes depends on whether he or she wants to see the step-by-step building process.

Thus, you can type horizon, triangle.1, triangle.2 (but not without first typing triangle.1), equal.spacing, 1.point, and cube. You can start with any of the three demonstrations by typing the new procedure name. The only procedures that will not work by themselves are triangle.2, tracks, 3.D, and erase.the.lines, because each of these is a part of the process and is not of use in isolation.

This technique of drawing inside of geometric figures is one that can be easily transferred to paper and pencil.

This technique for learning perspective should be used by students who are experienced enough in drawing to want to learn about perspective. Any art instructor with access to a computer can use Logo as an instructional medium. If students are interested in learning the concept of perspective, they will probably have fewer reservations about learning if they are given the opportunity to experience turtle geometry. Give students as little direction as possible because part of the learning process is discovering new ways to use old information. After the students have experienced perspective using Logo, show them how it can be applied to drawing with a pencil on paper. It will make them eager to experiment further with Logo and expand not only their knowledge of drawing but of programming and problem-solving as well.

Note that the procedures in this article were tested on IBM *LogoWriter*. They may not work as precisely in other versions.

Nancy Flynn wrote this article while a graduate student at the University of Nebraska at Omaha. She has since graduated and is now an instructor in microcomputer technology at Metropolitan Community College in Omaha.

> Nancy Flynn 2305 Beverly Road St. Paul, MN 55104

LEGO Robotics in a Macintosh Environment

by Glen L. Bull and Gina L. Bull

The *LEGO-Logo* robotic system never fails to captivate both teachers and children. The instructions and documentation for the *LEGO-Logo* kits are their great strength. We usually ask teachers to work together in teams of two or three when they begin working with *LEGO-Logo*. There is almost always someone in the group with *LEGO* experience; those who never had the opportunity to tinker with *LEGO* parts as children usually find it satisfying as adults.

Increasing numbers of classrooms have acquired inexpensive Macintosh computers such as the Macintosh LC. We have been faced by the prospect of teachers who have existing Apple II *LEGO-Logo* systems that they wish to use with their new Macintoshes. By the time this issue of *Logo Exchange* appears, at least two choices should be available.

Control Lab

Control Lab is a LEGO-Dacta product scheduled for release in late summer or early fall. Although it is still under development as this is written, and therefore is subject to change, the initial release was targeted for technologic explorations in middle schools and above. The software for Control Lab has been developed by Logo Computer Systems, Inc. (LCSI), creators of the popular LogoWriter environment. The Control Lab system includes a Logo environment that lacks turtle graphics but provides Logo tools for reading sensors and controlling robotic motors.

Although Logo without a screen turtle may seem a radical departure, evolution and renewal are an important part of the technologic cycle. The last issue of *Logo Exchange* contained two articles on the future of Logo, asking "Will Logo survive?". Innovative products such as *Control Lab* that capture the spirit of the Logo philosophy in new forms may represent one of the best answers to this question. When the final version of *Control Lab* is completed, we hope to devote a full column to a review of this robotics system.

The Paradigm Robotics Controller

Another Logo robotics product for the Macintosh is equally innovative but fills a different niche, we believe. Paradigm Software has developed a robotics controller that allows an existing *LEGO-Logo* Apple II or IBM robotics kit to be used with a Macintosh. The Paradigm system offers three benefits:

- It provides a solution for the Logo traditionalist who wants both the Logo turtle and LEGO-Logo robotics for their Macintosh.
- 2. It provides an upgrade path for teachers who wish to preserve their investment in an Apple II *LEGO-Logo* system by adapting it for use with a Macintosh.
- It allows teachers to continue to use existing (and excellent) LEGO-Logo robotics documentation developed for separate grade levels (elementary, middle, and high school).

The Paradigm system has two components:

- A hardware adapter that allows the LEGO-Logo interface to be connected to a Macintosh serial port
- Software that provides the user with access to traditional LEGO-Logo commands

The hardware adapter worked perfectly. It only took a minute to attach the adapter to the *LEGO-Logo* interface and connect it to the Macintosh. This was facilitated by an intelligent, unambiguous design, supplemented by clear instructions in the manual.

The software provides several options, including an emulation of the *LEGO-Logo* commands within *Object Logo*, as well as an emulation of the *LEGO-Logo* commands within *HyperCard*. Paradigm is the distributor of *Object Logo*. *Object Logo* includes the usual features of Logo, but also provides access to objectoriented programming. Object-oriented systems make it possible to program by defining a set of behaviors for an object. This innovative system that extends the Logo environment has received considerable acclaim and is worthy of a column in itself.

It is possible to program directly within the *Object Logo* environment to control the LEGO robotics system. However, many teachers will want to continue to use the *LEGO-Logo* commands and environment. Paradigm provides a *LEGO-Logo* emulator to meet this need. The *LEGO-Logo* emulator allows the existing *LEGO-Logo* documentation to be used with minimal changes. The ideal transition for a teacher currently using an Apple II *LEGO-Logo* robotics kit would be a *LogoWriter Robotics* software system for the Macintosh. However, since this option is not available (at least at the time this was written), the Paradigm *LEGO-Logo* emulation for the Macintosh provides the next best solution.

Hyper-Logo

The Paradigm system also provides an option offered by no other commercial product: access to *LEGO-Logo* commands from within *HyperCard*. *HyperCard* is a popular authoring system developed for the Macintosh by Bill Atkinson. The HyperTalk programming language shares many of the attributes of Logo.

- Both are procedural languages, with procedures that can communicate with one another through inputs and outputs.
- Both are interactive languages.
- Both support recursion.
- Both are extensible, and provide the capability to add to the language new commands that can function just as though they were built-in or *primitive* commands.

We have found that students who are familiar with Logo can easily make the transition to *HyperCard* and the HyperTalk programming language. Since Apple provided a complete version of *HyperCard* with each Macintosh for many years, it is readily available.

The concept of a programming environment with a low threshold and no ceiling was central to the original vision of Logo. The intent was not only to provide an environment that would allow even young children to control the computer in fulfilling ways in their first encounter, but also to provide a power of expression that would not limit advanced learners. We believe that *LEGO-Logo* commands within *HyperCard* can extend the Logo environment in a positive fashion.

The Paradigm robotics interface can provide a useful bridge between Logo and *HyperCard* within a Macintosh environment. We would recommend using the Paradigm *LEGO-Logo* emulator initially in conjunction with the *LEGO-Logo* documentation and projects. Depending upon the age of the group, one of the simpler projects, such as the computer-controlled traffic light, may be appropriate, followed by more complex projects, such as the LEGO floor turtle, as the group gains experience. We find that groups of two to four students work well.

The sample *LEGO-Logo* projects have the advantage of extensive testing with the age groups for which they are designed. As groups gain experience, they frequently develop extensions of sample projects or create original ones of their own.

A Sample Design Project

The *LEGO-Logo* merry-go-round project is a good example of the type of project that can serve as a bridge between a Logo environment and an enhanced project in a *HyperCard* environment. We have watched numerous groups of students successfully construct a carrousel following the sample *LEGO-Logo* project directions. These directions include one booklet that provides step-by-step directions for putting together the LEGO parts to build a merry-go-round driven by a computer-controlled motor, and a second booklet that offers sample Logo procedures for controlling the carrousel.

Once a group has a gained the confidence that comes from successfully completing a project of this kind, project extensions and elaborations are in order if there is sufficient time. One extension that we have found to be a natural elaboration of a project of this kind is the design of a computer control panel.

In a project of this kind, we find it useful to ask groups to create a set of design specifications. For example, a set of functions which might be specified could include the following:

- start and stop the carrousel
- control the direction of the carrousel
- control the speed of the carrousel
- allow each seat on the carrousel to be advanced for loading and unloading of passengers
- provide a counter that allows the operator to monitor the number of revolutions of the carrousel that have elapsed during the current ride

Depending upon the enthusiasm of the group, other functions might also be included. These could include settings for a long or short ride, controls for a sedate or exciting ride, and other functions limited only by the imagination of the group.

The next step in the development process involves graphic design. The graphic design process should group logical functions together to facilitate use by the operator. Sometimes it is helpful to provide older students with articles that discuss good and bad examples of industrial design. Any of the common Macintosh paint or drawing tools can be used for the graphic design component, such as those found in *ClarisWorks* or Microsoft *Works*, or the paint tools available in *Hyper*- *Card* can be used for this process. The following illustration provides an example of a control panel developed by one group.



This control panel provides buttons to start or stop the carrousel and to set the speed and direction. A counter at the top displays the number of revolutions that the carrousel turned since the beginning of the ride. This counter could also form the basis for programming decisions such as the length of the ride.

Logic and Programming in a Robotic Environment

After the control panel has been designed, the next step is the programming itself. For those who are not familiar with the *LEGO-Logo* environment, a control box provides three ports into which LEGO motors can be plugged.



If a motor is plugged into Port A (which, to avoid confusion with the Macintosh serial ports, is referred to as "Slot A" in Paradigm documentation), a *LEGO-Logo* procedure to turn on the motor might be written in the following way:

TO MOTOR.ON TALKTO "A ON END A HyperTalk procedure would be written in almost the same way as the Logo procedure. *HyperCard* makes buttons that can be clicked to initiate events. For example, buttons could be created to start or stop the carrousel. Each button can have an associated procedure or script that describes what should happen when the button is clicked.



For example, in the case of the STOP button, the following procedure could be written. This procedure says that when the mouse button is clicked (on mouseUp), *HyperCard* should talk to the motor connected to Port A and tell it to turn off.

```
on mouseUp
talkTo "A"
off
end mouseUp
```

As you can see, the Logo procedure and the HyperTalk procedure are similar. The main difference is that the HyperTalk procedure can be associated with a button on the screen of the computer, making it possible to create the type of control panel shown in the illustration above.

Instructional Connections

There are both technologic and instructional lessons that can be obtained from working in an environment of the kind described above. In the future, almost all computers will have a graphical user interface that supports multiple windows with different applications. The process described above can demonstrate how multiple applications in different windows can be used in conjunction with one another—specifications can be developed with a word processor followed by procedures developed and tested in a *LEGO-Logo* environment with a graphics design for a control panel created with a paint or drawing program, leading to all of the above ultimately being combined within *HyperCard* to create the final product.

The instructional process is perhaps even more interesting than the technologic benefits. The steps of this process involve the following instructional areas in a single, multidisciplinary project:

• physics and mechanical skills—the carrousel is constructed with motors, gears, and LEGO parts.

LOGOEXCHANGE

- electrical and electronic concepts—the motor and sensors must be connected to the interface box.
- writing and language arts—the specifications for the control panel must be developed and justified.
- art and graphic design—the layout of the control panel must be developed.
- programming and logic skills—the procedures needed to make the control panel operational must be developed.

One of the positive aspects of the above list that we particularly like is the fact that all of these elements are ultimately tied to real-world events—whether the carrousel turns in the desired fashion. We have found that students with proper support will persist in their efforts to design and create the perfect carrousel for extended periods of time, and they obtain considerable satisfaction when they achieve the goals they have set for themselves.

Summary

In the future, all computing environments will provide access to windows with multiple applications and a graphics user interface. The Paradigm controller allows teachers with Macintoshes who have existing Apple II *LEGO-Logo* robotics sets to preserve their investment by providing an upgrade path that allows them to use these systems with the Macintosh. Although we would prefer to see development of *LogoWriter Robotics* software that supports the Macintosh, Paradigm has done an excellent job of emulating the *LEGO-Logo* environment. In addition, this is currently the only commercial product that allows *LEGO-Logo* robotics systems to be controlled with *HyperCard*. Paradigm is to be commended for developing an excellent product that meets a real need.

This is likely to be a rapidly developing and changing area. We will report on future developments as they become available.

For more information on the products described in this article, see box above.

Glen Bull is an associate professor in the Instructional Technology Program of the Curry School of Education at the University of Virginia. Gina Bull is a system administrator in the Department of Computer Science at the University of Virginia. By day she works in a Unix environment, by night in a Logo environment. Internet Addresses: GBull@Virginia.edu, Gina@Virginia.edu

BITNET Addresses: GBull@Virginia, Gina@Virginia

WIN-LOGO is Available

WIN-LOGO is an environment for learning and developing applications in Logo language in a windows-like user interface. WIN-LOGO's graphical interface is indistinguishable from popular windows based applications. Pull down menus and dialog boxes provides quick access to many features. Traditional Logo systems users should feel at home with the easy to use interface.

WIN-LOGO offers several functions beyond those found in most Logo implementations. It consists of eight areas or windows for application viewing and interacting. These areas can be moved, resized and can be overlapping. The main windows are Graphics, Text and the Work window. There can be up to 12 turtles, 128 user-defin-

able shapes, different line widths and fonts. The package supports PCX images and zooming.

The Text window resembles a roll of paper, which can be scrolled up and down. It makes use of different fonts and the color of the foreground and background can be chosen.

When the Work window is resized, the contents will be rewritten to fit the new size. An arrow key can used to display any previously written text, and pressing Enter on any line of the text causes WIN-LOGO to run that command.

WIN-LOGO has a flexible text editor for ease of programming. It includes block delete, copy, search and replace functions.

WIN-LOGO has over 300 primitives. The new primitives are designed to use the windowing environment and mouse. The user can define primitives either in C or Assembly language.

The Debug tool can be used to control the execution of the interpreter and procedure step by step. The graphical procedure tree can improve code management and rapid development of applications. WIN-LOGO runs on IBM PCs or compatibles and supports industry standard graphics cards and printers.

For more information contact:

Softeast Corporation Knox Trial Office Building 2352 Main Street Concord, Massachusetts 01742



onnect with telecommunications leaders from all over the globe.



Join us at Tel•Ed '93—Global Connections—The Second International Symposium on Telecommunications in Education and meet with telecommunications leaders from all over the globe.

Be one of the estimated 1,000 educators, policymakers, and researchers who will join together in this unique international forum—for the first time since 1989—to exchange the latest in telecommunications ideas, techniques, strategies, and policy concerns.

Topics will include:

- · Multimedia and telecommunications
- · Global educational development through telecommunications
- Telecommunications in math, science, and technology education
- · Policy and legal issues

To receive attendee information as it becomes available, call Juanita Benzer, 512/471-4014.



The Second International Symposium on Telecommunications in Education November 10-13, 1993 Dallas, Texas, USA at the INFOMART Tel-Ed '93 is sponsored by the International Society for Technology in Education (ISTE).

Journal Excerpts

by A. J. (Sandy) Dawson

In an earlier column this year, I mentioned that during the fall of 1992 I would be working with a group of 12 secondary school mathematics teachers (6 of each gender), all but 3 of whom are enrolled in a master's degree program, focusing on secondary school mathematics, at Simon Fraser University.

That course is now over. We used Borasi's (1992) book Learning Mathematics Through Inquiry as the focal point of many discussions in the class. Students in the course wrote book reports, kept journals, led their colleagues through a wide variety of mathematical learning experiences, wrote their biographies as mathematics teachers, did some action research with the pupils they were teaching, talked, argued, debated with each other, and devoted one class meeting to a visit to the new school where one of them was teaching.

The teacher in that new school, Beth Mehrassa, kept a reflective journal as one of the assignments for my class. It is with her permission that I share some of the entries in her journal with *Logo Exchange* readers. Beth drew on discussions she was part of when our class met, on her own readings, and of most concern here, on her experience with the pupils in her new school setting. Why did she decide to keep a journal? Listen to what Beth says about that:

I chose to write a journal for this course because looking back on my student teaching experience, the reflective journal we wrote during our practicum was most useful to me. I did not limit my entries to the readings and in-class experiences, but included some of my own teaching experiences during the past months.

The honesty and openness of the 12 students taking my course was a pleasure to behold. This was the fourth course the 9 students in the secondary mathematics masters program had taken together. They were pretty comfortable with one another. They quickly made the 3 new students welcome, and didn't even seem to mind too much that I was there prodding them to examine their own teaching and thinking! All were willing to expose the weaknesses they saw in their own teaching, and as with so many teachers, were reluctant at times to acknowledge that many things they did were creative and powerful for the pupils in their charge.

Hence, Beth's responses and analyses and reflections are fairly typical of all the students in the course. I was pleased when she approved of the selections I made from her journal for inclusion in this article. Because Borasi's book formed the basis from which the course was launched, and upon which the course ended some 13 weeks later, let me begin by letting you in on Beth's initials thoughts about Borasi's book.

October 10th: When I first read Borasi's book, I found it interesting and its style immediately appealed to me. I enjoyed the students' comments as well as Raffaella's reflections as a teacher and a researcher. Despite this, I did not find much of it relevant to me as a teacher for I felt it was not applicable to my teaching. This was before I undertook a teaching assignment at the new Thomas Haney Secondary School. After working there for one month, I found much that I can apply from Borasi's book.

The new school where Beth chose to teach is not typical of secondary schools. It enrolls students in grades 8 to 12, and has scheduled classes for eighth graders as well as some selected courses in grades 9 to 12. For the majority of courses, however, students work through self-directed learning guides prepared by the teachers. Each teacher is responsible for a homeroom group (a teacher advisory group as they are called at Thomas Haney) composed of approximately 20 students, some from each of grades 8 to 12. In addition to these students for whom Beth is directly responsible, she also oversees and works with all students who are working their way through the learning guides for mathematics for grades 9 and 10. She marks these latter students' work and assists them one-to-one or in small groups. Listen to Beth as she talks about the transition that took place in her teaching as she struggled with how to teach in this remarkable new school.

October 10th, continued: I found Mary's [one of the two students Borasi worked with and about whom she wrote in her book] comments on their sessions especially relevant to my current teaching. Mary said:

I felt that, instead of having a teacher that was standing up in front of the room and dictating and saying, "No, you're wrong. Yes, you're right," it was more like, "Well, maybe, let's try it" (Borasi, 1992, p. 125). This passage jumped out at me, for I thought (rather self-righteously), "This is what happens at my school, for I don't stand up in front of the room and dictate." But then, upon further reflection, I realized that even though it's a smaller group of students, I did try to dictate. In the first week, when all students were on the same learning guide, I fell comfortably into my routine of "giving" a lesson. Although I told the students that I would follow their lead and make their questions my top concern, I ended up doing a mini-lecture and then posing questions to check for understanding. I fell back into the role that I was used to and they remained in their student as receiver roles. It seemed that we both stayed with what was familiar.

About one week later, however, this approach was no longer possible. The nature of the system forced us to make changes as students began to spread out among several learning guides. If we, as a mathematics department, were going to stick with our original goal of offering discussion sessions at set times but not on set topics, then I would just have to change. I was not very comfortable with this change and was quite nervous as discussion session time approached every two days. Fortunately, both I and the students improved. I now feel quite comfortable with the notion that I have no idea what will be discussed ahead of time at our sessions.

This does not mean, however, that I have applied Raffaella's style of "Well, maybe, let's try it." I still find myself saying, "No you're wrong. Yes, you're right," quite often. Just because I am now directing this to smaller groups of students does not make me any less guilty of it. The students are helping me to change this style though. Because I do not work with all of the students in a session as one group, and, hence, ask the ones with whom I am not working to try to sort out some of their questions on their own, the students do get a fair chance to "just try it." Recently I have often found that by the time I get back to the students who have been working on their own, they are intent on their own work. It feels like an intrusion if I ask them if I can help.

Initially I felt a bit hurt when they declined my offer of assistance. I realized, however, that I cannot hope my students will become independent learners and still want them to depend on me for help. Nonetheless I felt a bit rejected. My colleagues helped me by pointing out that what had happened should be seen as a very positive change. It is certainly true that the students have changed and I am often amazed at their ability to help themselves and each other to learn. They are applying Mary's prescription for learning: "try to figure it out and ... make errors first. Which is a regular way of learning things: you make an error and you try to correct it and you just work it through."

In the next two excerpts from Beth's journal, she talks about our graduate class. I had offered the opportunity to all students in the class, as one tool of assessment for the course, to involve the rest of their classmates and myself in a mathematical learning experience. During the first few of meetings of the class, I had done this on four or five occasions, and we had all found the experiences tremendously valuable for raising various issues about the teaching and learning of mathematics. I insisted that the experiences had to be real; that is, we weren't to be asked to pretend that we were high school students and to then see how we would respond to that activity. The activity had to challenge us, with all our experience of teaching mathematics and with all our knowledge of mathematics itself. The next selections from her journal indicate the impact our class experiences had on Beth. They also indicate how Beth and her colleagues extrapolated some of these experiences to their teaching situations.

November 5th: Today in class, Devi brought in a tape for us to listen to. Albert Einstein's comment about daydreaming struck me. The commentator said that by daydreaming, Einstein came up with some of his theories. I have often been frustrated with students getting off topic during my lesson. I can hear myself saying, "We have to concentrate on factoring today," without giving the students a chance to pursue their thoughts. By seeing so many connections in mathematics recently, I know that a seemingly off-topic question in mathematics can quite possibly lead to some very interesting connections with the topic at hand.

Now, without having a class for which to plan, I have most often pursued the students' questions. It doesn't seem like such a risk as I am usually only working with only one or two students at a time and nothing is really offtopic, for it is the students themselves who provide the topic. I find that I enjoy discussing practically anything with the students, and I am seeing many more connections through these discussions. November 11th: After reading Fisher's review of *The Research Agenda Project*, I began to think again about the assessment procedures we use at Thomas Haney. Unfortunately, as a department we have not spent much time thinking about assessment techniques used in our mathematics courses. The assessment we use has been more of a "quick fix" as there was no assessment guidelines included in the learning guides. I and others simply altered tests we had prepared in previous years to match the learning objectives for each guide.

A product-oriented assessment tool is being piloted in the math 11A course. The *final exam* in this course is a set of *tasks*, one for each of the main topics included in the course. Each task is quite detailed and involves much mathematical thought. For example, one question on the trigonometry section is, "Determine the height of the Great Hall." It is stated on the exam that the tasks may be done over an extended period of time. Also, students are allowed to get help from various sources as long as they are all referenced.

The Great Hall to which Beth refers is a huge open area, rectangular in shape, that runs the length of one wing of the Thomas Haney school. It is more than two stories high. It is where students spend much of their time working alone or with groups of other students.

November 11th, continued: The first student to hand in this exam did very well on some parts whereas others had to be improved. The teacher discussed the necessary revisions with the student during a half hour session which, in itself, was a good assessment procedure. I see this experience as a very positive direction for assessment in our math courses. I feel that it provides both the student and teacher with an insight into the student's mathematical abilities as well as a useful learning experience.

