LOGO EXCHANGE

The Magazine for LOGO Activities Worldwide

University of Virginia
Summer Logo Fellowship Program
1986 - 1987

What is the UVA Summer Logo Fellowship Program?

An opportunity for educators to come to the University of Virginia for a three week summer period of individual Logo related study.

What are the objectives of the Logo Fellowship program?

The objectives are to:
Encourage the development of innovative Logo projects in all grade levels and subject areas
Disseminate Logo projects produced by the fellowship program
Provide fellowship recipients with time and resources for study, work, and growth

When does the fellowship program operate?

The next fellowship period of study will begin June 1987. The application cycle for this period begins in October 1986.

How is the fellowship program supported?

The program is made possible by a series of grants from Logo Computer Systems Incorporated (LCSI) to the University of Virginia. From these grants, support for travel, room, board, graduate credit hours, and a cash award are provided to each fellowship recipient.

Who may apply for the UVA Summer Logo Fellowship PRogram?

Teachers of K-12 students, college and university teachers,and teacher educators who have used Logo on a regular basis for the past year are eligible to participate.

What other qualifications are important?

Fellowship recipients must possess exceptional communication skills and initiative, be able to work well with others, and be highly motivated about the possibilities for using Logo in education.

What is the application process?

Applicants should write immediately to the University of Virginia Summer Logo Fellowship Program, Curry School of Education, Ruffner Hall, Charlottesville, VA 22901, requesting the application forms. Applications will be mailed in late October. Completed applications are to be returned to the University of Virginia before December 20, 1986. A selection committee will evaluate the applications and choose a group of finalists, from which the two fellowship recipients for 1987 will be named.

What are the fellowship expectations?

A Logo fellowship recipient is expected to plan and begin carrying out a self-designed Logo-related project during the fellowship period. Tom Lough, Glen Bull, Paula Cochran, and others will serve as consultants to each fellowship recipient. At the conclusion of the summer study period, the recipient would be expected to submit a reasonable plan for completing the project, and for dissemination of the project.

What is a typical fellowship project?

Projects are conceived and planned by the fellowship candidates themselves. Typical projects could include innovative Logo units related to particular subject areas, teaching or training modules, informal educational research, and course development. Projects carried out under the current series of grants must be based on LCSI Logo products.

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The Magazine for LOGO Activities Worldwide

ISSN 0888-6970　　　　VOLUME 5 NUMBER 3　　　　NOVEMBER 1986

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Cover: The Logo house and heart design was contributed by Carol Goodman, a K-7 teacher of computers at Campbell Hall, an independent school in North Hollywood, CA. The design was inspired by a Logo song published in the November 1984 issue of *The National Logo Exchange* newsletter.

From the Editor

by Tom Lough

Whispering Hope

"Hey! This is what my son has just started to learn in the fourth grade!"

The excited comment was made by one of my students at Piedmont Virginia Community College during the introduction to Logo for my physics classes. "Mine, too!" another chimed in.

This realization gave an extra specialness to the lab activity. In addition to their own personal explorations, the other students delighted in watching what the two "Logo parents" were drawing. A cheer went up when their designs came out on the printer.

Somewhere in Charlottesville, there soon would be a couple of very proud refrigerators! After all, how often have you seen Logo school work of both parents and children displayed side by side?

In itself, the experience was heartwarming. But let's also think about what caused it to happen. In a word, Logo is evolving.

I believe that such events will soon be commonplace. As Logo's use continues to spread (Minnesota has purchased LogoWriter for all its elementary schools, for example), a majority of children in developed countries and a sizeable portion of those in developing countries will have had the opportunity to work with the turtle.

But Logo is also making slow but steady headway in the postsecondary schools everywhere. (I just received a letter from a physics professor in China who wants to incorporate Logo into the curriculum there!) This is aided by the appearance of Logo books with more sophisticated applications. As more and more "adult" courses begin to appropriate Logo as part of the regular medium of instruction, the opportunity for parents and children to consult each other will increase.

Imagine this: Mom is working on an assignment in her college geometry course. She is using Logo to conduct an exploration of angles and parallel lines for a class project. But the internal and external nature of the angles is puzzling when she uses the turtle. When she wants to draw a 120 degree angle, she has to use RIGHT 60 to set it up.

"Whatcha doin', Mom?" The query is squeezed out between peanut butter and jelly sandwich munches. After a brief parental explanation, the 12-year-old Logo "consultant" makes a helpful suggestion. "Why not just turn RIGHT 180 first? Then the LEFT 120 will be the angle you want."

Isn't it a wonderful thing to contemplate? In these times of peril for the family as an institution, Logo can provide an opportunity for a cooperative and enjoyable experience.

In this period of quiet, steady Logo growth, I believe that we will see quiet, steady changes in education, also. No, nothing like a "revolution;" the present system is much too firmly entrenched for that. But, at the personal teaching level, as more and more individuals learn of Logo's potential, changes in attitude, style, and philosophy can be gently encouraged and supported. Not with a bang, but a whisper.

FD 100!

Logo Integration:
Working towards the Ideal

by Dave Chesebrough

David's eyes were telling me that my "guest appearance" to introduce the use of variables held nothing new for him.

Mary Ellen Wampler's sixth grade math group had been challenged to create a FILL procedure to color the different rooms in their Logo created scale drawings