In the next excerpt, Beth once again reflects on an experience that occurred in our grad class. It revolves around the issue of teacher talk, and how productive, or not, it might be. Some wag once suggested that perhaps it is because teachers, when attending university to educate themselves as teachers, are talked at by university professors, endlessly it seems, that they seek their due by talking nonstop at pupils once they have a classroom of their own. Whatever the reason, Beth displays her openness and honesty as she confronts herself as she tries not to intervene unnecessarily when leading her colleagues in a mathematical experience.

November 19th: In class tonight, during our

Tower of Hanoi experience, I played the role of presenter and observer. For me this proved to be a difficult task. I had looked forward to it, as almost every week I have participated in an experience and this time I would get a different perspective; I would have the opportunity to step back and watch others in action.

It turned out that I found it very hard to step back. Ihad to bite my tongue several times and, on some occasions, I did not succeed in shutting myself up. I wanted to help Sandy and the other graduate students, guiding them toward a solution. I found it nearly impossible to leave them alone and let them think, especially in the beginning if they had trouble getting started. I wanted to tell them exactly how to begin so that they would get going. Sometimes it seemed that they were doing nothing and, at those times, I longed to jump in!

I realize that this habit pertains to my own teaching, as I often jump in to help my students. I am now trying to stop myself, especially as I don't have the time constraint excuse (i.e., class will end soon so I'd better get them going) as much now at Thomas Haney. This experience helped me to be more aware of this aspect of my own teaching. It also relieved some of my anxiety as I saw that all the participants did work the problem out. They resolved it without my help and I think that perhaps backing off actually helped them, by allowing them to think it out. In fact Surjeet got annoved when Kanwal and I did try to intervene and, in the end, I felt that they all had a good understanding of the patterns they had discovered. I do not always feel that my students have a good understanding of their work; maybe this is because I lead them a lot and they haven't internalized the understanding. That is, they may see how I can do it and each step may make sense, but they cannot do it themselves. I have to allow them to do it themselves. It's difficult for me to think that the assistance I offer may not actually help my students, but this experience has certainly made me think carefully about that very topic.

Another point I learned from this experience is that when I have an active role to play, I am better able to keep quiet. I realized this lesson when, during the second run through the experience, I had to be a recorder. As a recorder, I had a job to do and I could observe quietly as I was writing. I was observing with a specific purpose and the tension was reduced. I had

LOGOEXCHANGE 30

less time to jump in since I was busy writing. I think this will help me with my students. If I make sure that I record or have something specific to look for in their work, I will be less likely to interrupt their thought process with my *help*.

It was a pleasant happenstance that the grad class had equal representation from each gender. Though I did not monitor the discussion on every occasion, during those times that I did do so it was clear that the women were not at all shy and retiring or inhibited about making their points of view known. Nor were the men reluctant to speak about their own affective responses to particular situations. Perhaps this was an unusual group. Perhaps over the 18 months that most of them had taken classes together, they had developed a level of camaraderie and trust that enabled them to speak of their own and others' struggles in teaching and learning mathematics. What is clear to me is that as a group they were sensitive to and aware of the challenges that face so many students, male and female, when studying mathematics. Moreover, interactions with pupils were not seen as just opportunities for the teacher to teach, but perhaps even more importantly as a chance for the teacher to learn. In the next, shortened, excerpt, Beth talks about one of several female students she worked with as a consequence of her role as Teacher Advisor to more than just her own advisory group.

November 24th: I have enjoyed the opportunity I've had recently to work with girls who have felt very negatively toward mathematics. One particular example began last week when one of my colleagues came to me expressing concern over a girl named Aldona from her Teacher Advisor group. This girl has struggled in mathematics classes in the past and her frustration with math was continuing as she had not yet been successful with any of her learning guide tests. She moved on anyway and got even more confused as she was attempting to work on many different topics, feeling pressured to progress through the guides. Compounding Aldona's problem was her fear of mathematics and her past failures as she was scared to ask for help, feeling sure that all of her questions were silly. Her TA asked me if I could meet with Aldona individually because Aldona did not feel comfortable asking for help in the group sessions. The TA also felt it was important for Aldona to connect with a female mathematics teacher.

I had the pleasure of working closely with Aldona this past week. I found her to be a thoughtful and creative student who strives to understand the concepts in her own way. I am fortunate because she will often say words such as, "Oh, you mean..." so I do not usually have to ask her to express her understanding of the concepts verbally.

This voluntary expression of her thought process has proven to be enlightening for me. She often sees things in quite a different way than I do and so my own understanding of some concepts has been enhanced. When I shared this experience with Aldona's TA, she was delighted and said that Aldona seems much happier recently; in fact, she even received a note from Aldona at the end of one day excitedly reporting that she had just finished a math test! I, too, have noticed a difference in Aldona because she voluntarily comes to the kiosk to ask for help now, and we no longer have to set up individual tutoring times. She still does not come to the group sessions and often finds mathematics difficult and frustrating, but I am very pleased with the changes I've seen in one week. I am hopeful for Aldona's mathematical future.

This type of communication is a welcome change for me. I now feel I can take the time to address the very important subject of feelings about mathematics. I did also pursue this previously, but always felt restricted to time after class or very short periods of time in between covering the curriculum during class. Now, at Thomas Haney I do not feel pressured to cover anything. I am concentrating much more on the students' needs and addressing feelings of anxiety is a large need as I see it. As Jenny Maxwell (1989) writes in her Mathephobia article, mathematics is, unfortunately, often "a barrier to, rather than a means of, communication, which is not only about methods, hypotheses and answers but about feelings" (italics mine) (p. 225). I am seeing first-hand what a big role feelings about and attitudes toward mathematics play in students' success with this subject.

There are those who at times despair of ever changing what they perceive as the sorry state of secondary school mathematics teaching. Certainly, reviews of the literature in the past few years do not paint a very complimentary picture of how mathematics is presented to secondary school students. But there are exceptions, and believe it or not, things do change. In her next excerpt, Beth gives us evidence that not only was there discussion with her graduate student colleagues regarding issues of, say, gender bias in the teaching of mathematics, or of ethnomathematics, or historical aspects of mathematics, but such issues were beginning to be raised in her departmental meetings. After all, mathematics is above all else a very human enterprise!

December 4th: Another positive experience for me (on the subject of discussing feelings with students) took place at a recent departmental meeting when our department head brought up the topic of the affective side of mathematics. He and my other colleagues are concerned with promoting mathematics as a human endeavor in our school. It is very exciting for me to be working with others who have similar concerns. This year I am beginning to see possibilities to deal with some of these issues. Our department is starting to work together on a cross-grade program that will address some issues such as mathematics in society, women in math, and some cultural as well as historical aspects of mathematics. Although it was just one of the many goals we have set for our department, I left the meeting feeling excited about the future of the more human side of mathematics in our school.

In her book, Borasi (1992) argues that teachers should organize sessions which provide students with "occasions for reflecting on the significance of one's inquiry" (p. 199). She suggests that students should reflect on the significance of their inquiries both while engaged in the investigation and after it has been completed. In my view, the latter is much more readily accomplished than is the former. Regardless, I do agree that being aware of what one is doing is the only way in which learning will occur. The additional step of being aware of oneself as one is learning is a challenge that requires working with students to help them develop tools for accomplishing this task. Beth's final journal entry reinforces this point.

December 6th: I enjoyed reading the final chapter of Borasi's book, especially the section on student reflection. I agree with her position on the positive effects of providing opportunities for students to reflect on their learning. From my own experience in this class, I realize that reflecting on mathematical activities is difficult at first but very worthwhile. It has provided much insight for me. Why not pass that opportunity on to my students? I thus want to incorporate this element into the math programs at Thomas Haney, but I feel it must be done carefully as I further agree with Borasi's comment regarding the importance of providing structure to help students with their reflections.

No student learns in a vacuum, except perhaps in a university mathematics education classroom, and some of us are even trying to change that! Beth's journal provides evidence that the concepts and ideas generated by students need to be tested for viability, and one sure way to do that is to bounce those ideas and concepts off of one's colleagues. This can be done by discussion, by writing stories or keeping diaries, by large- and small-group presentations, by quiet one-onone dialogue, but whatever the means, the important thing is for students to communicate with each other regarding the outcomes of their mathematical investigations. This is what 12 graduate students and I tried to do in my course last fall.

How are you doing in the courses you teach?

References

- Borasi, R. (1992). Learning mathematics through inquiry. Portsmouth, NH: Heinemann Educational Books, Inc.
- Fisher, C. W. (1990). The research agenda project as prologue. A review of Research Agenda for Mathematics Education, Vol. 1-5. *Journal of Research in Mathematics Education*, 21(1), 81-89.
- Maxwell, J. (1989). Mathephobia. In Paul Ernest (Ed.) Mathematics teaching: The state of the art. New York: The Falmer Press.

Beth Mehrassa obtained her teacher education through Simon Fraser University's Professional Development Program. She has taught for four years in Maple Ridge, a suburb of Vancouver, BC, Canada. Beth is currently enrolled in SFU's Master's Program for secondary school mathematics teachers.

Sandy Dawson is an associate professor of mathematics education at Simon Fraser University, and director of that institution's teacher education program. His most recent research interests center on the areas of LEGO/Logo and the exploration of what mathematics lessons with a constructivist or humanistic focus might look like.

> A. J. (Sandy) Dawson Faculty of Education Simon Fraser University Vancouver, BC, Canada V5A 1S6 Email address: Sandy_Dawson@sfu.ca

32 A LOGOEXCHANGE

A Little Light on LEGO-Logo

by Douglas H. Clements and Julie S. Meredith

Fourth-grader Kevin started, as many other students do, by building a car out of LEGO (Resnick, 1988). After racing the car, he added a motor. The car moved forward a bit...and then the motor fell off and vibrated across the table.

The movement interested Kevin. He wondered if he could use the vibrations to power the vehicle. He mounted the motor on a platform of LEGO axles. Experimentation taught him that he needed some way to amplify the vibrations. Building on his skateboarding experience, he created a swinging arm. As the gear turned, the arm whipped around—and amplified the motor vibrations. Indeed, the amplification often tipped the walker over, and he took a friend's advice and attached tires horizontally at the bottom. He could control the walker—it turned right when the motor rotated in one direction, left when it rotated in the other.

Logo: Search and Research

Kevin eventually made the walker follow a black line by attaching a LEGO sensor to it. He wrote code similar to the following (rewritten a bit for readability).

```
to follow
look-for-line
go-past-line
reverse-direction
follow
end
to look-for-line
waituntil [floor-color = "black]
end
to go-past-line
waituntil [floor-color = "white]
end
to floor-color
if sensor? [output "black]
if not sensor? [output "white]
end
```

The researchers claim that Kevin learned specific engineering concepts, an appreciation for both the constructive uses and destructive potential of vibration in mechanical systems, and basic ideas about feedback and control. Most important, he gained a sense of process of design.

Research on LEGO-Logo

With its lights, sensors, motors, gears, and pulleys, LEGO-Logo is a unique new member of the Logo family. Designed to offer students the opportunity to invent meaningful constructions in their classrooms, LEGO-Logo provides a more motivating context for exploring science ideas. Researchers have conducted only a few studies, but they provide an initial glimpse at learning with LEGO-Logo.

Bolstering Achievement and Investigative Processes

Only a few studies have measured student achievement in relation to the use of LEGO-Logo. In one of those studies, fourth-grade students made small but important gains mathematical achievement (Browning, 1991), They improved the most on items related to angle concepts. For example, only 3 of 22 students in a fourth-grade class entered a response that even resembled an angle when asked to draw a right angle. On the posttest, 17 drew the angle adequately.

In another study (Flake, 1990), one fourth- and one fifth-grade class worked with LEGO-Logo, while another fourth- and fifth-grade class studied the same curriculum without LEGO-Logo. The LEGO-Logo classes increased more in math achievement in both concepts and problem solving, although the control group experienced higher gains in computation.

Weir (1992) also reported gains in mathematics achievement, especially on tasks requiring higher-order thinking. As one example, one boy, Peter, was playing with his LEGO-Logo car and the procedures he wrote, WIGRT (wiggle-to-the-right) and WIGLT. He had typed REPEAT 10 [WIGRT WIGLT]. Then, having already explored the SETEVEN command (which sets the motor in an even, or forward, direction), he realized that programming can create alternating evens, and that odd-even distinctions can be used. This leads to the following investigation.

Interviewer: So where does it end up?

Peter: Right back where it started! That's because I chose an even number.

Peter tries an odd number, but it still ends up where it started. He thinks, and then types, REPEAT 9 [WIGRT WIGLT WIGRT]. All are delighted with the result.

The notion of reversibility apparently became a real tool for Peter. One day, a wire became stuck in a worm gear. An adult reached out to try and untangle it physically. Peter stopped him and used the computer to reverse the direction of the motor, smiling as the wired gracefully unwound.

Weir (1992) asserted that both LEGO and Logo help "decontextualize" concrete experiences, letting them become more generalized and abstract. She also claimed that LEGO-Logo supports higher-order processes, such as debugging, and invites creativity. Of course, teachers must help make this happen. The researcher/teachers found they were often successful when they used fewer verbal descriptions and instead adopted a participatory, "let's do it with LEGO-Logo," approach.

Finally, using LEGO-Logo did not substantially change a fourth- and fifth-grade class' science-like behavior (Dawson & Bell, 1991). A separate fifth-grade class increased in both science-like behavior and inventor-like behaviors, while a split sixth- and seventhgrade class increased in science-like, but not in inventor-like, behaviors.

Overall, then, results with LEGO-Logo are similar to those with Logo: there are mixed results, generally with small but significant gains in achievement. It is promising to see some measure of different kinds of achievement, especially in problem solving and in processes.

Supporting Large, Complex Tasks

A study of a fourth-grade class in an Apple Classroom of Tomorrow revealed that immediate access to computer technology, including LEGO-Logo and writing plays using the computer program Showtime, supported teachers' implementation of tasks that were larger, more complex, and more open-ended than usual classroom tasks (Fisher, 1990/91). (Tasks were rated on characteristics such as task size and cognitive complexity. On both characteristics, handwriting instruction was rated 1 and LEGO-Logo was rated 4 on a 5-point scale.) Students had to make more decisions, and different kinds of decisions, as they worked on these larger tasks. This in turn helped them become more active and independent learners.

The effect on students' autonomy and empowerment varied to the extent that they caused, controlled, or influenced the content, process, product, and evaluation of their own learning. LEGO-Logo was especially high in this regard (compared to Showtime). Why? With LEGO-Logo, students made decisions about the product they were to build and the processes they would use to build and test models. These were to be working models of some real-world mechanism or situation. They included a car wash, a basketball court, a jumbo jet, and a house in which the lights came on when the door opened. Team members took individual roles, including builders, programmers, and recorders.

What role do computers play? They help minimize the problems involved in managing more complex tasks. The high-access computers help "absorb" more student variation before the classroom management problems become overwhelming. Also, larger tasks can be more easily supported with technology than with noncomputer materials.

Increasing Motivation and Self-Esteem

LEGO-Logo appears to motivate students. In two studies of fourth-grade students, attitudes were positive and motivation increased in comparison to other classroomtasks (Browning, 1991; Fisher, 1990/91). There is some evidence that interaction with LEGO-Logo may develop self-esteem (Weir, 1992). This may be because LEGO-Logo provides an academic setting in which students can develop their own goals.

Other researchers report increased empowerment with LEGO-Logo, especially among underachievers (Silverman, 1990). In Flake's (1990) study, one boy who had performed poorly in math in the past became enthralled with LEGO-Logo and completed a fairly complicated project, much to the surprise of his teacher.

Affecting Social Interaction

Some of these studies also reported beneficial smallgroup interactions as an outcome of LEGO-Logo work. However, not all studies with fourth-graders have been positive. In one, some fourth- and fifth-grade groups got along, but others broke up. Generally, the students performed poorly in groups and did not improve over time (Dawson & Bell, 1991). The group behavior of students in higher grades seemed to improve with LEGO-Logo work. Dawson and Bell then concentrated their work on students in grades 5-7. Teachers and students believed that students learned to work cooperatively with LEGO-Logo, although the students did not believe that the work in groups improved. Teachers and students agreed that six students were too many for one group.

When the researchers asked teachers to compare the two years, they believed that they provided more structure for the students, gave them more challenges, and pushed them more. The students agreed that the second year was more challenging, but they also believed it was more interesting and better organized. More adequate supplies of equipment were also beneficial. Such insights argue that we need research from teachers.

Like Logo, LEGO-Logo is the kind of innovation that might best be studied by dedicated teacher-researchers, possibly in collaboration with other researchers.

References

Browning, C. A. (1991). Reflections on using Lego®TC Logo in an elementary classroom. In E. Calabrese (Ed.), Proceedings of the Third European Logo Conference (pp. 173-185). Parma, Italy: Associazione Scuola e Informatica.

- Dawson, A.J., & Bell, D. (1991). LEGO TC Logo: A study of children's learning. Logo Exchange, 9(5), 20-24.
- Fisher, C. W. (1990/91). Some influences of classroom computers on academic tasks. *Journal of Computing in Childhood Education*, 2, 3-15.
- Flake, J. L. (1990). An exploratory study of Lego Logo. Journal of Computing in Childhood Education, 1(3), 15-22.
- Resnick, M. (1988). LEGO, Logo, and design. Children's Environments Quarterly, 5(4), 14-18.
- Silverman, N. S. (1990). Logo and underachievers. Unpublished masters thesis, University of the Virgin Islands.
- Weir, S. (1992). LEGO-Logo: A vehicle for learning. In C. Hoyles & R. Noss (Eds.), Learning mathematics and Logo (pp. 165-190). Cambridge, MA: MIT Press.

Support in preparing this material was partially provided by the National Science Foundation under Grants No. MDR-8954664 and MDR-9050210. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the National Science Foundation.

Douglas H. Clements, associate professor at the State University of New York at Buffalo, has studied the use of Logo environments in developing children's creative, mathematics, metacognitive, problem-solving, and social abilities. He is currently working with several colleagues on an NSF-funded project, Investigations in Number, Data, and Space, to develop a full K-6 mathematics curriculum featuring Logo.

Julie S. Meredith is a mathematics education doctoral student at the State University of New York at Buffalo. She is currently designing and programming a new version of Logo for the NSF-funded Investigations project.

Douglas H. Clements and Julie Meredith State University of New York at Buffalo Department of Learning and Instruction 593 Baldy Hall Buffalo, NY 14260 CIS: 76136,2027 BITNET: CLEMENTS@UBVMS

PC Logo for Windows™ Debuts

Harvard Associates is pleased to announce the immediate availability of PC Logo for Windows, a complete version of the Logo programming language for the Microsoft (R) Windows TM operating system.

"PC Logo for Windows is designed to appeal to those already familiar with Logo while extending its power and flexibility to the Windows environment with features like pull-down menus, buttons, multiple windows, advanced debugging tools, and a complete on-line Help system, "according to Mr. William Glass, President of Harvard Associates. It joins PC Logo 4.0TM the latest release the MS DOS version of Logo developed and marketed by Harvard Associates.

Features of PC Logo for Windows include the full range of Logo capabilities as well as multiple windows for commands, graphics, editing and debugging, multiple turtles that can change color, speed and shape with the new shape editor, a complete music system for easy writing and playing tunes, and an automated, quick install program. PC Logo provides control of the Windows environment via access to API and MCI for multimedia applications.

PC Logo for Windows comes complete with 500 pages of documentation, including a stepby-step tutorial and technical reference manual. Multiple workstation licensing is available for educational institutions.

For more product information or to order PC Logo for Windows or DOS, please contact:

Harvard Associates, Inc. 10 Holworthy Street, Cambridge MA 02138 U.S.A. Phone : 617 492-0660 Fax: 617 492-4610

All you need is the right tool...

With either HyperCard for Educators (Macintosh) or LinkWay for Educators (MS-DOS) as an introduction to the interactive world of hypermedia, you can learn to build libraries of knowledge suitable for both classroom and personal use.

Link

If you have basic computer skills, you can follow the simple tutorials and start using buttons, fields, and backgrounds or base pages to make FFFFFFFFF your data and images come alive in your classroom.

By starting with the foundation that these books provide, you'll be on your way to using sounds, images, and animation to jump-start your curriculum in no time!

Take advantage of the organizational tools computers provide.

Call ISTE to order and begin building your HyperCard or LinkWay skills today.

International Society for Technology in Education 1757 Agate Street, Lugene, OR 97403-1923 Order Desk: 500 336-5191 - Fax: 503/346-5590

HyperCard For Educators

An Introduction

Global Logo Comments

by Dennis Harper

Logo Exchange Continental Editors

Africa Fatimata Seye Sylia UNESCO/BREDA BP 3311 Dakar Senegal, West Africa Asia Marie Tada St. Mary's Int. Scho. 6-19 Seta 1-Chome Setagaya-Ku Tokyo 158, Japan Australia Anne McDougall Monash Univ. 6 Riverside Dr. East Kew 3120 Victoria, Australia Europe Harry Pinxteren Logo Centrum Nederland P.O. Box 1408 BK Nijmegen 6501 Netherlands Latin America Jose Valente UNICAMP 13082 Campinas Sao Paulo, Brazil

Preparing Teachers to Do Logo Research

An infusion of federal money in the past three years has enabled the schools of the United States Virgin Islands to receive much in the way of computer equipment and software. The University of the Virgin Islands has been offering graduate-level courses leading to a master's degree in computers and technology in education. More than 300 Caribbean teachers have enrolled in these courses over the past two years. In the summer of 1989, Glen Bull, Tom Lough, George Uhlig, Mary Ann Gillis, and Bulgaria's Iliana Nikolova came to the Virgin Islands to deliver an intensive three-week Logo workshop attended by 40 teachers.

This column will focus on steps taken to prepare teachers to do Logo research and will specifically discuss research conducted by three teachers in the Virgin Islands. One of these involved six low-achieving fifth graders, another involved a group of high school computer programming students, and the third involved a group of kindergartners.

Preparation for the Studies

A major criticism of Logo research is that the researchers have had little experience with Logo (or any other programming language), using computers with children in a classroom, or research methodology (Moursund, 1983/84; Leousis, 1985). The three researchers conducting the studies described below methodically prepared for their research by:

- taking an extensive three-week workshop
- taking five semester-long courses in computers and technology in education
- taking two courses on research methods and statistics
- conduciting an extensive search of the literature related to their study
- conducting classes using Logo

Each of these five preparatory events is discussed in more detail below.

Workshops

The researchers attended the three-week, intensive, residential workshop entitled Logo in Paradise. Instructors for this workshop included some of the Logo community's most recognized trainers, including Glen Bull (University of Virginia), Tom Lough (founder of Logo Exchange and presently U.S. educational director for Lego TC Logo), George Uhlig (Logo researcher, former ISTE board member, and dean of education at Southern Alabama University), Iliana Nikolova (one of Europe's top Logo researchers and authors), and myself. Each of the on-site instructors has written books and articles on Logo. In addition, 15 Logo-using educators from the U.S. mainland were present to lend their assistance and expertise to teachers in the Virgin Islands. These K-12 teachers have Logo experience in a variety of grades and subject areas.

The workshops and laboratories ran daily rom 9 in the morning until to 10 at night. Laboratories and instructors were available at all times. Michael Temple, then of LCSI, provided the *LogoWriter* software for both IBM and Apple II equipment. Tom Lough provided 10 Lego TC Logo kits. The students textbooks included *Logo Theory and Practice* (Harper, 1989) and *Introduction* to Programming Using LogoWriter (Yoder, 1989). These texts were supplemented by handouts from the instructors, Lego TC Logo documentation, and articles from *Logo Exchange*.

Logo philosophy was discussed throughout the workshop, and a teleconference dealing with this topic was conducted with Judi Harris, a Logo educator and researcher then with the University of Virginia.

Computers in Education Courses

Each researcher also attended all five courses offered by the University's Computers and Technology in Education program. These classes required 150 hours of in-class time and the completion of numerous projects in the schools of the Virgin Islands. Projects included conducting an inservice workshop for teachers, evaluating a school's computer education program, conducting a telecommunications project with a class of students in the Virgin Islands and with an overseas class, producing an educational video tape, developing a substantial *HyperCard* stack, producing a document using desktop publishing and collecting data on hardware available in Virgin Islands schools.

Research Courses

In addition to the above Computers in Education courses, each researcher completed two semesters of research methods and statistics. These are standard graduate-level courses that required each participant to conduct small research studies as part of the course curriculum.

Familiarity With the Literature

Each researcher did a substantial search of the literature related to his or her study. A free Dialog account was given to each researcher. In addition, the researchers contacted experts in the field, such as Douglas Clements, Tom Lough, Dave Moursund, and Glen Bull. My own extensive Logo library was also available to the researchers.

Teaching Experience

Each researcher taught a group of students Logo and LEGO/Logo before conducting his or her study. As part of the masters program at the University of the Virgin Islands, groups of youngsters were brought to the university on eight consecutive Saturdays for graduate students to teach Logo and LEGO/Logo. These sessions lasted for two hours each. Graduate students were matched with six to eight children whose ages matched those they would be teaching in the public schools.

The Studies

The five areas of preparation described above provide a reasonable background for a teacher to conduct research in the classroom use of Logo. The results of each of the three studies (a high school study, a middle school study, and a kindergarten study) will now be described and examined. Each of the following three sections will give a brief background of the students involved, the hypotheses being tested, research results, and any conclusions the researchers arrived at.

High School Study

This study was conducted by Lennox Douglas (Douglas, 1990). Mr. Douglas is an educator from the Caribbean country of St. Kitts/Nevis.

Douglas (1990) hypothesized that:

- 1. there would be no significant difference in the amount of computer knowledge acquired
- 2. there would be no difference in students' atti-

tudes toward either computers or learning of students taking Logo, Pascal, or BASIC programming in secondary school

Mr. Douglas wanted to investigate the effects of learning a particular computer programming language and how it affects:

- students' attitudes toward school
- students' attitudes toward computers
- the general computer knowledge of students in three different secondary-level computer literacy classes.

The sample consisted of 11th- and 12th-grade students from three separate required computer literacy classes (Computer I) in a secondary school in St. Thomas, U.S. Virgin Islands. The students were arbitrarily placed in each class by the principal. Each class was randomly assigned to one of the three conditions: Logo, Pascal, or BASIC programming. The Logo group consisted of 19 students, while the BASIC and Pascal groups consisted of 10 students each. Although the sample size was small and the use of descriptive statistics in Logo research is now rare, Douglas' extensive programming and teaching background along with the aforementioned preparation make his conclusions and recommendations meaningful to teachers using Logo.

Statistical analyses were done on scores from pretests, midtests, and posttests to determine any significant differences within and between groups. The results showed no significant differences between any of the groups. Hence, in these cases, it was concluded that exposure to the treatments (Logo, BASIC, or Pascal) did not have any significant effect on students' attitudes toward school with one group relative to the other. These results seem to verify the hypothesis that there is no significant difference in the three groups' attitudes towards either computers or learning.

On the other hand, results revealed some significant differences within the groups (from pre-, mid-, and posttest differences). There was a significant decrease in the Pascal students' excitement about the computer class from pretest to posttest. These attitudinal changes toward school could be attributed to the fact that students viewed Pascal as being much more difficult than Logo or BASIC (Teacher's Diary). The students in the Pascal class had greater fears than did Logo or BASIC students that the class would be difficult, and, hence, they felt less excited about taking programming.

On average, the BASIC students indicated having more problems writing programs in BASIC than did the students in Logo or Pascal. This is a possible reason why students in the BASIC class seemed to undergo greater stress in learning than did the students in the Logo or Pascal class. The Logo students had a significant increase in their belief that they had used the computer much more after the midtest. It was only the ratings given by students of the BASIC class that showed no significant differences in their beliefs that they used the computer very much after any of the two treatments. This is consistent with the fact that they viewed BASIC programming as difficult (Diaries), and seemed to be less motivated once the programming classes got under way.

After the programming treatment, the Pascal group was the only group that showed a significant increase in their belief that they could learn to use the computer quickly. The fact that they generally had the preconceived notion that Pascal was more difficult than Logo or BASIC and the fact that "they had learned to program in Pascal" suggest that they might have seen this accomplishment as being much greater than the other two groups perceived their learning to be. Hence, they believed they could learn to use the computer more quickly.

One of the main objectives of this study was to compare the general knowledge of students after each treatment. Results show that there were no significant differences between any of the groups on the pretest or midtest. This indicates that the groups were homogeneous and began the study with similar knowledge. On the other hand, the significance level between the two sets of scores for the BASIC posttest and the Pascal posttest indicate that there is a 96% chance that Hypothesis 1 is correct (there would be a significant difference between the knowledge levels of both classes after each class learned programming in two different programming languages). Hence, the null-hypothesis was rejected, and it was concluded that learning to program a computer with a particular programming language will affect students' computer learning in a way that might be different from learning to program using another programming language. In this particular case, these findings revealed that the Pascal students learned more than the students in the BASIC class, having undergone different treatments under similar conditions. Hence, it is likely that students in a Pascal class may learn more than students in a BASIC class who undergo similar treatments. The BASIC group is the only group that did not learn significantly more from the programming treatment. The study tends to suggest therefore, that discrepancies may be raised about using BASIC to teach programming in preference to Logo or Pascal.

These results had implications on which computer language was used in the schools of the Virgin Islands. Pascal and Logo are now being promoted in the territory. Of course, there are some apparent problems. Each language was designed for very specific and very different ends. For example, for a sorting operation, Pascal wins hands down. Attempt to "speed" program and BASIC wins. Try to introduce structure in programming (without writing to files) and Logo wins. With file writing, Pascal wins. Mr. Douglas concluded that the controversy concerning which programming language should be used to teach programming in the schools will continue until there is substantive evidence that students will learn more by using one language than by using another.

Middle School Study

This study was conducted by Canadian teacher/ researcher Nancy Silverman (Silverman, 1990). Her sample consisted of four sixth-grade students who were classified in the Virgin Islands as being underachievers; all the grades of each student were below Cin each course taken the previous semester. The four students met after school in the computer laboratory for 25 sessions lasting 45 to 60 minutes each.

The purpose of the study was twofold:

- 1. Could these underachieving middle school students learn to program using Logo?
- 2. Could an extracurricular course of this nature increase the students" feelings of empowerment by increasing their self-esteem, self-confidence, and social skills?

A Logo hierarchy (checklist), along with the students' daily diaries, was used to answer the first question. The teacher's diary, student diaries and questionnaires given to the students' subject-area teachers and their parents were used to make conclusions regarding the second question.

Two students were able to master all nine skills of the hierarchy. One student could not do skill 7, while one student could not do skills 4, 5, 6, and 7. Subjectarea teachers were pleased with the way all four students were achieving in class. All four students' conduct, attendance rate, and grades improved during the subsequent semester. The classroom teachers also noted that the students related better to both their peers and teachers. Ms. Silverman concluded that these positive results were due to the Logo classes, which provided a success experience that changed the way the students thought about themselves.

One problem noted by the researcher was that the children did not want to stop using the computer to fill out their diaries. She felt that if the diaries were done on-line, the students would be more enthusiastic about completing them.

Because of the positive results of this research, many teachers at Ms. Silverman's school have enrolled in the graduate-level Logo courses. A videotape taken during the study was produced, which showed "learning-disabled students" using Logo. This tape has been

39

distributed to 30 schools in the Virgin Islands, and Ms. Silverman has expanded the program to reach more students in her own school.

Kindergarten Study

This study was conducted by Lucinda Parsons, a kindergarten teacher on the island of St. John. This study involved four kindergarten students not in her class and unfamiliar with Logo. Ms. Parsons tested two hypotheses:

- 1. Logo can help provide a learning environment for kindergarten students that will encourage peer interaction and cooperative learning.
- A marked increase in attention span (time on ask) will take place over time as a result of using Logo.

To test these hypotheses, the researcher bought in a two pair of students for a one-hour period and videotaped the Logo learning session. Fifteen sessions were delivered to the four students. Analysis of the videotape provided data relevant to the two hypotheses.

A stop watch was used to collect data. The amount of time the children worked alone, talked to others, listened to teachers, and so forth was graphed over time to see if cooperative learning increased. The amount of time on-task for each student was plotted over time to see if this variable increased over time. In addition, observations that may be of interest to other primary school teachers was noted from the tapes. Ms. Parsons is well aware that some educators feel that the earliest a student should use Logo is the third grade, but having worked with kindergartners for two semesters, she is very much interested in whether positive benefits can occur.

Final results did indicate that both time on-task and peer interaction increased with these kindergarten students.

Conclusions

The three studies from the Virgin Islands summarized above took special care to prepare the researchers for their studies. Much of the criticism aimed at Logo research has been that the studies were conducted quickly by university graduate students. These three studies evolved over a three-year period and were completed by experienced classroom teachers.

The three studies involved both qualitative (observational) and quantitative data. Only one of the studies made conclusions based on the central tendencies of learning outcomes because two of the studies involved only four subjects. There has been some question as to whether measures of central tendencies is possible in Logo or any new educational philosophy (Huber, 1985; Papert, 1985). Based on the results of the Douglas study, something can be said for quantitative studies because the statistics gathered accounted for the fact that it is impossible to keep everything the same except Logo and that a teacher cannot expect to see the same changes in all students as a result of being exposed to Logo.

There has been much recent concern in the Virgin Islands about low mathematics test scores. These three studies have pointed out to curriculum planners that Logo can be beneficial in developing higher-order thinking skills that are not necessarily going to show up on standardized tests. The school superintendent is now encouraging other teachers to develop the skills necessary to use Logo in their classrooms.

David Moursund (1983/84)asked, "Is it fair or possible that Logo be evaluated with ordinary teachers those with modest levels of training, experience, and interest in Logo?" The answer is probably "no," seeing that, for example, an art teacher or a reading teacher would have the interest and expertise when conducting his or her classes. That is why such special care was taken to provide the needed background and motivation to make these three studies as valid as possible.

References

- Douglas, Lennox. (1990). Comparison of Logo, BASIC, and Pascal programming languages in a igh school computer literacy course. Unpublished master's thesis. University of the Virgin Islands.
- Harper, Dennis. (1989). Logo theory and practice. Monterey, CA: Brook/Cole Publishing.
- Huber, Leonard N. (1985, October). Computer learning through Piaget's eyes. Classroom Computer Learning.
- Leousis, Elias. (1985, February). Black sheep and Logo. Computers in Education.
- Moursund, David. (1983/84, December/January). Logo frightens me. The Computing Teacher.
- Papert, Seymour. (1985, July). Computer criticism vs. technocentric thinking. Logo 85 Theoretical Papers.
- Silverman, Nancy. (1990). Logo and underachievers. Unpublished master's thesis. University of the Virgin Islands.
- Yoder, Sharon. (1989). Introduction to programming using LogoWriter. Eugene, OR: International Society for Technology in Education.

SIGLogo Members and List of Subscribers

EDWIN J. MARTINEZ P. O. BOX 820 CAMUY, PR 00627-0820

JULIA E. RODRIGUEZ LOS ROBLES #1007-A RIO PIEDRAS, PR 00927

JOHN C. KENNEDY ACSS BULDING 19 FORT BUCHANAN, PR 00934

DE BAYAMON (ACR-UPR) COLEGIO UNIV TECNOLOGICO CRA SECCION DE REVISTAS BAYAMON, PR 00959

THEODORE M. NORTON 3 PINE TREE CIRCLE PELHAM, MA 01002

PROF. HOWARD PEELLE UNIVERSITY OF MASSACHUSETTS 10 FURCOLO HALL / SCHOOL OF ED. AMHERST, MA 01003

MATTHEW GOLDFIELD 72 LAUREL PARK NORTHAMPTON, MA 01060

ALAN RUDNITSKY/EDUCATION SMITH COLLEGE 37 PROSPECT ST/MORGAN HALL NORTHAMPTON, MA 01063

WILLIAM MAGUIRE GROTON SCHOOL BOX 991 GROTON, MA 01450

MR. WALSH / CAPALBO NORTHBORO MIDDLE SCHOOL 145 LINCOLN STREET NORTHBORO, MA 01532

FRAMINGHAM STATE COLLEGE HENRY WHITTEMORE LIBRARY FRAMINGHAM, MA 01701

JANE D. TCHAICHA BUNSAI GAKUEN SCHOOL 17-19 CAMBRIDGE TURNPIKE LINCOLN, MA 01773

ALBERT CUOCO WOBURN HIGH SCHOOL 88 MONTVALE AVE. / MATH. DEPT. WOBURN, MA 01801

STEPHEN PURINGTON PHILLIPS ACADEMY ANDOVER, MA 01810

VINCENT W. CARISTO 4 SENECA CIRCLE ANDOVER, MA 01810

JOHN J DIGNEY NORTH ANDOVER MIDDLE SCHOOL 14 KIMBALL RD METHUEN, MA 01844

MEDIA CENTER MARSH ELEMENTARY SCHOOL 311 PELHAM STREET METHUEN, MA 01844

Volume 11 Number 4

SANDRA QUIGLEY ST. ANN'S HOME, INC. 100A HAVERHILL STREET METHUEN, MA 01844

ROBERT HARDY DANVERS HIGH SCHOOL 60 CABOT ROAD DANVERS, MA 01923

DONNA ROSENBERG 3 SELMAN STREET MARBLEHEAD, MA 01945

PAT LOCKHART CARYL SCHOOL 4 SPRINGDALE AVENUE DOVER, MA 02030

MARIE NORTON MEDFIELD MIDDLE SCHDOL / COMPUTER 88R SOUTH STREET MEDFIELD, MA 02052

ALMA E. WRIGHT 44 WAUMBECK STREET DORCHESTER, MA 02121

LARRY DAVIDSON LEARNING STRATEGIES 955 MASS AVE STE 182 CAMBRIDGE, MA 02124

FREDERICK R EICHORN 20 SEDALIA RD DORCHESTER, MA 02124

VIRGININA C. GRAMMER 62 SULLIVAN STREET CHARLESTOWN, MA 02129

ELWOOD W. STREETER 4 PARLEY VALE JAMAICA PLAIN, MA 02130

ANNE CENTOLA CRIMMINS 82 SANBORN AVENUE WEST ROXBURY, MA 02132

SEYMOUR PAPERT 20 AMES STREET CAMBRIDGE, MA 02138

ANDRE ROSSI HARVARD ASSOCIATES, INC. 10 HOLWORTHY STREET CAMBRIDGE, MA 02138

NOLA SHEFFER 8 GARDEN COURT CAMBRIDGE, MA 02138

LIBRARY LESLEY COLLEGE 30 MELLEN STREET CAMBRIDGE, MA 02138-2703

NOVA CENTER FOR EDUCATION 955 MASSACHUSETTS AVE #133 CAMBRIDGE, MA 02139-3180

RICH ABRAMS TOM SNYDER PRODUCTIONS 90 SHERMAN ST CAMBRIDGE, MA 02140 CAMBRIDGE FRIENDS SCHOOL 5 CADBURY RD CAMBRIDGE, MA 02140-3598

SETH WEISS 80 LOWDEN AVENUE SOMERVILLE, MA 02144

SUSAN WEISS 117 STEDMAN STREET BROOKLINE, MA 02146

COMPUTERS / TUCKER PARK SCHOOL 171 GODDARD AVE BROOKLINE, MA 02146-7497

IRENE HALL 15 WINTER STREET, #2 MEDFORD, MA 02155

DAN & MOLLY WATT EDUCATION DEVELOPMENT CENTER 55 CHAPEL STREET NEWTON, MA 02160

MARGARET J. KENNEY BOSTON COLLEGE DEVLIN HALL 112/MATH INSTITUTE CHESTNUT HILL, MA 02167

ROLAND OCHSENBEIN D C HEALTH & COMPANY 95 HAYDEN AVE LEXINGTON, MA 02173-7967

ROSEMARY B FUSS 44 LONGFELLOW RD WELLESLEY, MA 02181

MARIE ABBATINOZZI FONTBONNE ACADEMY 930 BROOK ROAD MILTON, MA 02186

EDWARD SIEGFRIED, DIRECTOR MILTON ACADEMY / ACAD. COMPUTING 170 CENTRE STREET MILTON, MA 02186

DENNIS MCCOWAN /COMP.COORD. WESTON HIGH SCHOOL 444 WELLESLEY STREET WESTON, MA 02193

WILLIAM M. JOHNSON 29 LIANE WAY PEMBROKE, MA 02359

DEBORAH BARROWS HYANNIS EAST ELEMENTARY SCHOOL BEARSE'S WAY HYANNIS, MA 02601

MARIE GOULD 304 BEACH PLUM LN BREWSTER, MA 02631

BARBARA RINGGOLD 272 MAGNET WAY BREWSTER, MA 02631 MARJORIE A. MELLO 488 PRESCOTT STREET NEW BEDFORD, MA 02745

JOSEPH M. MARTIN TAUNTON HIGH SCHOOL 50 WILLIAMS STREET TAUNTON, MA 02780

MCCABE/COMPUTER WESTPORT HIGH SCHOOL 19 MAIN RD WESTPORT, MA 02790

MARY KEABLE, COMP. COORD. PONAGANSET HIGH SCHOOL 137 ANAN WADE RD GLOCESTER, RI 02857

DENIS M. COFFEY 86 ETHEL DRIVE PORTSMOUTH, RI 02871

PEACE DALE SCHOOL 109 KERSEY ROAD PEACE DALE, RI 02883-2493

DAVID NIGUIDULA COALITION OF ESSENTIAL SCHOOLS ONE DAVOL SQUARE PROVIDENCE, RI 02903

DR. JAMES T. SEDLOCK RHODE ISLAND COLL/MATH-COMP.SCI. 600 MT PLEASANT AVE PROVIDENCE. BI 02908

HELEN MCARDLE LONDONDERRY JR HIGH SCHOOL 313 MAMMOTH RD LONDONDERRY, NH 03053-3037

LINDA A. SLUSARZ 28 GREATSTONE DR MERRIMACK, NH 03054

JOHN MOSTO 41 TWINBROOK AVE SALEM, NH 03079

GAIL T. BENSON 231 DOLLY RD CONTOOCOOK, NH 03229

ROSAMOND S. METCALF R.R. 1, BOX 530 CHARLESTOWN, NH 03603

DEBORAH L. SISSON 31 BELLE LN LEE, NH 03824

PAULA RENDA 4 ACORN DRIVE KINGSTON, NH 03848

VERONICA B. EMERY YORK MIDDLE SCHOOL 86 ORGANUG ROAD YORK, ME 03909

LINDA DAVIS TELSTAR MIDDLE SCHOOL RFD. #1, BOX 1220 BETHEL, ME 04217

LOGOEXCHANGE

JUDY CHANDLER GARLAND STREET MIDDLE SCHOOL 304 GARLAND ST COMPUTER DEPT BANGOR, ME 04401-5543

MANTOR LIBRARY UNIVERSITY OF MAINE/ FARMINGTON 41 HIGH ST FARMINGTON, ME 04939-1947

ATTN: NICKERSON WINDSOR HIGH SCHOOL 29 UNION STREET WINDSOR, VT 05089

JUDY WILSON RR 1, BOX 513 WINDSOR, VT 05089

FISHER ELEMENTARY SCHOOL E ARLINGTON RD ARLINGTON, VT 05250

ALICE L. CARRIER 83 OAK GROVE AVENUE BRATTLEBORO, VT 05301

KAREN SHILGALIS 17 PHEASANT WAY SOUTH BURLINGTON, VT 05403

PAUL GARRETT ROUTE 1, BOX 513 RICHMOND, VT 05477

ORLEANS ELEMENTARY SCHOOL SCHOOL STREET ORLEANS, VT 05860

JAMES STUCENSKI GRANBY BOARD OF EDUCATION 11 NORTH GRANBY ROAD GRANBY, CT 06035

SERIALS DEPT CENTRAL CONN ST UNIVERSITY ELIHU BURRIT LIBRARY NEW BRITAIN, CT 06050

JOHN LASKARZEWSKI PLAINVILLE JUNIOR HIGH SCHOOL 74 EAST STREET PLAINVILLE, CT 06062

CATHY HELGOE LEGO DACTA 555 TAYLOR RD ENFIELD, CT 06083-1600

WARREN LOGEE ELLSWORTH SCHOOL 730 KENNEDY ROAD WINDSOR, CT 06095

GEORGE HADDAD BETANCES SCHOOL/COMP. EDUC. 42 CHARTER OAK AVENUE HARTFORD, CT 06106

A KRAWCZYK LANGFORD SCHOOL 61 ALPS DRIVE EAST HARTFORD, CT 06108-1402

DONNA D. BROWN 39 DUDLEY ROAD WETHERSFIELD, CT 06109

CAROL A MCCUE 245 CREST ST WETHERSFIELD, CT 06109-1418

ARLENE RUDDY UNIVERSITY OF HARTFORD HILLYER HALL 200 WEST HARTFORD, CT 06117 DR. JUNE L. WRIGHT EASTERN CONN. STATE UNIVERSITY 83 WINDHAM ST / COLLEGE OF ED. WILLIMANTIC, CT 06226-2295

LIBRARY LEBANON ELEMENTARY SCHOOL 479 EXETER RD LEBANON, CT 06249-1505

PAMELA SKELLY 614 NORTH WINDHAM ROAD EXT. NORTH WINDHAM, CT 06256

BONNIE HANNA 72 OLD COLCHESTER ROAD QUAKER HILL, CT 06375

SHEILA GOLDMAN PINE POINT SCHOOL BARNES ROAD / P.O. BOX 392 STONINGTON, CT 06378

MARY A. ESBORN 33 OLD SMUGGLERS ROAD BRANFORD, CT 06405

LEO F. KUCZYNSKI 20 GATEWAY COURT CHESHIRE, CT 06410

MR. NEIL A. KAYES HADDAM-KILLINGWORTH HIGH SCHOOL LITTLE CITY ROAD HIGGANUM, CT 06441

MARIAN W. SPIRO 393 TEMPLE STREET NEW HAVEN, CT 06511

ALAN J. CAPASSO TRUMBULL PUBLIC SCHOOLS 6254 MAIN STREET TRUMBULL, CT 06611

PETER KASHATUS BRUNSWICK SCHOOL 100 MAHER AVENUE GREENWICH, CT 06830

WILLIAM PUTERBAUGH BEDFORD MIDDLE SCHOOL 170 RIVERSIDE AVENUE WESTPORT, CT 06880

TOM GREEN 19 OLD MILL ROAD WESTPORT, CT 06880

DR. EDWARD A. FRIEDMAN STEVENS INSTITUTE OF TECHNOLOGY DEPARTMENT OF MANAGEMENT HOBOKEN, NJ 07030

DR DANIEL M SWIRSKY, SUPERVISOR LIVINGSTON HIGH SCHOOL ROBERT HARP DRIVE LIVINGSTON, NJ 07039

JOHN ZURCHER MONTCLAIR KIMBERLEY ACADEMY 201 VALLEY RD MONTCLAIR, NJ 07042

JOAN FENWICK AT&T LEARNING NETWORK 400 INTERPLACE PKWY RM B4C61 PARSIPPANY, NJ 07054

LIBRARY LESTER C. NOECKER SCHOOL PASSAIC AVENUE ROSELAND, NJ 07068 BOB FLAST 660 FAIRMONT AVE WESTFIELD, NJ 07090

ALP 15/LORRAINE MULLEN EDISON INTERMEDIATE SCHOOL 800 RAHWAY AVE WESTFIELD, NJ 07090

ATTN: S SALAGAJ NEWARK BD OF ED/COMP ED & TECH 2 CEDAR ST NEWARK, NJ 07102

JEANETTE PARHAM 57 ELMWOOD TERRACE IRVINGTON, NJ 07111

SHEILA ELMAN PESHINE AVENUE SCHOOL 433 PESHINE AVENUE NEWARK, NJ 07112

GERTRUDE LAPARE 333 WASHINGTON AVENUE ELIZABETH, NJ 07202

TONI S. CHOMSKY 209 CLARK STREET HILLSIDE, NJ 07205

ORLANDO O. MIHICH 339 PACIFIC AVENUE JERSEY CITY, NJ 07304

NANCY SULLA / ADMIN. OFFIC MAHWAH TOWNSHIP BOARD OF EDUC. RIDGE ROAD / BUILDING 8 MAHWAH, NJ 07430

BRUCE COOKE INDIAN HILLS HIGH SCHOOL 97 YAWPO AVENUE OAKLAND, NJ 07436

WALTER RYAN OAKLAND BOARD OF EDUCATION 315 RAMAPO VALLEY ROAD OAKLAND, NJ 07436-1896

MARJORIE WHITMAN 268 MANOR ROAD RIDGEWOOD, NJ 07450

LIBRARY WANDELL SCHOOL 97 EAST ALLENDALE ROAD SADDLE RIVER, NJ 07458-3023

GARY STAGER NAME-FALLON ED CENTER 51 CLIFFORD DR WAYNE, NJ 07470-3599

BETTY PRICE ABRAHAM LINCOLN SCHOOL 325 MASON AVENUE WYCKOFF, NJ 07481

SUSAN SMOLIN THE ELISABETH MORROW SCHOOL 435 LYDECKER STREET ENGLEWOOD, NJ 07631

HAROLD M ZULLOW 321 SUNSET AVE STE GR-4 ASBURY PARK, NJ 07712

JANDY BIRD CONOVER ROAD SCHOOL 80 CONOVER RD COLTS NECK, NJ 07722-1250

AUDREY PLANER NETCONG PUBLIC SCHOOLS 26 COLLEGE RD NETCONG, NJ 07857 CAROL KENNEDY KENT PLACE SCHOOL 42 NORWOOD AVENUE SUMMIT, NJ 07901

MRS ELLEN LEVY BEDMINSTER SCHOOL 350 MAIN ST BEDMINSTER, NJ 07921-2602

SALLYANN L. BERENDSÉN 152 ROCKWOOD ROAD FLORHAM PARK, NJ 07932

SAVIO VAZ, INSTR. TECH. SILVER BURDETT & GINN 250 JAMES ST MORRISTOWN, NJ 07960

STEVE RYNER RYNER SYSTEMS 37 LORD STIRLING MORRISTOWN, NJ 07960

LIBRARY THE PECK SCHOOL 247 SOUTH ST MORRISTOWN, NJ 07960-6018

ROD A. GRECO GLOUCESTER TWP. PUBLIC SCHOOLS 17 ERIAL ROAD, BOX 440-G BLACKWOOD, NJ 08012

JENNIFER FREDERICKSON KRESSON SCHOOL SCHOOL LANE VOORHEES, NJ 08043

LUCIA M.S. MITCHELL 212 SHADY LANE MARLTON, NJ 08053

LENORA M. DEBERNARDO 3 YARDLEY CT MT LAUREL, NJ 08054

BEVERLY R. DARKATSH 215 HEATHER DRIVE MOUNT LAUREL, NJ 08054

DAVID CORRIGAN P.O. BOX 914 SALEM, NJ 08079

BOBBI MARCIANO, ELEM. SUPV WASHINGTON TOWNSHIP PUBLIC SCHS. R.R. 3, BOX 137-A SEWELL, NJ 08080

JUNE RAMONDETTA CHESTNUT RIDGE MIDDLE SCHOOL 641 CROSS KEYS-HURFFVILLE RD SEWELL, NJ 08080

LYNNE LEVY 546 MORGAN AVE WOODBURY, NJ 08096

PEGGY ECKBOLD JORDAN ROAD SCHOOL SOMERS POINT, NJ 08244

MARYJAYE FRANKEL-SYPNIEWSKI RR1 BOX 2 WOODBINE, NJ 08270-9536

STEPHEN SLAVOFF P.O. BOX 317 ELMER, NJ 08318-0317

JAKARTA - PEL SCHOOL/JKT 8 PO BOX 5910 PRINCETON, NJ 08543-5910 ELENE VAN NOY 74 RIVER DR TITUSVILLE, NJ 08560

JANE A. McLAUGHLIN TRENTON STATE COLLEGE MATH DEPARTMENT TRENTON, NJ 08650-4700

RALPH L. PORTER P.O. BOX 1868 POINT PLEASANT, NJ 08742

PETER CHRIST 1269 OXFORD RD BRIDGEWATER, NJ 08807

REGIONAL CURRICULUM SRVS. UNI EDUCATIONAL TECH, TRAINING CENTER 200 OLD MATAWAN ROAD OLD BRIDGE, NJ 08857

PATRIA LEROY RUTGERS PREPARATORY SCHOOL 1345 EASTON AVENUE SOMERSET, NJ 08873

SHIRLEY A. GRANT NO UNIT, PSC 3 BOX 2091 APO AE, NY 09021

RHONDA CRAWFORD DODDS FRANKFURT MIDDLE SCHOOL UNIT 21305, BOX 25 APO AE, 09039

CAROL M. WEISKER AUGSBURG ELEMENTARY SCHOOL UNIT #25002 APO AE, 09178-0005

TIM CARTLEDGE INTERNATIONAL SCHOOL OF HAMBURG C/O AMERICAN CONSULATE APO NEW YORK, NY 09215

LIBRARY INTERN'AL SCH OF DUSSELDORF EV UNIT 22314 APO AE, 09234

AMERICAN EMBASSY (A.I.S.) P.O. L92-517 APO NEW YORK, NY 09672

ATTN: JUNIOR HIGH LIBRARY SAIS-R UNIT 61320 APO AE, 09803-1320

DEBORAH CLINTON/LIB-MEDIA CT CAIRO AMERICAN COLLEGE UNIT 64900, BOX 21 APO AE, 09839-4900

DHAHRAN ACADEMY UNIT 66804 APO AE, 09858-6804

MARK STEINBERGER 521 EAST 14TH STREET NEW YORK, NY 10009

STEVE NEIMAN 16 W. 16TH STREET, APT. 1BN NEW YORK, NY 10011

VICKI KIPNIS VILLAGE COMMUNITY SCHOOL 272 WEST 10TH STREET NEW YORK, NY 10014 ANDY SPURGEON THE TOWN SCHOOL 540 E. 76TH STREET NEW YORK, NY 10021

LAURA ALLEN THE BUCKLEY SCHOOL 113 EAST 73RD STREET NEW YORK, NY 10021

BILING ED CT/I. NOTOWIDIGDO HUNTER COLLEGE OF CUNY 695 PARK AVENUE, ROOM W924 NEW YORK, NY 10021

MICHAEL TEMPEL 250 WEST 85TH STREET NEW YORK, NY 10024

FRIEDA OFFEN PS 145 MAN 150 WEST 105TH STREET NEW YORK, NY 10025

THOMAS F. TROCCO ST. HILDA'S & ST. HUGH'S SCHOOL 619 WEST 114TH STREET NEW YORK, NY 10025

SERIALS DEPT TEACHERS COLLEGE LIBRARY BOX 307 - 525 W 120TH ST NEW YORK, NY 10027

RALPH SODEN 1623 - 3RD AVENUE, APT. #33A NEW YORK, NY 10028

JUDITH MENKEN 91 PAYSON AVENUE NEW YORK, NY 10034

GEORGE ORIO CONVENT OF THE SACRED HEART 1 EAST 91ST STREET NEW YORK, NY 10128

LOUIS F. FARESE, JR 385 NORTH BURGHER AVE STATEN ISLAND, NY 10310

PHIL FIRSENBAUM 3915 ORLOFF AVENUE BRONX, NY 10463

JANET Y. ANDRES 100 - 23 DeKRUIF PLACE BRONX, NY 10475

DR. ROBERT POSTMAN LONG ISLAND UNIVERSITY 555 BROADWAY DOBBS FERRY, NY 10522

ALAN E. ALTERMAN 53 BYRAN LAKE ROAD MT. KISCO, NY 10549

JERRY CAMPBELL PUTNAM VALLEY ELEM SCHOOL 171 OSCAWANA LAKE RD PUTNAM VALLEY, NY 10579

DONALD M. SHAPIRO NEW YORK MEDICAL COLLEGE MUNGEN 502 VALHALLA, NY 10595

KRIS RONNINGEN-FENRICH PRODIGY SERVICES CO. 445 HAMILTON AVENUE WHITE PLAINS, NY 10601

IHOR CHARISCHAK 10 BOGERT AVENUE WHITE PLAINS, NY 10606 ROCHELLE ZEITLIN 378 WASHINGTON AVENUE PELHAM, NY 10803

STEVE KOHN 126 CHURCH STREET (3-D) NEW ROCHELLE, NY 10805

OLGA C. BOUTENEFF 92 BREWERY NEW CITY, NY 10956

MATT WILKINSON 283 W CLARKSTOWN ROAD NEW CITY, NY 10956-7224

JOHN BARRIE/LIBRARY LONG ISLAND UNIV/ROCKLAND CAMPUS RTE 340 ORANGEBURG, NY 10962

ATTN: COMPUTERS SOUTH MIDDLE SCHOOL 349 LAKEVILLE ROAD GREAT NECK, NY 11020

JUDY STIPP, LIBRARIAN MUNSEY PARK SCHOOL HUNT LANE MANHASSET, NY 11030

EMILY BYRUM 52 CLARK ST #4-0 BROOKLYN, NY 11201

MIKE ROAM & BOB WALLACE SAINT ANN'S SCHOOL 129 PIERREPONT STREET BROOKLYN, NY 11201

FADHILIKA ATIBA-WEZA P.O. BOX 3148 BROOKLYN, NY 11202

KATHLEEN PARASCANDOLO 290 DAHLGREEN PLACE BROOKLYN, NY 11228

JUDITH TOROP 1636 EAST 56TH STREET BROOKLYN, NY 11234

ANNETTE ALAGGIA 147-17 17TH AVE WHITESTONE, NY 11357

DR. JOHN MARTIN PUBLIC SCHOOL 32-QUEENS 171-11 35TH AVE FLUSHING, NY 11358-1819

ANNA GOURDJI 72-18 LOUBET STREET FOREST HILLS, NY 11375

DR. ARI-ZEV ANOLIC MINEOLA U.F.S.D. / MIDDLE SCHOOL 200 EMORY ROAD MINEOLA, NY 11501

JOSEPH MALKEVITCH 86 GARDEN STREET GARDEN CITY, NY 11530

LESLIE M. RODIN LINDELL SCHOOL LINDELL BLVD. / ROOM 239 LONG BEACH, NY 11561

JUDY BERNSTEIN 39 BIRCH STREET LYNBROOK, NY 11563

SHARI CAMHI ADMIN.OFFICES - BROOKSIDE SCHOOL 1260 MEADOWBROOK RD NORTH MERRICK, NY 11566 SYDNEY FREIFELDER MERRICK UFSD / ADMIN. OFFICES 21 BABYLON ROAD MERRICK, NY 11566

CARMINE FERRARO OCEANSIDE HIGH SCHOOL 3160 SKILLMAN AVE OCEANSIDE, NY 11572

JOEL RINDLER, ASST. SUPT. ROSLYN PUBLIC SCHOOLS P.O. BOX 367 ROSLYN, NY 11576

JUDITH ZORNBERG NASSAU BOCES / INSTR. RESC. CTR. 1196 PROSPECT AVE WESTBURY, NY 11590

ADMIN. BLDG. CALLER SERVICE #1035 WESTBURY PUBLIC SCHOOLS HITCHCOCK LANE & JERICHO TPKE. WESTBURY, NY 11590

MARQUERITE COSTELLO NASSAU BOCES - DIV OF SP. ED. VALENTINES & THE PLAIN ROAD WESTBURY, NY 11590

LYNN PATTEN 94 BELLECREST AVE EAST NORTHPORT, NY 11731-1206

MICHAEL POMARA SACHEM SCHOOL DISTRICT 245 UNION AVENUE HOLBROOK, NY 11741

FRAN ROTHKIN 255 LINDEN STREET MASSAPEQUA PARK, NY 11762

THOMAS D. WHITBY 35 SALISBURY RUN MT. SINAI, NY 11766

JAMES / CARMON SACHEM HIGH SCHOOL NORTH 212 SMITH RD LAKE RONKONKOMA, NY 11779-2229

SOUTH CAMPUS LIBRARY SACHEM HIGH SCHOOL 51 SCHOOL ST LAKE RONKONKOMA, NY 11779-2231

WILLIAM M. STENZLER 8 PROSPECT PLACE PLAINVIEW, NY 11803

ROBERTA KEIS / COMPUTERS QUOGUE U.F.S.D. EDGEWOOD ROAD / BOX 957 QUOGUE, NY 11959

MARCIE S. ANGEL 76 S PHILLIPS AVE REMSENBURG, NY 11960

J FRIEDLAND MIDDLEBURGH ELEMENTARY SCHOOL UPPER MAIN ST MIDDLEBURGH, NY 12122

PATRICIA B. COON R.R. 1, BOX 257A STEPHENTOWN, NY 12168

R. EVANS WATERFORD-HALFMOON SCHOOL 125 MIDDLETOWN ROAD WATERFORD, NY 12188-1516



KAREN SWAN SUNY / ALBANY ED 347 ALBANY, NY 12222

DAVID J. CARTMELL 4 ROSE LANE SAUGERTIES, NY 12477

GLORIA DUFFRIN CORNWALL ELEMENTARY SCHOOL LEE ROAD CORNWALL, NY 12518

STEPHEN HEGYI MARLBORO SCHOOL DISTRICT MARLBORO, NY 12542

PATRICIA MAJORS ULSTER COUNTY BOCES 175 ROUTE, 32 NORTH NEW PALTZ, NY 12561

PAM HALE 4 ROBIN COURT NEW PALTZ, NY 12561

CYNTHIA MAGY 9 OLD NOXON RD POUGHKEEPSIE, NY 12603

RICHARD TOPPER 140 SPRING GLEN ROAD MOUNTAINDALE, NY 12763

JOSEPH PROSCIA ADMIN. OFFICES / CENTRAL SUPPLY THORNTON AVENUE AUBURN, NY 13021

GIFTED PROGRAW DRAKE BLODGETT SCHOOL 312 OSWEGO STREET SYRACUSE, NY 13204

DEBORAH Y. BAUDER SUNY INSTITUTE OF TECH. AT UTICA P.O. BOX 3050 UTICA, NY 13504-3050

C MOSES WEST CARTHAGE ELEMENTARY SCHOOL 27 N JEFFERSON ST CARTHAGE, NY 13619-1131

CHARLES MLYNARCZYK BOX 309, CONEY ISLAND ROAD HANNAWA FALLS, NY 13647

JUNE LEE 411 S. JACKSON STREET BATAVIA, NY 14020

LYN RIVERS 203 SHERBURN DRIVE HAMBURG, NY 14075

LIBRARY MEDIA CENTER BOSTON VALLEY ELEMENTARY SCHOOL 7476 BACK CREEK ROAD HAMBURG, NY 14075-7202

DIANE M MANUEL 3876 LYNN DR ORCHARD PARK, NY 14127-2104

DR. CRAYTON BUCK BUFFALO STATE COLL/LEARNING LAB 1300 ELMWOOD AVENUE / LA 100 BUFFALO, NY 14222 RICHARD DEGLOPPER KENMORE-TOWN OF TONAWANDA UFSD 540 PARKHURST BLVD. KENMORE, NY 14223

NORMAN SCHOELL 280 OEHMAN BLVD. BUFFALO, NY 14225

DOUGLAS H. CLEMENTS UNIVERSITY OF BUFFALO 572 BALDY/LEARNING & INSTRUCTION BUFFALO, NY 14260

THERON ROCKHILL SUNY - BROCKPORT MATH DEPT. BROCKPORT, NY 14420

DAVID S BROWN SHERMAN CENTRAL SCHOOL P.O. BOX 950 SHERMAN, NY 14781

BRUCE PEFFLEY 10 SOUTH MAPLE STREET CORNING, NY 14830

FELICIA KESSEL CORNING INC MP-RO-03-2 CORNING, NY 14831

DONALD J. SLATER SEWICKLEY ACADEMY 315 ACADEMY AVENUE SEWICKLEY, PA 15001

JOHN A MIHALOEW OUR LADY OF THE SACRED HEART H S 1504 WOODCREST AVE CORAOPOLIS, PA 15108

BOARD OF PUBLIC EDUCATION PROFESSIONAL LIB/635 RIGE AVE. PITTSBURGH, PA 15212

PROF. LIBRARY BOARD OF PUBLIC ED. 635 RIDGE AVENUE PITTSBURGH, PA 15212-6001

JUDITH W. WEINBERG/ ROOM 281 PITTSBURGH PUBLIC SCHOOLS 590 CRANE AVE/COMPS. IN ED. DIV. PITTSBURGH, PA 15216

DOUGLAS W. BOLIN 505 ALLENBY AVE PITTSBURGH, PA 15218

SR. MARY JOHN DE PAUL INSTITUTE CASTLEGATE AVENUE PITTSBURGH, PA 15226

LOUIS NAGY SENECA VALLEY JR HIGH SCHOOL 122 SENECA SCHOOL RD HARMONY, PA 16037-9198

ROBERT LAMBERT / ADMIN. OFFICES HUNTINGDON AREA SCHOOL DISTRICT 2400 CASSADY AVE STE 2 HUNTINGDON, PA 16652

DWIGHT MOSTOLLER STATE COLLEGE AREA SCHOOL DIST. 131 WEST NITTANY AVE/ COMP.TECH. STATE COLLEGE, PA 16801 KATHY BOYLE 135 WEST LOUTHER STREET CARLISLE, PA 17013

VELMA YODER MESSIAH COLLEGE GRANTHAM, PA 17027

MESSIAH COLLEGE LIBRARY GRANTHAM, PA 17027

ATTN: FREDERICK STROUP HERSHEY MIDDLE SCHOOL 231 EAST GRANADA AVENUE HERSHEY, PA 17033

J. ARTHUR VAUGHAN 620 HAMMOND ROAD YORK, PA 17402-1321

WILLIAM GROVE HEMPFIELD HIGH SCHOOL 200 STANLEY AVE LANDISVILLE, PA 17538-1299

MR. T. KAUFFMAN LITITZ ELEMENTARY SCHOOL 20 SOUTH CEDAR STREET LITITZ, PA 17543

LITITZ ELEM SCHOOL 20 S CEDAR ST LITITZ, PA 17543-1998

TRUDY SHANNON BECK ELEMENTARY SCHOOL 600 ARCH STREET SUNBURY, PA 17801

DR. JUNE L. TRUDNAK 7010 SCENIC DRIVE BLOOMSBURG, PA 17815

CRAIG ROBERTS 37 EAST HIGH STREET BANGOR, PA 19013

KAY S. GIRARDOT 1138 SIOUX STREET BETHLEHEM, PA 18015

CHRISTINA CHARNITSKI 701 HAVEN LN CLARKS SUMMIT, PA 18411

RONALD PRYOR LOCKVILLE ROAD BOX 249 F, R.D. #1 PITTSTON, PA 18643

IMANTS GAILIS WYOMIHG SEMINARY MARKET & SPRAGUE STREETS KINGSTON, PA 18704

SHEILA GARBER 95 TOLL DRIVE SOUTHHAMPTON, PA 18966

SUSAN DAVIS SHADY GROVE ELEMENTARY SCHOOL 351 W SKIPPACK PIKE AMBLER, PA 19002-4798

SANDE BLUMENTHAL 376 WELSH ROAD HUNTINGDON VALLEY, PA 19006

DR. ROBERT SIEGFRIED ROSEMONT COLLEGE DIRECTOR, GRADUATE FACULTY ROSEMONT, PA 19010

BETTY KROUT 814 LINCOLN DRIVE BROOKHAVEN, PA 19015 MEL LEVIN 2322 EBURY CT. BENSALEM, PA 19020

PAULA J. ROTHMAN \$19 PINE TREE ROAD JENKINTOWN, PA 19046

JESSICA KAHN 1416 BRYANT LANE MEADOWBROOK, PA 19046

SUSAN S. COOK 150 MIDWAY AVENUE LANSDOWNE, PA 19050

JOANNE ROMANO DELAWARE CO INTERMEDIATE UNIT 6TH & OLIVE ST MEDIA, PA 19063

RUTH M LIST 147 PINE LN YARDLEY, PA 19067

SR KATHLEEN HELBIG ANCILLAE-ASSUMPTA ACADEMY 2025 CHURCH RD WYNCOTE, PA 19095

KENNETH DERSTINE 311 S. 13TH ST. #602 PHILADELPHIA, PA 19107

MICHELE EMERY 1326 HELLERMAN STREET PHILADELPHIA, PA 19111

ARNOLD INDICTOR 5004J NORTH CONVENT LANE PHILADELPHIA, PA 19114

DAVID BRANN 9540 WISTARIA STREET PHILADELPHIA, PA 19115

GARY HOFFMAN 114 BUCKLEY PL PHILADELPHIA, PA 19115-2705

INSTRUCTIONAL MATERIALS SERVICES MONTGOMERY CO. INTERMEDIATE UNIT MONTGOMERY AVE. & PAPERMILL

RD. ERDENHEIM, PA 19118

MARY CLYDE 5951 PALMETTO STREET PHILADELPHIA, PA 19120

LIBRARY T K FINLETTER SCHOOL FRONT & GODFREY AVENUE PHILADELPHIA, PA 19120

EILEEN SCHWARTZ 204 CLARION AVENUE MELROSE PARK, PA 19126

ARLENE KRAMER J.F. KENNEDY CENTER 734 SCHUYLKILL AVE RM 614 PHILADELPHIA, PA 19146

ROSALIE DELBORRELLO 829 N 65TH ST PHILADELPHIA, PA 19151

SUSAN G. CORNETT RD 1, 4 LANDENBERG MANOR LANDENBERG, PA 19350

SARA WARNER 118 W MEADOW DR WEST GROVE, PA 19390 SANDRA DOUNCE 709 SUNNYSIDE AVENUE AUDUBON, PA 19403

ALETA C. DUEY 735 ROY ROAD KING OF PRUSSIA, PA 19406

CHRISTINE ROTH HAMBURG AREA HIGH SCHOOL WINDSOR STREET HAMBURG, PA 19526-0401

CARLA J REPSHER 61 LUTZ RD KUTZTOWN, PA 19530

JANE F. KERN 400 HIGHLAND AVENUE KUTZTOWN, PA 19530

GREGORY M. WILLIAMS 145 FAIRVIEW DRIVE KUTZTOWN, PA 19530

DR LYNN G PHILUPS MUHLENBERG SCHOOL DISTRICT 801 BELLEVUE AVE LAURELDALE, PA 19605

PAT WILLIFORD 9 RANCH COURT NEWARK, DE 19711

SHIRLEY MULLIGAN ST. MARY MAGDALEN 9 SHARPLEY ROAD WILMINGTON, DE 19803

NANCY L. HAUCK 1304 E WILLOW RUN DRIVE WILMINGTON, DE 19805

TOWER HILL SCHOOL 2813 WEST 17TH STREET WILMINGTON, DE 19806

DENNIS WOOTTEN, TECH. COORD DOVER HIGH SCHOOL 625 WALKER RD DOVER. DE 19901

JOSEPH A. DEFELICE CAPITAL SCHOOL DISTRICT 945 FOREST ST DOVER, DE 19901

DENNIS BYBEE ISTE USA NATIONAL OFFICE P.O. BOX 52 STE 240 WASHINGTON, DC 20001-8000

ELAINE SHERMAN CAPITOL HILL DAY SCHOOL 210 SOUTH CAROLINA AVENUE, S.E. WASHINGTON, DC 20003

JOSEPH RENARD INSTRUCTIONAL TECHNOLOGY / ETS 415 12TH ST NW RM 221 WASHINGTON, DC 20004

JANE RAND JOSTENS LEARNING CORPORATION 576 BRUMMEL COURT, NW WASHINGTON, DC 20012

CENTER FOR INSTR. TECH.& TRNG. TAKOMA SCHOOL PINEY BRANCH RD. & DAHLIA ST.N.W WASHINGTON, DC 20012

JOAN HARDY NATIONAL CATHEDRAL SCHOOL MOUNT ST. ALBAN WASHINGTON, DC 20016 DR. B. LYNCH / ED. LEADERSHIP DEPT. GEORGE WASHINGTON UNIVERSITY 2201 G ST NW RM 501 WASHINGTON, DC 20052

MICHAEL MONCHILOV INTERNATIONAL SCHOOL OF BELGRADE DEPARTMENT OF STATE WASHINGTON, DC 20520-5070

LINCOLN INTERNATIONAL SCHOOL KAMPALA - DEPT OF STATE WASHINGTON, DC 20521-2190

OF ABU DHABI AMERICAN COMMUNITY SCHOOL DEPARTMENT OF STATE WASHINGTON, DC 20521-6010

NEW DELHI - AES (92-150) AMERICAN EMBASSY DEPT. OF STATE WASHINGTON, DC 20521-9000

NEW DELHI - AES 92-0175 AMERICAN EMBASSY DEPT OF STATE WASHINGTON, DC 20521-9000

GIFT SECTION/EXCH. & GIFT LIBRARY OF CONGRESS 10 FIRST STREET S.E. WASHINGTON, DC 20540

JERRY REGIER 4213 WOODBERRY ST UNIVERSITY PARK, MD 20782

LOWER SCHOOL LIBRARY HOLTON-ARMS SCHOOL 7303 RIVER ROAD BETHESDA, MD 20817-4697

LIBRARY C.E. SMITH JEWISH DAY SCHOOL 1901 EAST JEFFERSON STREET ROCKVILLE, MD 20852

DONNA WONNACOTT 10100 BEVERN LANE ROCKVILLE, MD 20854

ED SALNERS TUTOR/ALL 13804 BONSAL LANE SILVER SPRINGS, MD 20906-3048

DAVID F. WITHROW HARFORD DAY SCHOOL 715 MOORES MILL ROAD BEL AIR, MD 21014

JOSEPH J CHRISTY ST. PAUL'S MIDDLE SCHOOL BROOKLANDVILLE, MD 21022

NATALIE A. SAMLLWOOD ST. PAUL'S SCHOOL FOR GIRLS 11232 FALLS RD BROOKLANDVILLE, MD 21022

ANN MANGOLD MAJOR EDUCATIONAL RESOURCES 10153 YORK ROAD, #107 HUNT VALLEY, MD 21030

RICH WEISENHOFF HOWARD CO PUBLIC SCHOOL SYSTEM 10910 RTE 108 ELLICOTT CITY, MD 21043

JOHN KOLP / COMP. SRVS. U.S. NAVAL ACADEMY 290 BUCHANAN RD ANNAPOLIS, MD 21402-5045 MARCIA B. CUSHALL FROSTBURG STATE UNIVERISTY EDUCATIONAL PROFESSIONS FROSTBURG, MD 21532

WANDA BIRD LACEY INSTRUCTIONAL CENTER 3705 CREST DR ANNANDALE, VA 22003

WANDA BIRD LACEY INSTR. CENTER 3705 CREST DRIVE ANNANDALE, VA 22003-1701

SR ELIZABETH DALTON 4111 MEADOW HILL LN FAIRFAX, VA 22033-3113

JENNIE EHRENZELLER THOMAS JEFFERSON ELEMENTARY 601 S. OAK STREET FALLS CHURCH, VA 22046

GRACE GALLAGER STONEWALL MIDDLE SCHOOL 14951 LARGO VISTA DR HAYMARKET, VA 22069

CHRISTOPHER J. FLYNN 2601 CLAXTON DRIVE HERNDON, VA 22071

ANNE T. SAVAGE 2187 CABOTS POINT LN RESTON, VA 22091

SUSAN B FORSTER POTOMAC SCHOOL 1301 POTOMAC SCHOOL RD MCLEAN, VA 22101-2398

JOHN BORONKAY CITY OF MANASSAS SCHOOL BOARD 9000 TUDOR LANE MANASSAS, VA 22110

ROBERT A WRIGHT 130 S MADISON MIDDLEBURG, VA 22117-0065

CARLA SCHUTTLE 8462 RUSHING CREEK COURT SPRINGFIELD, VA 22153

LIBRARY VIENNA ELEMENTARY SCHOOL 128 CENTER STREET S. VIENNA, VA 22180

DEBORAH GWALTNEY 9948 MURNANE STREET VIENNA, VA 22181

DR. KAREN J. ROSEBAUM TIC COMPUTER CAMP INC. 4620 DITTMAR ROAD ARUNGTON, VA 22207

SHERYL ASEN ARLINGTON PUBLIC SCHOOLS 1426 N. QUINCY STREET ARLINGTON, VA 22207

LIBRARY BURGUNDY SCHOOL 3700 BURGUNDY ROAD ALEXANDRIA, VA 22303

C. ALAN HITE BOX 448 BOWLING GREEN, VA 22427

GARFIELD M. PARKER P.O. BOX 261 HEATHVILLE, VA 22473 ALDERMAN LIBRARY UNIVERSITY OF VIRGINIA SERIALS/PERIODICALS CHARLOTTESVILLE, VA 22903

CHRISTINE L. APPERT 2104 ARLINGTON BLVD. #12 CHARLOTTESVILLE, VA 22903

SUE LYDDAN ROUTE 1, BOX 279 A MANQUIN, VA 23106

WILLIAM HOGGARD WILLIAMSBURG-JAMES PUBLIC SCHS. P.O. BOX 179 WILLIAMSBURG, VA 23185

RICHARD SCHLEY DEPARTMENT OF EDUCATION 101 N 14TH ST/18TH FLOOR RICHMOND, VA 23219

KAREN HYDE MATHEMATICS & SCIENCE CENTER 2401 HARTMAN STREET RICHMOND, VA 23223

R. SCOTT GARDNER, JR. HENRICO COUNTY PUBLIC SCHOOLS 3820 NINE MILE RD RICHMOND, VA 23223

BILL CRAIG 4111 FOREST HILL AVENUE RICHMOND, VA 23225

JOHN VAN DE WALLE VIRGINIA COMMONWEALTH UNIV. 1015 W. MAIN, 3RD FL., EDUCATION RICHMOND, VA 23284-2020

WILLIAM SPANTON NORFOLK ACADEMY 1585 WESLEYAN DRIVE NORFOLK, VA 23502

ROOM 708 INSTRUCTIONAL TECH. NORFOLK PUBLIC SCHOOLS 800 EAST CITY HALL AVENUE NORFOLK, VA 23510

CAPT J SMITH LIBRARY CHRIS NEWPORT COLLEGE 50 SHOE LN NEWPORT NEWS, VA 23606-2949

DR. LORA FRIEDMAN 134 STAGE ROAD NEWPORT NEWS, VA 23606-6103

LINDA RAE TAG GREENSVILLE COUNTY SCHOOLS 105 RUFFIN STREET EMPORIA, VA 23847

SALLY LAUGHON 3008 MAYWOOD ROAD, S.W. ROANOKE, VA 24014

LISA GAULDIN CARLISLE SCHOOL P.O. BOX 5388 MARTINSVILLE, VA 24115

SUSAN ROLLINSON 849 LOU AVENUE CLIFTON FORGE, VA 24422

THOMAS A STEBBINS JR KANAWHA CO SCH/RESA III OFFICE 501-22ND ST DUNBAR, WV 25064-1711 DARIS G. ALBRIGHT 1010 VIRGINIA AVENUE MARTINSBURG, WV 25401

MARTHA D. SHEAFF FORSYTH COUNTRY DAY SCHOOL 5501 SHALLOWFORD ROAD LEWISVILLE, NC 27023

DR. LEAH McCOY WAKE FOREST UNIVERSITY BOX 7266 / DEPT. OF EDUC. WINSTON-SALEM, NC 27109

DR. J. KENT WILLIAMS UNIV.OF N.CAROLINA/ GREENSBORO SCHOOL OF MUSIC GREENSBORO, NC 27412-5001

MARY VIRGINIA FRY P. O. BOX 26 CARY, NC 27512

HOWARD DIAMOND CHIP PUBLICATIONS, INC. 107 BRASWELL ROAD CHAPEL HILL, NC 27516

CURRIC. OFFICE SHEILA CORY CHAPEL HILL-CARRBORO CITY SCHS. LINCOLN CENTER/MERRITT MILL RD.

CHAPEL HILL, NC 27516

DONNA STEWART 1008 S 11TH ST LILLINGTON, NC 27546

D. FRINK LIGON 472 706 E. LENOIR STREET RALEIGH, NC 27601

LEZLIE COVINGTON 116 HORNE STREET RALEIGH, NC 27607

MARGARET MASON DUKE SCHOOL FOR CHILDREN 1516 HULL AVENUE DURHAM, NC 27705

LARRY LUGAR NASH COUNTY SCHOOLS 930 EASTERN AVENUE NASHVILLE, NC 27856

WILLIAM F. PALMER 304 NORTH PARK DRIVE SALISBURY, NC 28144-2463

CYNDY ELKINS 361 ELMHURST ROAD CHARLOTTE, NC 28209

ATTN: BILL LANDIS FORT BRAGG SCHOOLS (92-M-4863) PO BOX 70089 FORT BRAGG, NC 28307-5000

TONI MASSEY COLLEGE PARK MIDDLE SCHOOL 409 8TH AVE NE HICKORY, NC 28601

TERRY BLEDSOE CATAWBA COUNTY SCHOOLS 10 EAST 25TH STREET NEWTON, NC 28658

ANTHONY D ALLEY 2712 SIGMON DAIRY RD NEWTON, NC 28658-8607

JUDITH CLAUSS P.O. BOX 2528 CULLOWHEE, NC 28723



LYNN CLARK 1001 SYLVAN BLVD. HENDERSONVILLE, NC 28739

JIM HOCKMAN / INSTR. COMPUTING RICHLAND COUNTY SCHOOL DIST.

1616 RICHLAND STREET COLUMBIA, SC 29201

SERIALS DOC DEPT COLLEGE OF CHARLESTON ROBERT S SMALL LIBRARY CHARLESTON, SC 29424

DIANE SIGMON 102 PARK ST DARLINGTON, SC 29532

JEAN SUMMERVILLE FORT MILL ELEMENTARY SCHOOL 114 MUNN RD FORT MILL, SC 29715

LIBRARY UNIV. OF SOUTH CAROLINA-AIKEN 171 UNIVERSITY PKWY AIKEN, SC 29801-6309

MARY LU ARMSTRONG COBB CO PUBLIC SCHOOL 514 GLOVER STREET MARIETTA, GA 30060

SHEILA MASSIE KEHELEY ELEMENTARY SCHOOL 1985 KEMP ROAD MARIETTA, GA 30066

M L ARMSTRONG / PROF LIB FT WILLS EDUC SVC CTR 2601 WARD ST SMYRNA, GA 30080

JACKIE GRIFFITH 3998 DONEGAL COURT TUCKER, GA 30084

SUSAN PAALZ SCALLY 6111 RACHEL RDG NORCROSS, GA 30092

ELLIE GRANT BERKELEY LAKE ELEMENTARY SCHOOL 4300 BERKELE LAKE ROAD DULUTH, GA 30136-3055

ROBERT P. BRYANT 191 PEACH TREE/KING & SPAULDING ATLANTA, GA 30303

PATRICK EDMONDSON 433 LAKESHORE DRIVE, N.E. ATLANTA, GA 30307

KATHY HURLEY IBM EDUCATIONAL SYSTEMS 4111 NORTHSIDE PKWY H-06R1 ATLANTA, GA 30327

MICHAEL A. OREY UNIVERSITY OF GEORGIA 607 ADERHOLD HALL ATHENS, GA 30602

MARK HULME 1112 E 52ND ST SAVANNAH, GA 31404

ROY BHAGALOO MUSCOGEE COUNTY SCHOOL DISTRICT 539 BROWN AVENUE COLUMBUS, GA 31906 LYNN THOMPSON ROUTE 2, BOX 410 JENNINGS, FL 32053

DIANA M. WILLIS ROUTE 10, BOX 395 LIVE OAK, FL 32060

JAMES R. NORDMAN, JR. 7945 SAN JOSE BLVD. JACKSONVILLE, FL 32217

JEANNIE MULLINS 40 OAKWOOD ROAD JACKSON BEACH, FL 32250

ANNAMARIE RICHMAND, PROJ. MGR. FIRN-SOL (TOGL) 2107 CHEEKE NENE TALLAHASSEE, FL 32301

DAVID BRITTAIN / B1-54 FL. ED. CTR. DEPARTMENT OF EDUCATION 325 W. GAINES STREET TALLAHASSEE, FL 32399-0400

ANDY HOWARD /PROF. DEVEL. WALTON COUNTY SCHOOLS 202 PARK STREET DEFUNIAK SPRINGS, FL 32433

RICHARD S MCKENZIE PEA RIDGE ELEM SCHOOL 250 SCHOOL LN PACE, FL 32571

LINDA HAYES 2250 COVENTRY RD WINTER PARK, FL 32792

MARGARET WHILE 7548 GLENMOOR LN WINTER PARK, FL 32792-9060

UNIVERSITY OF CENTRAL FLORIDA COLLEGE OF EDUCATION / ED 220 ORLANDO, FL 32816

GINGER A. WRIGHT 994 SOUTH FORK CIRCLE MELBOURNE, FL 32901

SONG KOH 501 SHERMAN STREET, S.E. PALM BAY, FL 32909

KATHLEEN McKINNEY 421 BANANA RIVER BLVD. COCOA BEACH, FL 32931

SUSAN WAGNER 8 INWOOD WAY INDIAN HARBOR BEACH, FL 32937

BEVERLY CAMERON 12107 LYMESTONE WAY HOLLYWOOD, FL 33026

JOANNE URRUTIA COMPUTER EDUCATION & TECH-9611 1444 BISCAYNE BLVD, SUITE #310

MIAMI, FL 33032

COMPUTER EDUCATION & TECH-9608

1444 BISCAYNE BLVD RM #310 MIAMI, FL 33132

HERTA HOLLY THE CUSHMAN SCHOOL 592 NE 60TH ST MIAMI, FL 33137

MOLLY WEEKS 17890 WEST DIXIE HWY., #305 MIAMI, FL 33160 JAMES GOW 12331 SW 188TH TERR MIAMI, FL 33177

CUTLER RIDGE ELEM SCHOOL 20210 CORAL SEA RD MIAMI, FL 33189

ROBERT SCHEINBLUM CUTLER RIDGE ELEMENTARY SCHOOL 20210 CORAL SEA ROAD MIAMI, FL 33189

TONY PANARIELLO BROWARD COUNTY SCHOOLS 1300 W. LAS OLAS BLVD/DATA MGT FT. LAUDERDALE, FL 33312

LOTTIE J. SIMMS 4444 S.W. 72 TERRACE DAVIE, FL 33314

VALORIE WOOLLEY LYNX AIR/ UNSCH P.O. BOX 407139 FT. LAUDERDALE, FL 33340

JUDY MCGREGGOR JEWISH COMMUNITY DAY SCHOOL 5801 PARKER AVE WEST PALM BEACH, FL 33405

JUNE NILSEN 8129 SOUTH ST. BOCA RATON, FL 33433

LISA VANBROEKHOVEN ROUTE 8, BOX 902 LUTZ, FL 33549

FRED TRIEFENBACH THE BERKELEY PREP SCHOOL INC 4811 KELLY RD TAMPA, FL 33615-5020

DON ZEPFE 6823 MT. PLEASANT ST. PETERSBURG, FL 33702

KELLEEN LIST 5300 18TH ST NE ST. PETERSBURG, FL 33703

RANDI ROSSMAN MODERN TALKING PICTURE SERVICE 5000 PARK STREET N ST PETERSBURG, FL 33709

LOWER SCH. LIB. AMERICAN SCHOOL - RIO/LSL CONSULATE GENERAL APO MIAMI, FL 34030

KEITH W. CAMERON 1368 PIPER ROAD SPRING HILL, FL 34606

CATHARINE D. BEAUDRIE 405 HILL PARK DR GARDENDALE, AL 35071

MARK WILLIAMS 1206 ARGENT CIRCLE HUNTSVILLE, AL 35803-1607

ANN Y HUDGENS 38 BENZING RD ANTIOCH, TN 37013

KAKI BECKETT 5321 WILLIAMSBURGH RD. BRENTWOOD, TN 37027 JERRY SWAIM / CURR. & INSTR. DEPARTMENT OF EDUCATION 4TH FLNO.WING CORDELL HULL BLDG NASHVILLE TN 37243-0379

RICHARD WAGGONER/FED PRG DIR LINCOLN CO DEPT OF ED 208 E DAVIDSON DR FAYETTEVILLE, TN 37334-3502

THE BRIGHT SCHOOL, INC. 1950 HIXSON PIKE CHATTANOOGA, TN 37405-9968

BOB EVRIDGE 8200 BENNINGTON DR KNOXVILLE, TN 37909

CURRICULUM LAB UNIVERSITY OF TENNESSEE 302 CLAXTON ADDT KNOXVILLE, TN 37996-0001

LIBRARY JOHNSON BIBLE COLLEGE 7900 JOHNSON DR KNOXVILLE, TN 37998

BETTY WILSON GRACE ST. LUKES EPISCOPAL SCHOOL 246 SOUTH BELVEDERE MEMPHIS, TN 38104

LIBRARY SERVICES ADMINISTRATION 2597 AVERY, ROOM 140 MEMPHIS, TN 38112

TERENCE BRICE 3351 RIVERSIDE DR JACKSON, TN 38301

BILL BARNES JEFFERSON COUNTY PUBLIC SCHOOLS 911 S BROOK ST LOUISVILLE, KY 40203

EILEEN B. YOUNG 3214 FIVE OAKS PLACE LOUISVILLE, KY 40207

CHARLOTTE WRIGHT, TECH. COORD. ANDERSON COUNTY SCHOOL DISTRICT 103 N MAIN LAWRENCEBURG, KY 40342

DON E. RYOTI 162 REDWOOD DRIVE RICHMOND, KY 40475

LYDIA WELLS SLEDGE / ED. DEPT. KENTUCKY DEPARTMENT OF EDUC. 1809 CAPITAL PLAZA TOWER FRANKFORT, KY 40601

ATTN: TURNER MCCRACKEN COUNTY BOARD OF ED 260 BLEICH RD PADUCAH, KY 42003

DON HALL CHRISTIAN COUNTY BOARD OF ED. 200 GLASS AVENUE HOPKINSVILLE, KY 42240

JULIE FOX QUEST INTERNATIONAL 1206 HOLLAR LN NEWARK, OH 43055

JOHN WATTS 2098 INDIANA AVENUE COLUMBUS, OH 43201 BETH DUPONT 1698 NW BLVD COLUMBUS, OH 43212

ORCLISH 470 GLENMONT AVENUE COLUMBUS, OH 43214

RENEE PRAYZER HASTINGS-COMPUTER ED 1850 HASTINGS LN UPPER ARLINGTON, OH 43220

GAYLE M. MILLSAPS 7587 TOWERON LANE WORTHINGTON, OH 43235

MARION CAMPUS LIBRARY OHIO STATE UNIVERSITY 1465 MT. VERNON AVENUE MARION, OH 43302

CAROL YOUNGS WASHINGTON LOCAL SCHOOLS 3505 W. LINCOLNSHIRE BLVD. TOLEDO, OH 43606

GALE ANN WATSON 7 PROSPECT AVENUE BRIDGEPORT, OH 43912

LINDA C. BURECH 112 FRANKLIN STREET ST. CLAIRSVILLE, OH 43950

MARY SALTER 437 LINDUFF AVENUE STEUBENVILLE, OH 43952

EDWIN WESTCOTT 1747 EAST MORGAN ROAD JEFFERSON, OH 44047

SOLOMON SCHECHTER DAY SCHOOL 3300 MAYFIELD ROAD CLEVELAND HEIGHTS, OH 44118

STEVE SNYDER SUMMIT COUNTY BOARD OF ED 420 WASHINGTON AVE STE 200 CUYAHOGA FALLS, OH 44221-2042

MARYANN M. MCLURE 2883 MIDDLETON ROAD HUDSON, OH 44236

KEN FRASE 121 NORTH CENTER STREET SEVILLE, OH 44273

DOUGLAS LAUER AKRON PUBLIC SCHOOLS/ ADMIN.BLDG. 70 N BROADWAY AKRON, OH 44308

DELENE PERLEY 2629 ARMSTONG DR WOOSTER, OH 44691

MR. JOHN T. YODER 565 WILLIAMSBAUGH CT., APT. D WOOSTER, OH 44691

CHRISTINE ZESS 117 CEDAR POINT RD SANDUSKY, OH 44870

DAVID R EVANS ST PETERS ELEMENTARY 63 S MULBERRY ST

DAVID BINNION 139 W. JOSIE AVENUE, #1 HILLSBORO, OH 45133

MANSFIELD, OH 44902

WILLIAM C. BOSWELL 120 CHURCH STREET LEESBURG, OH 45135

MAIN CAMPUS CENTRAL LIBRARY UNIVERSITY OF CINCINNATI SERIALS RECEIVING/ACQ DEPT CINCINNATI, OH 45221

KENNETH J. UCKOTTER 1302 MEADOWBRIGHT LANE CINCINNATI, OH 45230

VIRGINIA KEISER INDIAN HILL BOARD OF ED 6855 DRAKE RD / ADMIN OFFICES CINCINNATI, OH 45243-0001

LIBRARY EDISON STATE COMMUNITY COLLEGE 1973 EDISON DRIVE PIQUA, OH 45356

K. FASIMPAUR / CREATIVE SRVS. DIV. THE MAZER CORPORATION 2501 NEFF RD DAYTON, OH 45414

JOYCE D. BUSCH, INSTRUCTOR ADA HIGH SCHOOL 500 GRAND AVENUE ADA, OH 45810

ROBERT L. CARROLL GTE EDUCATIONAL NETWORK ACCESS 11495 N. PENNSYLVANIA, STE. 205 CARMEL, IN 46032

LINDA SMITH 192 HILLCREST MOORESVILLE, IN 46158

MICHAEL RUSH 4605 BROADWAY INDIANAPOLIS, IN 46205

RICK SWARTZ HOBART MIDDLE SCHOOL 705 E 4TH ST HOBART, IN 46342

GLENDA S. SPIECE 1811 WOODHAVEN DRIVE, #7 FORT WAYNE, IN 46819

CARL DeGRAAF 6531 HWY 11 ELIZABETH, IN 47117-9608

BARBARA ELLEFSEN SOUTHWESTERN HIGH SCHOOL 167 MAIN CROSS HANOVER, IN 47243

ANNETTE THEISS 8538 HARDING CENTER LINE, MI 48015

TERRI SPENCER EAST DETROIT PUBLIC SCHOOLS 19200 STEPHENS DR EASTPOINTE, MI 48021

TRINITY LUTHERAN SCHOOL 38900 HARPER LN CLINTON TOWNSHIP, MI 48036-3222

JULIE A. RAUPP 711 19TH ST. MARYSVILLE, MI 48040

TIMOTHY MENO 1005 HURON AVENUE PORT HURON, MI 48060 FROST CURR CTR/ROBERT HAXD WARREN CONSOLIDATED SCHOOLS 14301 PARKSIDE WARREN, MI 48093

WENDY LaVALLE EMERSON SCHOOL 5425 SCIO CHURCH ROAD ANN ARBOR, MI 48103

ROGER VERHEY / MATH & STATS DEPT UNIVERSITY OF MICHIGAN-DEARBORN

4901 EVERGREEN RD DEARBORN, MI 48128

RICHARD WEAVER DEXTER COMMUNITY SCHOOLS 2615 BAKER RD DEXTER, MI 48130-1598

ROBERT MecDONALD HAWTHORN MEADOWS 10225 NANCY'S BLVD., APT. #63 GROSSE ILE, MI 48138

DAVID MURPHY MADONNA COLLEGE / SERIALS LIB 36600 SCHOOLCRAFT RD LIVONIA, MI 48150-1173

BARBARA M. FIFE ED TECH CTR/MEADS MILL MIDDLE SC 16700 FRANKLIN ROAD NORTHVILLE, MI 48167-2515

LORANA A. JINKERSON 242 SALINE RIVER ROAD SALINE, MI 48176

PHILIP COHEN 931243 WASHINGTON CAREER CENTER 13000 DEQUINDRE DETROIT, MI 48212

MARK LINDSAY 19231 BRETTON DETROIT, MI 48223

ANNE PORTER OAKLAND UNIVERSITY 501 ODOWD/SHES ROCHESTER, MI 48309-4401

ERNEST C. BUTKI CHILDREN'S VILLAGE 1200 NORTH TELEGRAPH ROAD PONTIAC, MI 48341

WILLIAM RAKOW 6251 ORCHARD DRIVE MARLETTE, MI 48453-1159

STUART A. CHOATE MIDLAND PUBLIC SCHOOLS 600 EAST CARPENTER STREET MIDLAND, MI 48640

DONNA REHBECK INGHAM INTERMEDIATE - ESC 2630 HOWELL ROAD MASON, MI 48854

JAMES W. ARMSTRONG 6332 HAMPTON STREET KALAMAZOO, MI 49002

ROBERT METZGER GRAND HAVEN JUNIOR HIGH SCHOOL 1400 SOUTH GRIFFIN STREET GRAND HAVEN, MI 49417 MATT BURNS - INFO. SERVICES GRAND RAPIDS PUBLIC SCHOOLS 143 BOSTWOCK N.E. GRAND RAPIDS, MI 49503

MIKE FARRIMOND EAST JORDAN ELEMENTARY SCHOOL 304 - 4TH STREET EAST JORDAN, MI 49727

ROBERT KELLY 2103 McCARTHY ROAD AMES, IA 50010

TECH COORD/ TIM BUENZ JEFFERSON COMM.SCHS./MID. SCHOOL 203 WEST HARRISON JEFFERSON, IA 50129

BARRY PITSCH HEARTLAND AEA 11 6500 CORPORATE DRIVE JOHNSTON, IA 50131-1603

GORDON K DAHLBY VALLEY HIGH SCHOOL 1140 35TH ST WEST DES MOINES, IA 50265-2198

DR. MORRIS WILSON DES MOINES PUBLIC SCHOOLS 1800 GRAND AVENUE DES MOINES, IA 50307

ROBERT W. TITUS 3500 LINDLAVISTA WAY DES MOINES, IA 50310

LARRY BOYD ARROWHEAD AEA/ED SRVS DIVISION 1235 5TH AVE S FORT DODGE, IA 50501-4847

BEVERLY CUNNINGHAM P.O. BOX L TREYNOR, IA 51575

ROBERT M ADAMS 1605 MARJORIE CIR DUBUQUE, IA 52002-2614

BOB BEHREND / CENTRAL RECEIVING WEST DELAWARE SCHOOLS 601 NEW STREET MANCHESTER, IA 52057

WILSON / PENCE COMPUTER LAB PENCE ELEMENTARY SCHOOL 1006 - 6TH STREET FAIRFIELD, IA 52556

MEDIA CENTER GREAT RIVER AREA ED. AGENCY #16 1200 UNIVERSITY BURLINGTON, IA 52601

JOHN ALBEE 4033 LILLIE AVENUE, #14A DAVENPORT, 1A 52806

LINDA DANFORTH BROOKFIELD ACADEMY 3460 NORTH BROOKFIELD ROAD BROOKFIELD, WI 53005

DALE STEVENS DISTRICT OFFICE W68 N611 EVERGREEN BLVD CEDARBURG, WI 53012

DENISE LEONG N8066 PEREGRINE LANE HORICON, WI 53032 KRISTINE DIENER 330 C WILLOW GROVE DRIVE PEWAUKEE, WI 53072

PRICIPAL/L. J. HART TRINITY EV. LUTHERAN SCHOOL 824 WISCONSIN AVENUE SHEBOYGAN, WI 53081

JUDITH A. BRANDT S70 W14963 DARTMOUTH CIRCLE MUSKEGO, WI 53150

GLEN PARK ELEM. SCHOOL 3500 S. GLEN PARK ROAD NEW BERLIN, WI 53151

SHIRLEY GARTMANN UNIV OF WISCONSIN AT WHITEWATER WINTHER HALL 4040 WHITEWATER, WI 53190

HENRY KEPNER /CURR.& INST. UNIV. OF WISCONSIN/MILWAUKEE ENDERIS HALL /BOX 413 MILWAUKEE, WI 53201

JOSEPH W. KMOCH 1035 E. COLFAX PLACE WHITEFISH BAY, WI 53217

ANNE M. GOODE WHITNALL HIGH SCHOOL 5000 S 116TH ST RM 257 GREENFIELD, WI 53228

SERIALS DEPT. ALVERNO COLLEGE LIBRARY 3401 S. 39TH ST/PO BOX 343922 MILWAUKEE, WI 53234-3922

DONALD GRANGER EDGERTON COMM. ELEMENTARY SCHOOL 100 ELM HIGH DRIVE EDGERTON, WI 53534

ELELYA B. HECTOR 307 WASHINGTON MINERAL POINT, WI 53565

NAN YOUNGERMAN CRESTWOOD ELEMENTARY SCHOOL 5930 OLD SAUK ROAD MADISON, WI 53705-2599

MILTON MITCHELL / MATH DEPT UNIVERSITY OF WISCONSIN 1 UNIVERSITY PLAZA PLATTEVILLE, WI 53818

JOHN BENNIN BARABOO SCHOOL DISTRICT 101 - 2ND AVENUE BARABOO, WI 53913

DANA GRAHAM WAYLAND ACADEMY 101 N UNIVERSITY AVE BEAVER DAM, WI 53916

MELISSA RUSK 2273 RAINBOW DR GREEN BAY, WI 54313-7806

TED DASLER LAKELAND UNION HIGH SCHOOL 8669 HIGHWAY 70 WEST MINOCQUA, WI 54548

SCOTT CUNNINGHAM THREE LAKES ELEMENTARY SCHOOL P. O. BOX 280 THREE LAKES, WI 54562 BRANDON HOLT HOGAN ADMINISTRATIVE CENTER 807 EAST AVENUE SOUTH LA CROSSE, WI 54601

BOBBIE KUCHTA PEDERSEN ELEMENTARY SCHOOL / IMC 1827 BARTLETT AVENUE ALTOONA, WI 54720

PEGGY NEHRING CHIPPEWA AREA CATHOLIC SCHOOLS 1316 BEL AIR BLVD. CHIPPEWA FALLS, WI 54729

JOAN M. QUENAN RR 2, BOX 303 SHELL LAKE, WI 54871

PAUL & MARILYN TAYLOR 105 KIRKWOOD DRIVE OSHKOSH, WI 54901

JAMES DEAN EINSTEIN JUNIOR HIGH SCHOOL 324 E. FLORIDA AVENUE APPLETON, WI 54914

LOIS LANGHOLZ, MEDIA SPEC PINECRESCT ELEMENTARY SCHOOL 975 W 12TH ST HASTINGS, MN 55033

KELLY GROENEWOLD INDEP. SCHOOL DISTRICT #196 14445 DIAMOND PATH/STAFF DEVEL.

DENISE GRIFFITH ISD #196 14445 DIAMOND PATH W ROSEMOUNT, MN 55068-4199

LIBRARY GALTIER SCHOOL 1317 CHARLES ST. PAUL, MN 55104

THERESA REARDON OFFERMAN MOUNDS PARK ACADEMY 2051 EAST LARPENTEUR ST. PAUL, MN 55109

MARY JOYCE 502 DEER RIDGE LANE MAPLEWOOD, MN 55119

DIANE HEWITT OXBOW CREEK SCHOOL 6050 - 109TH AVENUE NO. CHAMPLIN, MN 55316

PACER CENTER/COMP. RESOURCE CTR. 4826 CHICAGO AVENUE SOUTH MINNEAPOLIS, MN 55417

LEONARD H. BROWN 7932 SUNNY BEACH ROAD GRAND RAPIDS, MN 55744

BOB KAISER/TECH ER/TECHNICAL BUILDIN INDEPENDENT SCHOOL DIST #706 411 5TH AVE SOUTH VIRGINIA, MN 55792

MEDIA CENTER WASHINGTON ELEMENTARY SCHOOL 1100 ANDERSON DRIVE MANKATO, MN 56001 RICK BOLDA MINNESOTA VALLEY LUTHERAN H.S. ROUTE 5, BOX 52A NEW III M MN 56073

NEW ULM, MN 56073

306 VIKING DRIVE VALLEY CITY, ND 58072

JIM TOWNER 510 CENTRAL AVENUE BISMARCK, ND 58501

THOMAS LADENDORF 114 12TH AVE NE MINOT, ND 58701-1430

CRAIG NANSEN MINOT PUBLIC SCHOOL DISTRICT #1 215 - 2ND STREET, S.E. MINOT, ND 58701-3924

DR BARBARA BREHM EASTERN MONTANA COLLEGE 1500 N 30TH / CURR & INSTR DEPT BILLINGS, MT 59101-0245

DARLENE HESS 900 CALICO AVENUE BILLINGS, MT 59105

JOHNNY W. LOTT UNIVERSITY OF MONTANA DEPARTMENT OF MATH SCIENCE MISSOULA, MT 59812

DONALD V. PURN 987 SHEFFIELD CRYSTAL LAKE, IL 60014

MARCY REED 864 CENTRAL DEERFIELD, IL 60015

LINDA ANSTINE KIPLING ELEMENTARY SCHOOL 700 KIPLING PLACE DEERFIELD, IL 60015

ED COUGHLIN LAKE COUNTY ESC 19525 W. WASHINGTON STREET GRAYSLAKE, IL 60030

MARK MUELLER 4164 BLACKSTONE AVENUE GURNEE, IL 60031

T SLOCUM OLD ORCHARD JR HIGH SCHOOL 9310 N KENTON SKOKIE, IL 60076

HALL LIBRARY / M. LUNDQUIST NORTH SHORE COUNTRY DAY SCHOOL 310 GREEN BAY RD WINNETKA, IL 60093

JANET KELLER 256-F EAST GEORGE STREET BENSENVILLE, IL 60106

LAVONNE A. ZISK 632 BRYAN STREET ELMHURST, IL 60126

PENNY ELLSWORTH 23 W. 030 MULBERRY LANE GLEN ELLYN, IL 60137

TERRI KENOST 813 N. 14TH AVENUE MELROSE PARK, IL 60160

Summer 1993

48 | | | | | | LOGOEXCHANGE

JUDITH GOETSCH 416 TEBAY PLACE SCHAUMBURG, IL 60194

ROBERT STEPHENS 224 TRAVIS CT APT. 308 SCHAUMBURG, IL 60195

CHRISTINE & STEEL 2500 LAWNDALE EVANSTON, IL 60201

SANDRA TURNER 2300 EWING AVENUE EVANSTON, IL 60201

LIBRARY - PERIODICALS NATIONAL LOUIS UNIVERSITY 2840 SHERIDAN RD EVANSTON, IL 60201-1730

AMY S. RAINS 836 NORTH LOMBARD OAK PARK, IL 60302

AIKO BOYCE 1122 SOUTH HUMPHREY OAK PARK, IL 60304

JOHN J. WILLIAMS P.O. BOX 2785 JOLIET, IL 60434-2785

CONNIE J. HODSON 15317 LAS ROBLES STREET OAK FOREST, IL 60452

FAITH T CARON 8548 W 145TH ST ORLAND PARK, IL 60462

DIANE POLONCSIK 4620 LINSCOTT DOWNERS GROVE, IL 60515

CAROL STRANDBERG 4320 CENTRAL AVENUE WESTERN SPRINGS, IL 60558

RALPH E. MEYER 5708 CRESTVIEW DRIVE WESTERN SPRINGS, IL 60558

ROB GRIERSON THE LATIN SCHOOL OF CHICAGO 59 WEST NORTH BLVD CHICAGO, IL 60610

SISTERHOOD CHILDREN'S LIBRARY ANSHE EMET DAY SCHOOL 3760 NORTH PINE GROVE AVENUE CHICAGO, IL 60613

SERIALS LIBRARIAN DEPAUL UNIVERSITY LIBRARY 2350 N KENMORE AVE CHICAGO, IL 60614

PETER PEREIRA 4955 KIMBARK AVENUE CHICAGO, IL 60615

PETER CONOLLY 6449 N NEWGARD AVE CHICAGO, IL 60626-5011

JOHN J. BIEN 6327 N. OKETO CHICAGO, IL 60631-1919

RUTH SKINNER 1634 N. 73RD COURT ELMWOOD PARK, IL 60635

KAREN PUTMAN UNIV. OF CHICAGO LAB SCHOOLS 1362 EAST 59TH STREET CHICAGO, IL 60637 RICHARD BILLINGS 2420 N KENTON AVE CHICAGO, IL 60639

LAWRENCE JOSEPHSON 6934 N BELL CHICAGO, IL 60645

CAROLE J. RIVERA 3127 WEST BIRCHWOOD CHICAGO, IL 60645

ANN HEIDKAMP ST JULIANA SCHOOL 7400 W TOUHY AVE CHICAGO, IL 60648-4193

BETTE SILVERMAN CHICAGO CITY DAY SCHOOL 541 W. HAWTHORNE PLACE CHICAGO, IL 60657

COMPUTER DEPT. STONY CREEK SCHOOL 11700 SOUTH KOLIN ALSIP, IL 60658

THOMAS EDISON SCHOOL 1991 E MAPLE ST KANKAKEE, IL 60901

JUDITH OLSON 1 MARTY LANE MACOMB, IL 61455

PATRICIA L. HUTINGER WESTERN ILLINOIS UNIVERSITY 27 HORRABIN HALL MACOMB. IL 61455

MARILYN WARD WESTERN ILLINOIS UNIVERSITY HORRABIN HALL 39 MACOMB, IL 61455

SERIALS DEPT WESTERN ILLINOIS UNIVERSITY UNIVERSITY LIBRARY MACOMB, IL 61455

LEARNING RESOURCES WESTERN ILLINOIS UNIVERSITY CURRICULUM LAB.- HH 72 MACOMB, IL 61455

MATH DEPARTMENT ILLINOIS STATE UNIVERSITY MATH LAB, STV 302 NORMAL, IL 61761

BARBARA PETERS 501 SOUTH 5TH STREET ST. JOSEPH, IL 61873

HAL ANDERSON EASTERN ILLINOIS UNIVERSITY MATH DEPARTMENT CHARLESTON, IL 61920

MARY STEPHEN 33 GLEN HOLLOW ROAD EDWARDSVILLE, IL 62025

BOB ROBLEY EDUCATIONAL SERVICE CENTER #16 500 WILSHIRE DRIVE BELLEVILLE, IL 62223

SUE MAUPIN ROUTE 2, BOX 349 ALTAMONT, IL 62411

DAVID CAREY LERNA ELEMENTARY SCHOOL P.O. BOX 129 LERNA, IL 62440 KAREN THOMPSON R.R. 1, BOX 192 BUFFALO, IL 62515

DR. LLOYD KLINEDINST PARKWAY SCHOOL DISTRICT 455 N. WOODS MILL ROAD CHESTERFIELD, MO 63017

TERRY BOTTORFF ROCKWOOD SCHOOL DISTRICT 265 OLD STATE ROAD ELLISVILLE, MO 63021

CORI HARTJE 1959 SAN LUIS REY ST. LOUIS, MO 63026-3237

MARILYN WEBERN 3012 GEORGETOWN FARMS CT. ST. ANN, MO 63074

LIBRARY FONTBONNE COLLEGE WYDOWN & BIG BEND BLVD. ST. LOUIS, MO 63105

SALLY JEAN DOBRUNZ STEGER SCHOOL 701 N. ROCK HILL ST. LOUIS, MO 63119

GLENDA BENTZ #2 VILLAWOOD ST LOUIS, MO 63119

JANET EMERSON ROHAN WOODS SCHOOL 1515 BENNETT ST. LOUIS, MO 63122

HARRY M. LYKENS MARY INSTITUTE 101 NORTH WARSON ROAD ST. LOUIS, MO 63124

STEVE CULVER COMMUNITY SCHOOL 900 LAY ROAD ST. LOUIS, MO 63124

R. MEYER CONWAY SCHOOL 9900 CONWAY ROAD ST. LOUIS, MO 63124-1651

KARIM REICH ST. ELIZABETH OF HUNGARY SCHOOL 1414 SAPPINGTON ROAD ST. LOUIS, MO 63126

RALPH OLLIGES 9362 BUXTON ROAD ST. LOUIS, MO 63126

ACADEMY OF THE VISITATION 3020 NORTH BALLAS ROAD ST. LOUIS, MO 63131

ELIZABETH FELLER THE ACADEMY OF THE VISITATION 3020 NORTH BALLAS ROAD ST. LOUIS. MO 63131

ALICE ADCOCK OLD BONHOMME SCHOOL 9661 OLD BONHOMME RD ST LOUIS, MO 63132-4112

MARIAN ROSEN 7541 MARILLAC DRIVE ST. LOUIS, MO 63133

MARILYN KAUFMAN SPOEDE SCHOOL 425 NORTH SPOEDE ROAD ST. LOUIS, MO 63141 FRANK J. CORLEY ST. LOUIS PRIORY SCHOOL 500 SOUTH MASON ROAD ST. LOUIS, MO 63141

TONI GROVIER FRANCIS HOWELL SCHOOL DIST 4545 CENTRAL SCHOOL ROAD ST CHARLES, MO 63304

TAMMY LIEURANCE HANNIBAL SCHOOL DISTRICT 4650 MCMASTERS HANNIBAL, MO 63401

KATHY WILLIAMS WARD PARKWAY CAMPUS 5121 STATE LINE RD KANSAS CITY, MO 64112

LYNN CASSITY 23720 HIGHWAY V DEARBORN, MO 64439

CHRISTINE COPELAND ROUTE 2, BOX 320 SHELDON, MO 64784

DR. DIANE McGRATH KANSAS STATE UNIVERSITY 261 BLUEMONT HALL MANHATTAN, KS 66506

DAN FLUMMERFELT UNIFIED SCHOOL DIST. NO. 465 400 E 9TH WINFIELD, KS 67156

CHERRY HART 9900 KENNY LN WICHITA, KS 67212

SKYLINE ELEMENTARY SCHOOL 400 SOUTH 210TH ELKHORN, NE 68022

SHERRI L. MOYERS-MACHT 8516 C. ST. OMAHA, NE 68124

JOHN L. MOON 2013 ELK STREET BEATRICE, NE 68310-3236

SUE SYLWESTER 1060 FAIRLANE AVE SEWARD, NE 68434-1310

DONNA PETERSON/ STAFF LIB.MEDIA SRVS LINCOLN PUBLIC SCHOOLS P.O. BOX 82889 LINCOLN, NE 68501

STAFF LIBRARY MEDIA CENTER LINCOLN PUBLIC SCHOOLS P.O. BOX 82889 LINCOLN, NE 68501

GINNY ELLIS CALVERT ELEMENTARY SCHOOL 3709 SOUTH 46TH STREET LINCOLN, NE 68506

JAMES FEJFAR / CURR. & INS UNIVERSITY OF NEBRASKA-LINCOLN 214A HENZLIK HALL LINCOLN, NE 68588

SYLVIA PERSON HOLDREGE SCHOOLS 315 EAST AVE HOLDREGE, NE 68949

SANDY GRIMM 1126 BIVENS LANE HOLDREGE, NE 68949



JACK DEGOLYER 1331 RAPIDES DR NEW ORLEANS, LA 70122

BECKY CONTOIS CHRIST EPISCOPAL SCHOOL 120 N NEW HAMPSHIRE COVINGTON, LA 70433

MARY JANE FORD 523 KAISER DRIVE LAFAYETTE, LA 70508

SHERYL R. ABSHIRE WESTWOOD ELEMENTARY SCHOOL 1900 SAMPSON ST WESTLAKE, LA 70669

ROXANA PLATT 12 VALLEY FORGE DR LITTLE ROCK, AR 72212-2614

SUE OATES 509 EVERGREEN CIRCLE NORMAN, OK 73072-4618

LINDA L CARTER 1424 BRADLEY AVENUE OKLAHOMA CITY, OK 73127

MARILYN HOWARD 3319 SOUTH DARLINGTON TULSA, OK 74135

JUNE EHINGER 5105 E 98TH ST TULSA, OK 74137-4919

CHERI T. BURCH PONCA CITY HIGH SCHOOL 5TH & OVERBROOK PONCA CITY, OK 74601

LYNDA M. NICHOL SHAWNEE PUBLIC SCHOOLS 326 N UNION SHAWNEE, OK 74801

DONNA CRAIGHEAD DLM TEACHING RESOURCES ONE DLM PARK ALLEN, TX 75002

CARY ROBERTS FRISCO I.S.D. P.O. BOX 910 FRISCO, TX 75034

LARRY D RHODES GARLAND IND SCHOOL DISTRICT 2825 S FIRST ST GARLAND, TX 75041

DOROTHY EMBRY 4662 DEVONSHIRE DRIVE GRAND PRAIRIE, TX 75052-3520

THERESA OVERALL/COMP COORD LAMPLIGHTER SCHOOL 11611 INWOOD RD DALLAS, TX 75229

JAMES F STRAUSS 10825 PAGEWOOD PL DALLAS, TX 75230

JUDY ZEITER GREENHILL SCHOOL 14255 MIDWAY ROAD DALLAS, TX 75244

RHONDA BRETTE GREENHILL SCHOOL-LOWER SCHOOL 14255 MIDWAY ROAD DALLAS, TX 75244-3698 DEE MILLER ST JAMES DAY SCHOOL 5501 NORTH STATE LINE AVE TEXARKANA, TX 75503

BARBARA FLYNN, PROG.COORD,ELEM.MATH ARLINGTON IND. SCHOOL DISTRICT 1203 W. PIONEER PARKWAY ARLINGTON, TX 76013

PAT MILLER 3113 SHENANDOAH BEDFORD, TX 76021

FRANK V MOZINA 3504 BLUE QUAIL LN BEDFORD, TX 76021-2002

JAMIE ALEXANDER / EDUCATION DIVISION RADIO SHACK 1600 ONE TANDY CENTER FORT WORTH, TX 76102

DIKES / JONES HIGH SCH. FOR FINANCE & COMM.P 1300 CONNER STREET FORT WORTH, TX 76105

JULIA S. MEMSER TRINITY VALLEY SCHOOL 6101 MCCART AVE FORT WORTH, TX 76133

S. W. HOLLINGSWORTH NORTHWEST I. S. D. RT. 1, BOX 39A JUSTIN, TX 76247

MARIELLA MORGAN TEMPLE ISD PO BOX 788 TEMPLE, TX 76503

CYNTHIA L. LIBBY 116 SHERWOOD OAKS WACO, TX 76705

PANDEE REISINGER WACO ISD-ADMIN BLDG 3420 W WACO DR WACO, TX 76710-5437

M.L. CENATIEMPO ST. VINCENT DE PAUL SCHOOL 6802 BUFFALO SPEEDWAY HOUSTON, TX 77025

LORI LUSK/ RES CENTER ALDINE ISD/CENTRAL RECEIVING 14910 ALDINE WESTFIELD RD HOUSTON, TX 77032

DENNIS W. SPUCK / SCHOOL OF ED UNIV. OF HOUSTON - CLEAR LAKE 2700 BAY AREA BLVD., BOX 509 HOUSTON, TX 77058

FRANK MATTHEWS UNIVERSITY OF HOUSTON 2700 BAY AREA BLVD. HOUSTON, TX 77058

DR. PHIL LANASA 3711 GLENMEADE HOUSTON, TX 77059

MARILYN CLARK 15410 PENN HILLS LANE HOUSTON, TX 77062

TRONIE GUNN 10722 VALLEY HILLS DRIVE HOUSTON, TX 77071 JUDY WOODS / COMPUTER LITERACY DREW JUNIOR HIGH SCHOOL 2100 W LITTLE YORK HOUSTON, TX 77091

JOAN BRUMMETT KATY I.S.D./ADMINISTRATION BLDG. 6301 SOUTH STADIUM LANE KATY, TX 77494

ETHEL J. TALBOT 324 FOREST DRIVE LAKE JACKSON, TX 77566

JERRY WILLIS UNIV. OF HOUSTON / COLLEGE OF ED

1007 N SUNSET DR PEARLAND, TX 77581-6766

DARYLANN HANSEN BEAUMONT I.S.D./ ADMIN. BUILDING 3395 HARRISON BEAUMONT, TX 77706-5009

C/O AMERICAN EMBASSY WAREHOUSE USA EMBASSY MEXICO CITY (ASF) 620 LOGAN ST LAREDO, TX 78044

JOHN EVANS 530 JOHN PAGE SAN ANTONIO, TX 78228

BARBARA HUSTING FORT SAM HOUSTON ELEM. SCHOOL 3370 NURSERY ROAD SAN ANTONIO, TX 78234

JUDITH HARRIS 1704 ENFIELD RD #101 AUSTIN, TX 78703-3348

GENERAL LIBRARIES UNIVERSITY OF TEXAS SERIALS ACQUISITIONS AUSTIN, TX 78713

JUAN M. MONROY COMPUMASTER 2120 E PAISANO DR STE 135 EL PASO, TX 79905

MARIE MCDERMOTT COMPUTER COORDINATOR P O BOX 118 AGATE, CO 80101

MARK STEVENS COLUMBIA COMPUTING SERVICES 8101 E. PRENTICE ST., SUITE 700 ENGLEWOOD, CO 80111-2911

ROBERT DeBLAUW LITTLETON PUBLIC SCHOOLS 5776 S. CROCKER STREET LITTLETON, CO 80120

JOHN C SHAFFER SHAFFER ELEMENTARY CRISTO RD LITTLETON, CO 80127

MARTHA WILCOX 245 JASMINE DENVER, CO 80220

SAM SORTORE REGIS UNIV / ACADEMIC COMPUTER W 50TH & LOWELL BLVD DENVER, CO 80221-0001

MARK V. HOLIDAY BOX 100415 DENVER, CO 80250-0415 WILLIAM HORTON 2940 JUILLIARD BOULDER, CO 80303

JOYCE DICKEY PROFESSIONAL LIBRARY MEDIA CTR 1829 DENVER W.DR./BLDG.#27 GOLDEN, CO 80401-3100

NANCY BOND 298 SOUTH 22ND AVENUE BRIGHTON, CO 80601

L.R.S. EL PASO COUNTY SCHOOL DIST. #11 1036 N. FRANKLIN COLORADO SPRINGS, CO 80903

STEVE COWDREY SCHOOL DISTRICT #11 1036 N. FRANKLIN STREET COLORADO SPRINGS, CO 80903

ADAMS STATE COLLEGE LIBRARY - PERIODICALS ALAMOSA, CO 81102

FRANK MILLER LARAMIE COUNTY SCHOOL DIST. #1 2810 HOUSE AVENUE CHEYENNE, WY 82001

MIRIAM MIMI GILMAN P.O. BOX 1091 SARATOGA, WY 82331

KRISTINE HANSEN SHO-BAN SCHOOL P.O. BOX 306 FORT HALL, ID 83205

DOUG POOLE SCHOOL DIST. #91/COMPUTER CENTER 690 JOHN ADAMS PARKWAY IDAHO FALLS, ID 83401

DEBORAH MASON 2506 SCHILLER RD EMMETT, ID 83617-9747

CHRIS SEVERUD 1513 N 10TH ST BOISE, ID 83702

JOANN MAXSON 1862 BELMONT BOISE, ID 83706

DR. HEIDI ROGERS UNIVERSITY OF IDAHO 925 W GARDEN AVE COEUR D'ALENE, ID 83814

RON TER HARK COEUR d'ALENE HIGH SCHOOL N 5530 4TH ST COUER d'ALENE, ID 83814

DEAN LINDSTROM WALLACE SCHOOL DISTRICT #393 P.O. BOX 500 WALLACE, ID 83873

EDUC. DIVISION WICAT P.O. BOX 539 MS2 OREM, UT 84059

BRUCE NELSON, K-12 PROG. MANAGER NOVELL, INC. 122 EAST 1700 SOUTH PROVO, UT 84606 MIKE CHARLES 6813 N. 29TH AVENUE PHOENIX, AZ 85017

EDWARD PETTENGILL 7709 N 38TH DR PHOENIX, AZ 85051-6414

ED PETTENGILL PHOENIX COUNTRY DAY SCHOOL P.O. BOX 15087 PHOENIX, AZ 85060

BETH MORGAN 1990 N ALMA SCHOOL RD #136 CHANDLER, AZ 85224

ANNE MILLER KYRENE SCHOOL DISTRICT 8700 SOUTH KYRENE ROAD TEMPE, AZ 85284

HANK STABLER PEORIA UNIFIED SCHOOL DIST. 11251 N 67TH AVE GLENDALE, AZ 85304

RON SHANNON AMPHITHEATER PUBLIC SCHOOLS 701 WEST WETMORE ROAD TUCSON, AZ 85705

ADM COMPUTER COORDINATOR SUNNYSIDE UNIF SCHOOL DIST #12 2238 E GINTER RD TUCSON, AZ 85706-5897

DEBORAH CARRABBA 7126 E ELI PL. TUCSON, AZ 85710

CANDY EGBERT CHPATER 2 TUCSON UNIF. SCH.DIST. P.O. BOX 40400 TUCSON, AZ 85719

MATHEMATICS UNIVERSITY OF ARIZONA RM 108, BLDG 89 TUCSON, AZ 85721

PAULA BLOKER / WAREHOUSE RECIEVING ARIZONA ST SCH FOR DEAF & BLIND 1200 W SPEEDWAY TUCSON, AZ 85745-2326

MARK LUFFMAN COTTONWOOD-OAK CREEK SCHOOL DIST 1 N WILLARD RECEIVING COTTONWOOD, AZ 86326-0000

MARY F. TAPSCOTT MANZANO DAY SCHOOL 1801 CENTRAL AVENUE NORTHWEST ALBUQUERQUE, NM 87104

KURT A. STENHAUS 1944 THOMAS AVENUE SANTA FE, NM 87505

DONNA CURTIS HEIZER JR HIGH SCHOOL LIBRARY 101 E STANOLIND RD HOBBS, NM 88240

JAMES C. NELSON 617 - 7TH STREET BOULDER CITY, NV 89005

J.R. PEAY // CN BLDG., RM. 1238 IND. & SERV. TECH. / CIT 3200 E. CHEYENNE AVENUE NORTH LAS VEGAS, NV 89030-4296 BARBARA ANN HOLMES C & I MICROCOMPUTER CENTER 601 NORTH 9TH STREET LAS VEGAS, NV 89101

BRUCE DALEY 3455 ERVA, #109 LAS VEGAS, NV 89117

NEAL STRUDLER UNLV, COLLEGE OF EDUCATION 4505 MARYLAND PKWYJ C & I DEPT. LAS VEGAS, NV 89154

COUNSELING / LEARNING CENTER KAISER-PERMANENTE WATTS 1465 EAST 103RD STREET LOS ANGELES, CA 90002

BEVERLY C. CLARK 3525 COUNTRY CLUB DRIVE LOS ANGELES, CA 90019

ROBERT K. NAGAI 937 S. CITRUS AVENUE LOS ANGELES, CA 90036-4928

SUSAN WRAY FUTUREKIDS, INC. 5777 W. CENTURY BLVD., #1555 LOS ANGELES, CA 90045

DORIS BERLAN THE MIRMAN SCHOOL 16180 MULHOLLAND DRIVE LOS ANGELES, CA 90049

ALLAN HANCOCK BERKELEY HALL SCHOOL 16000 MULHOLLAND DRIVE LOS ANGELES, CA 90049

DARWIN LUMLEY 9300 IMPERIAL HWY. (ECE119) DOWNEY, CA 90241

JANE HIRSH / COMPUTER ROOM 13 MARQUEZ ELEMENTARY SCHOOL 16821 MARQUEZ AVENUE PACIFIC PALISADES, CA 90272

GLORIA FOWLER 1070 LAS PULGAS ROAD PACIFIC PALISADES, CA 90272

IVAN FILIPPENKO 2101 VANDERBILT LANE #5 REDONDO BEACH, CA 90278

PATRICE ABARCA 7102 HOGEE DR. SOUTH GATE, CA 90280

JANE HIRSCH CROSSROADS ELEMENTARY SCHOOL 1229 - 4TH STREET SANTA MONICA, CA 90401

NANCY BLEY 2417 - 34TH STREET, #19 SANTA MONICA, CA 90405

JOANNE T. EVENSEN 20526 ENTRADERO AVENUE TORRANCE, CA 90503

MARILYN DICKERSON 4138 JOSIE AVENUE LAKEWOOD, CA 90713

JOANNE GRAM 1981 NORTH CRAIG AVENUE ALTADENA, CA 91001

JERRY JACO 633 S. BALDWIN AVE. "A" ARCADIA, CA 91007 JERELD N. KOILES 9659 EAST ARDENDALE ARCADIA, CA 91007

ANNABELLE TREACY FLINTRIDGE PREP SCHOOL 4543 CROWN AVE LA CANADA, CA 91011-3699

JEANNETTE HIGGINBOTHAM MAYFIELD JUNIOR SCHOOL 405 SOUTH EUCLID AVENUE PASADENA, CA 91101-3199

CAROL T. WHITE 945 MEDOFRD RD PASADENA, CA 91107

DARCY MUSE DANETTE 308 N VISTA AVE #7 PASADENA, CA 91107

DAVID KRESSEN 3081 ONEIDA STREET PASADENA, CA 91107

SALLY IRVING 1730 WINDSOR ROAD SAN MARINO, CA 91108

PATRICIA JOHNSRUD 3141 EMERALD ISLE GLENDALE, CA 91206

AUDREY J. KIDDER 5952 LOS VIRGENES RD APT. 755 CALABASAS, CA 91302

GRACE HUTCHINGS 7379 DARNOCH WAY WEST HILLS, CA 91307

J. LAURITZEN 11000 FARRALONE AVENUE CHATSWORTH, CA 91311

CHARLES LICHTER 18200 KINGSBURY STREET NORTHRIDGE, CA 91326

ANALEE PERICA P.O. BOX 7306 NORTHRIDGE, CA 91327

LINDA JONES CALIFORNIA STATE UNIVERSITY SCHOOL OF EDUCATION NORTHRIDGE, CA 91330

AUGUST BAKENHUS 6167 RESEDA BLVD. RESEDA, CA 91335

PAM GILLETTE 19533 VALDEZ DR TARZANA, CA 91356

PAT AKERS 1583 WAKEFIELD AVE THOUSAND OAKS, CA 91360

RANDEE BORGGREBE THE BUCKLEY SCHOOL 3900 STANSBURY AVE SHERMAN OAKS, CA 91423

WAYNE BACER 11017 PACIFIC ST RANCHO CUCAMONGA, CA 91701

BRETT MACKENZIE BENSON 3335 ORGANDY LANE CHINO HILLS, CA 91709

FOOTHILL COUNTRY DAY SCHOOL 1035 W HARRISON CLAREMONT, CA 91711 DR. GERALD R. VIERS 600 HUNTER'S TRAIL #54 GLENDORA, CA 91740

JOHN ST. CLAIR 1161 WEST 5TH STREET ONTARIO, CA 91762

MARTIN MULDER IMPERIAL JUNIOR HIGH SCHOOL 1450 EAST G STREET ONTARIO, CA 91764

MELODIE MERINO 332 COVERED WAGON DRIVE DIAMOND BAR, CA 91765

LYNN GUSTAFSON CLAIRBOURN SCHOOL 8400 HUNTINGTON DRIVE SAN GABRIEL, CA 91775

JULI-REED WOODSON 3023 VILLA ADOLEE SPRING VALLEY, CA 91978

BARBARA DIMANNO 324 HICKORY HILL DR ENCINITAS, CA 92024

HARRY W POWELL SOLANA BEACH SCHOOL DISTRICT 309 N RIOS AVE SOLANA BEACH, CA 92075

NATIONAL UNIVERSITY LIBRARY 4007 CAMINO DEL RIO SOUTH SAN DIEGO, CA 92108-4188

RICK CAMPBELL FRANCIS PARKER SCHOOL 1501 LINDA VISTA RD SAN DIEGO, CA 92111

JOHN WIENMAN 4253 CAMINITO TERVISO SAN DIEGO, CA 92122

LARRY SOWDER SAN DIEGO STATE UNIVERSITY COLL.OF SCIENCES/MATH SCIENCE SAN DIEGO, CA 92182

ARLENE H WIELAND BOBBY DUKE MIDDLE SCHOOL 85-358 BAGDAD ST COACHELLA, CA 92236

SHIRLEY SHAW VICTOR VALLEY UNION H.S. DIST. 16350 MOJAVE DR VICTORVILLE, CA 92308

DOUG LANE BOX 636 BIG BEAR CITY, CA 92314

CHRISTOPHER MADDY 16121 PITMAN LANE HUNTINGTON BEACH, CA 92647

PHILLIP ZEIDENBERG, M.D. 7402 COHO DRIVE, UNIT 101 HUNTINGTON BEACH, CA 92648

LORIE WATTS 16861 LYNN STREET HUNTINGTON BEACH, CA 92649

JUDITH A. CRUM 335 EAST MAPLE ORANGE, CA 92666

M. RIGGIO YORBA MIDDLE SCHOOL 935 NORTH CAMBRIDGE ORANGE, CA 92667 EDWINA WALSH 1225 SALVADOR DRIVE PLACENTIA, CA 92670

PATRICK W. LEVENS CAPISTRANO UNIF. SCHOOL DISTRICT 32972 CALLE PERFECTO SAN JUAN CAPO, CA 92675

MARGE HOLLAND / COMPUTER L FAIRMONT ELEMENTARY SCHOOL 5241 FAIRMONT BLVD YORBA LINDA, CA 92686

WENDY TURLEY 10908 LA FLOR AVE FOUNTAIN VALLEY, CA 92708

FUTUREKIDS INC OF IRVINE 15415 JEFFREY RD #110 IRVINE, CA 92720

DONNA DAYTON 1483 LA PALOMA DR. CARPINTENA, CA 93013

J. M. JOHNSON 100 PARK AVENUE OAK VIEW, CA 93022

MAX LIPSKY 1250 DRAKE DRIVE SIMI, CA 93065

LIVE OAK MIDDLE SCHOOL 980 NORTH LASPINA TULARE, CA 93274

M. SUEY & J. WILSON TULARE CITY SCHOOLS 600 NORTH CHERRY TULARE, CA 93274

CHARLES ROSENGARD KERN HIGH SCHOOL DISTRICT 2000 - 24TH STREET BAKERSFIELD, CA 93301

BAKERSFIELD CITY SCHOOL DISTRICT 1300 BAKER ST./PROFESSIONAL LIB. BAKERSFIELD, CA 93305-4326

JULIE ANN DAVIES P.O. BOX 782 LOMPOC, CA 93438

DR. ADELAIDE T. ELLIOTT 2990 HEMLOCK AVENUE MORRO BAY, CA 93442

MARILYN SHELTON 140 W SAN JOSE AVE APT 113 FRESNO, CA 93704

KATHY JACKSON 372 WEST HAGLER FRESNO, CA 93711

JUDY CANAVARRO 622 W ACACIA SALINAS, CA 93901

KAM MATRAY 25423 MARKHAM LN SALINAS, CA 93908-9434

TONY DOYLE BOX 613 GONZALES, CA 93926

MARK WOLCOTT SANTA CATALINA SCHOOL 1500 MARK THOMAS DRIVE MONTEREY, CA 93940 JOHN CRADLER, PRESIDENT EDUCATIONAL SUPPORT SYSTEMS 1505 BLACK MOUNTAIN ROAD HILLSBOROUGH, CA 94010

NINA ZOLT 6 OHLONE PORTALA VALLEY, CA 94028

DOLORES LAGUARDIA 1200 DALE AVENUE #114 MT. VIEW, CA 94040

RICK SCHULTZ IMMACULATE CONCEPT. ELEM. SCHOOL 1550 TREAT AVENUE SAN FRANCISCO, CA 94110

ROB MOORE 31 ACEVEDO AVENUE SAN FRANCISCO, CA 94132-2152

DECKER WALKER STANFORD UNIVERSITY SCHOOL OF EDUCATION STANFORD, CA 94305

KERRI FREDERICK P.O. BOX 1255 ALAMEDA, CA 94501

BONNIE MARKS ALAMEDA CO. OFFICE OF EDUC. 313 WEST WINTON AVENUE HAYWARD, CA 94544-1198

SCIENCE EDUC. CENTER / L-793 LAWRENCE LIVERMORE NAT'L. LAB P.O. BOX 808 LIVERMORE, CA 94550

BOB SCRUGGS/MEDIA SER PLEASANTON UNIFIED SCHOOL DIST 4663-A BERNAL AVE PLEASANTON, CA 94566

ANN FARIAS JOHN MUIR MIDDLE SCHOOL 1444 WILLIAMS ST SAN LEANDRO, CA 94577

HOGAN SR HIGH SCHOOL 850 ROSEWOOD AVE VALLEJO, CA 94591

MARGARET P. BELTRAMO 218 WARWICK DRIVE WALNUT CREEK, CA 94598

ANN CANTRELL FARALLON COMPUTING, INC. 2000 POWELL ST STE 600 EMERYVILLE, CA 94608

ROSLYN KIRBY THE GEORGE LUCAS ED. FOUNDATION 5858 LUCAS VALLEY RD NICASIO, CA 94646

JANET C. FISCHER 609 VISTAMONT AVENUE BERKELEY, CA 94708

BERNARD GLIFFORD UNIV. OF CALIFORNIA/SCHOOL OF

3639 TOLMAN HALL BERKELEY, CA 94720

L E TELANDER MARIN COUNTRY DAY SCHOOL 5221 PARADISE DR CORTE MADERA, CA 94925 LAURA ANNE LONDON AUTODESK 2320 MARINSHIP WAY SAUSALITO, CA 94965

TOM MARKUSE APPLE COMPUTER 900 E HAMILTON AVE, MS 73 EB CAMPBELL, CA 95008

SUE COLLINS APPLE COMPUTER, INC. 19925 STEVENS CREEK BLVD 43/H CUPERTINO, CA 95014

JEAN M. SUZUKI WILCOX HIGH SCHOOL 3250 MONROE ST SANTA CLARA, CA 95051

HAGGAI MARK 3434 LAGUNA CT SANTA CALRA, CA 95051

LAURIE EDWARDS CROWN COLLEGE UNIV. OF CALIFORNIA SANTA CRUZ, CA 95064

JOAN T. RANDOLPH 1205 GRANITE CREEK ROAD SANTA CRUZ, CA 95065

MARGE CAPPO WINGS FOR LEARNING P.O. BOX 660002 SCOTTS VALLEY, CA 95067

DOLORES R. LACHMAN 437 CANON DEL SOL LA SELVA BEACH, CA 95076

BADRU HYATT 1610 BOWLING GREEN DRIVE SAN JOSE, CA 95121

MARJORIE HARDING 1425 ALMA LOOP SAN JOSE, CA 95125

IRWIN MALOFF 3012 LAKE ESTATES CT SAN JOSE, CA 95135

KATHY COLEMAN / DELTA SIERRA LODI UNIFIED SPECIAL PROJECTS 2255 WAGNER HEIGHTS RD STOCKTON ., CA 95209

INSTRUCTIONAL MEDIA CENTER SAN JOAQUIN COUNTY SCHOOLS P.O. BOX 213030 STOCKTON, CA 95213

KATHRYN SCHALLER 21147 ARMSTRONG ROAD CROWS LANDING, CA 95313

S. MARY IMPELLIZZERI 1400 EAST 27TH STREET MERCED, CA 95340

RICK EASTERDAY 111 HIDDEN VALLEY COURT SANTA ROSA, CA 95404

ALAN M. GRAHAM P.O. BOX 412 CLOVERDALE, CA 95425

CARL SASSENRATH P.O. BOX 1510 UKIAH, CA 95482

CAROLYN & TED PERRY 5880 OUR WAY CITRUS HEIGHTS, CA 95610 DONNA K OLOVSON 5004 VALLEY WILLOW WAY ELK GROVE, CA 95758

BRIAN S FRAZIER DRY CREEK JESD 5949 MENDOCINO BLVD SACRAMENTO, CA 95824

PATRICIA KALFSBEEK P.O. BOX 388 ARBUCKLE, CA 95912

WILLIAM FISHER CSUC / DEPT. OF MATHEMATICS CHICO. CA 95929-0525

ROBERT E. MANNING EDGREN HIGH SCHOOL PSC 76 BOX 6439 APO AP, 96319-6439

SANDRA L. SIU 45-606 KULUKEOE STREET KANEOHE, HI 96744

EVELYN H HORIUCHI DISTANCE LEARNING TECHNOLOGY P.O. BOX 2360 / BUDGET BRANCH HONOLULU, HI 96804

SEIICHI KAIDA / COMPUTER DEPT. ST. ANDREWS PRIORY SCHOOL 224 QUEEN EMMA SQUARE HONOLULU, HI 96813

HAWAII EDUC DISS DIFF SYS 641-18TH AVE BLDG C #204 HONOLULU, HI 96816

PETE GERUM / ELEM. OFC. THE KAMEHAMEHA SCHOOLS KAPALAMA HEIGHTS HONOLULU, HI 96817

SHEILA KNUTSON THE KAMEHAMEHA SCHOOLS HAMAMALU BLDG /KAPALAMA HTS HONOLULU, HI 96817

DAVID M ROSS 4582 WAIKUI ST HONOLULU, HI 96821

MICHAEL YOUNG MARYKNOLL GRADE SCHOOL 1722 DOLE STREET HONOLULU, HI **96822**

P WILLIAMS PUNAHOU SCHOOL/BISHOP 1601 PUNAHOU ST HONOLÜLU, HI 96822-3336

BRAD KERWIN PUNAHOU SCHOOL —WINNE 1601 PUNAHOU STREET HONOLULU, HI 96822-3336

JAMES PETTY UOG/DIVISION OF MATHEMATICAL SCI UOG STATION MANGILAO, GU 96923

ROBERT T. HALL, JR. DIV. OF MATH SCI. U.O.G. STATION MANGILAO, GU 96923

DEBORA A. DOUCETTE P.O. BOX 5064 / U.O.G. STATION MANGILAO, GU 96923

JUDY UCHYTIL 7440 S.W. 102ND BEAVERTON, OR 97005 MUSE LTD 5200 SW MACADAM STE 250 PORTLAND, OR 97201

CHARLES HADDUCK, DIR. INFO.S PORTLAND PUBLIC SCHOOLS P.O. BOX 3107 PORTLAND, OR 97208

PAT MULLALEY 4024 S.E. ANKENY STREET PORTLAND, OR 97214

INSTR.COMP.CTR. CHILD SERVICES CENTER 531 SOUTHWEST 14TH PORTLAND, OR 97214

BRAD BAUGHER OREGON EPISCOPAL SCHOOL 6300 SW NICOL RD PORTLAND, OR 97223

CAROL QUTUB 7000 S.W. VERMONT COURT #201 PORTLAND, OR 97223

LOWER SCHOOL LIBRARY OREGON EPISCOPAL SCHOOL 6300 SOUTHWEST NICOL ROAD PORTLAND, OR 97223-7599

BRAD C. LEVERING 2224 ROCKRIDGE DRIVE KEIZER, OR 97303

MARY C. PAGE BOYS & GIRLS CLUB OF SALEM 1395 SUMMER STREET, N.E. SALEM. OR 97303

DOUGLAS SUCKLING SANTIAM HIGH SCHOOL/ COMP.CENTER 450 EVERGREEN BLVD MILL CITY, OR 97360

NANCY WEAVER 1213 N.W. NYE NEWPORT, OR 97365

ATTN: LANGEVIN SCIO PUBLIC SCHOOL, DIST. 95-C 38875 N.W. 1ST AVENUE SCIO, OR 97374

IRENE E. SMITH 1304 CITY VIEW, APT. #6 EUGENE, OR 97402

ELLEN SIEGEL 2720 AUGUSTA STREET EUGENE, OR 97403

CATE/RESC. ROOM UNIVERSITY OF OREGON 1787 AGATE STREET EUGENE, OR 97403

MARK A. HORNEY P.O. BOX 3697 EUGENE, OR 97403

DR. DAVID G. MOURSUND 2420 OLIVE STREET EUGENE, OR 97405

DR. STEPHEN KRIOEZBUGH, PRES. SWOCC 1988 NEWMARK COOS BAY, OR 97420

CRESWELL MIDDLE SCHOOL 655 W OREGON AVE CRESWELL, OR 97426 LIBRARY LONE PINE ELEMENTARY SCHOOL 3158 LONE PINE ROAD MEDFORD, OR 97501

MARTIN KARLIN 6326 PIONEER RD MEDFORD, OR 97501

ROBERT MEINHARDT, DIRECTOR JACKSON E.S.D. 101 NORTH GRAPE STREET MEDFORD, OR 97501

LINDA HOBACK, PRINCIPAL ILLINOIS VALLEY HIGH SCHOOL 625 E RIVER CAVE JUNCTION, OR 97523

DEAN A. FLOHR 7627 HIGHWAY 66 KLAMATH FALLS, OR 97603

SARAH CARLSON P.O. BOX 311, VALBY ROAD IONE, OR 97843

JOHN NEWSOM BELLEVUE PUBLIC SCHOOLS 12241 MAIN STREET BELLEVUE, WA 98005

PROFESSIONAL LIBRARY BELLEVUE SCHOOL DISTRICT 12241 MAIN STREET BELLEVUE, WA 98005-3524

ELLEN GLIVA EASTGATE ELEMENTARY SCHOOL 4255 - 153RD AVENUE, S.E. BELLEVUE, WA 98006

LIBRARY BENNETT ELEMENTARY SCHOOL 17900 NORTHEAST 16th STREET BELLEVUE, WA 98008-3242

MIKE MASSENGILL NORTHSHORE SCHOOL DISTRICT #417 18315 BOTHELL WAY, N.E. BOTHELL, WA 98011

MARTHA CLATTERBAUGH 7660 NE 195TH BOTHELL, WA 98011

GARY E. BLOOM P.O. BOX 219 EDMONDS, WA 98020

ELLEN MOSNER, PRODUCT MGR. MICROSOFT ONE MICROSOFT WAY, BLDG 10.2 REDMOND, WA 98052-6399

PACHE RITTERSPACHER SNOQUALMIE VALLEY SCH. DIST.#410 211 N SILVA ST SNOQUALMIE. WA 98065-0400

DANIELA BIRCH ALDUS CORPORATION 411 FIRST AVENUE SOUTH SEATTLE, WA 98104-2871

GRETCHEN HARRELL 5201 22ND NE SEATTLE, WA 98105

PAT GRAVES 2453 E INTERLAKEN BLVD SEATTLE, WA 98112

PHILIP MALLINSON 2422 EAST ROANKOKE STREET SEATTLE, WA 98112 DWIGHT & LOUISE HARRIS 7820 ROOSEVELT WAY NE SEATTLE, WA 98115

ALIREZA ASIAII 720 25TH AVE SEATTLE, WA 98122

JAMES R. KING UNIVERSITY OF WASHINGTON DEPT. OF MATHEMATICS, GN 50 SEATTLE, WA 98195

UNIV OF WASHINGTON LIBRARIES SEIALS DIVISION FM-25 SEATTLE, WA 98195

LAWTON ELEMENTARY SCHOOL 4000 27TH AVE W SEATTLE, WA 98199

DR. LES BLACKWELL WESTERN WASHINGTON UNIVERSITY INSTRUCTIONAL TECH, MS 9087 BELLINGHAM, WA 98225

KENNETH RUSSELL 113 PARK RIDGE ROAD BELLINGHAM, WA 98225-7906

DR. LISA BJORK SOUTH WHIDBEY SCHOOL DIST. 206 P.O. BOX 346 LANGLEY, WA 98260

CHARLOTTE A. WHITE EDUCATIONAL SERVICE DIST. 189 205 STEWART ROAD MT VERNON, WA 98273

TIMOTHY J. LAMAS 6205 - 102ND STREET EAST PUYALLUP, WA 98373

LARRY KUPER 4026 206TH ST CT E SPANAWAY, WA 98387

PATTI BIRCH BETHEL EDUC. SERVICE CENTER 516 EAST 176th STREET SPANAWAY, WA 98387

JAMES A. PRICHRD 1611 EVERETT STREET SUMNER, WA 98390

JOHN ROSMARYN TACOMA SCHOOL DISTRICT 10 601 SOUTH 8TH / INSTRUCT. TECH. TACOMA, WA 98405

SANAA INTERNATIONAL SCHOOL 5728 51ST AVENUE COURT WEST TACOMA, WA 98467

RICK SCHWENKE 3042 CARPENTER LOOP S.E. OLYMPIA, WA 98503

SEV BYERRUM YAKIMA PUBLIC SCHOOLS 104 N 4TH AVE YAKIMA, WA 98902

JEFFREY E. BARRETT 7606 SUMMITVIEW AVE #19 YAKIMA, WA 98908

FREDERICK & JEAN ABEL RR 5 BOX 960 ELLENSBURG, WA 98926-9380

WM. G. ENGEBRETSON KIRKWOOD SCHOOL 403 S. JUNIPER TOPPENISH, WA 98948 STANLEY F. ROBINSON 439 NORTH 4TH STREET CHENEY, WA 99004

DON HORNER EASTERN WASHINGTON UNIVERSITY CSB 202; MS#86 /COMP. SCI. DEPT. CHENEY, WA 99004-2495

LORNA B. KROPP E. 3311 DONORA COURT SPOKANE, WA 99223

GEORGIA TALBERT KENNEWICK SCHOOL DISTRICT 200 S DAYTON ST KENNEWICK, WA 99336

MARK MITROVICH KENNEWICK SCHOOL DISTRICT NO.17 200 S DAYTON ST KENNEWICK, WA 99336

AL BELL, DIR. / STAFF DEVELOPMENT RICHLAND SCHOOL DIST. NO. 400 615 SNOW AVE RICHLAND, WA 99352

BOB MEDINGER LOWER KUSKOKWIM SCHOOL DISTRICT P. O. BOX 305/TAI BETHEL, AK 99559

LEE WAYNE HOMER HIGH SCHOOL 600 E. FAIRVIEW AVENUE HOMER, AK 99603

JOYCE KOPPERT P.O. BOX 32048 MTN. VILLAGE, AK 99632

JIM LEGNER P.O. BOX 1884 SOLDOTNA, AK 99669

DAVID J. PIAZZA BERING STRAIT SCHOOL DISTRICT P.O. BOX 225 UNALAKLEET, AK 99684

BILL MORROW 813 - 5TH AVENUE FAIRBANKS, AK 99701

WILLIAM R MCKEE 418 RAMBLING RD FAIRBANKS, AK 99712-1502

INSTRUCTIONAL SERVICES N.W. ARCTIC BOROUGH SCHOOL DIST P.O. BOX 51, THIRD ST

KOTZEBUE, AK 99752

THOMAS A NASH HC 63, BOX 1221 TOK, AK 99780

SUE KOCYBA P.O. BOX 211088 AUKE BAY, AK 99821



Make This Step Your Next Step.

You've got your new Mac... Now what?

You want to know what those cute icons mean. You need to find out how to use that mouse-thing-a-ma-jig.

You'd like to know how to "empty the trash," and it'd be great to understand exactly what the "chooser" chooses.

By following the footsteps in ISTE's new book, *Macintosh Step* by Step, you'll pick up on all these basic Macintosh operating procedures, plus more—from finding the "power" button to demystifying the little Apple menu in the upper left corner.

And it also teaches you the theory behind Mac file storage and the importance of backing up your data on a regular basis.

In all, you'll find that this simple, illustrated guide will lead you on your way toward becoming a Mac user—not just a Mac owner.

Just call today and make your next computing step a step in the ISTE direction.

International Society for Technology in Education 1787 Agate Street, Eugene, OR 97403-1923 Order Desk: 800/336-5191 Fax: 503/346-5890







ISTE Books & Courseware Order Form

How to order ISTE products advertised in this publication

To order ISTE products advertised in this publication, please find the product(s) in the following list and enter it on the attached form. To receive a free 32-page ISTE catalog with a complete list of ISTE products and services, please call our toll-free order number listed below.

product name	nonmember prices		member prices	
	1-9 copies	10+ copies	1-9 copies	10+ copies
HyperCard for Educators	12.95	10.35	11.65	9.32
Linkway for Educators	12.95	10.35	11.65	9.32
Macintosh Step by Step	11.95	9.55	10.75	8.60

					LX4
Name	Membership	Membership #		ng & Handlin	8
Address			\$0-\$15.99 (subtot: \$16-\$45.99 (subtot: \$46-\$75.99 (subto \$76-\$100.99 (subto	al) tal) tal) otal)	Add \$3.25 \$4.50 \$5.50 \$6.50
Country	State Zip/Post	tal Code	5101 or more Do not indus when car	Le additional sile license j iputing shipping rates.	/% of sub total
TE Bo	oks, Courseware, & Nonmem	ber Subscrip	tions Member	Nonmember	Total Pric
			Add Shipping, based o	SUBTOTAL n SUBTOTAL	+
Payment Options Payment enclosed. (Make checks out to ISTE. U.S. funds only.)			Add additional 5% of SUBTC to P.O. Box, AK, HI	TAL if shipped , or outside U.S.	+
Non-U.S. orders must be prepaid with U.S. funds or credit card.	Add 7% of	SUBTOTAL for GST if shipp	ed to Canada	+	
Exp. Date		If billed with pr	irchase order add \$2.50; if Co	OD, add \$2.75 L PAYMENT	+
Purchase Purchase C.O.D. Yo	Order enclosed. (Please add \$2.50 for order processing. orders not including \$2.50 fee will be returned.) ou will pay UPS the total upon delivery if COD (check	Non-U.S. If you wa ISTE will	orders for Books & Coursev int your order shipped AIRI bill you the additional ship	vare are sent su MAIL, please ch ping charge.	rface mail. neck here.
or cash—I	or in the add of the processing . O.O. or acts only.				

ISTE, 1787 Agate St., Eugene, OR 97403-1923 • order desk 800/336-5191 • fax 503/346-5890

Submission of Manuscripts

Logo Exchange is published quarterly by the International Society for Technology in Education Special Interest Group for Logo. Logo Exchange solicits articles on all aspects of Logo use in education. Articles appropriate to the International column should be submitted directly to Dennis Harper. Advanced articles should be submitted to Mark Horney, editor of the Extra for Experts column. Articles appropriate for the MathWorlds column should be sent directly to Sandy Dawson.

Manuscripts should be sent by surface mail on a 3.5" disk (where possible). Preferred formatis Microsoft Word for the Macintosh. ASCII files in either Macintosh or DOS format are also welcome. Submissions may be made by electronic mail as well. Where possible, graphics should also be submitted electronically. Please include electronic copy with any paper submissions. Disk are preferred, but electronic mail is also welcome. Paper submissions will NOT be accepted.

Send surface mail to: Sharon Yoder 170 Education, DLIL University of Oregon Eugene, OR 97403 Send electronic mail to: Internet: YODER@oregon.uoregon.edu

Deadlines

In order to be considered for publication, manuscripts must be received by the dates indicated below.

Volume 12, Number 2	April 1, 1993
Volume 12, Number 3	July 1, 1993
Volume 12, Number 4	Oct 1, 1993

"Awesome" "Way cool" "Slammin'." **"Totally** there" "Swinging." "Wicked good."

(And these are just the teachers' comments.)

The fact is, whenever we show our three new educational software products to teachers and curriculum coordinators, they get as excited as kids.

And for good reason.

You see, our line of learning software for Macintosh[®] computers gives teachers of grades 4-8 a unique way of motivating their students.

For one thing, **MicroWorlds**[™] products are specifically designed for the classroom. Their flexibility lets students with all different learning styles use what they know to tackle new learning experiences.

What's more, the **MicroWorlds** packages were designed by LCSI, the company known for its award-winning educational products.

Take **MicroWorlds Math Links**[™] - it doesn't camouflage math as some space game. Instead, it lets you link math to art, science, and social studies. Students don't just study math, they think mathematically, using math to develop projects ranging from kaleidoscopes to Navaho textile patterns.

With MicroWorlds Language Art[™] you'll encourage students to explore words and images. Write text in any shape, color or direction. Add effects such as scrolling text, animation. Projects, including Visual Poetry, Ads, Haiku, help you assist students in developing writing skills.

MicroWorlds Project Builder™ gives you the

tools to develop a problem-solving, creative-thinking, learning culture across the curriculum. And features like text, drawing tools, animation, and music give students the tools to create anything from simple ecosystems to dynamic maps.

Plus there's more: Each of these products is offered under LCSI's wellknown site/network license - the most flexible policy available to schools today.

So for information or a free demo disk, call us today at 1-800-321-5646.

We think, like, you'll be blown away.





ISTE BRINGS THE WORLD OF TECHNOLOGY CLOSER TO YOU. LSO

By drawing from the resources of committed professionals worldwide. ISTE provides support that helps educators like yourself prepare for the future of education.

> ISTE members benefit from the wide variety of publications, specialized courseware, and professional organizations available to them.

They also enjoy exciting conferences, global peer networking, and mind-expanding independent study courses.

So if you're interested in the education of tomorrow, call us today.



International Society for Technology in Education 1787 Agate Street, Eugene, OR 97403-1923 Phone: 503/346-4414 Fax: 503/346-5890 Order Desk: 800/336-5191 CompuServe 70014,2117 Internet: ISTE@Oregon.uoregon.edu GTE: ISTE office

WE'LL PUT YOU IN TOUCH WITH THE WORLD.



International Society for Technology in Education 1787 Agate Street, Eugene, OR 97403-1923 Order Desk: 800/336-5191 Fax: 503/346-5890

Non-Profit Organization **US** Postage PAID Eugene, OR Permit No. 63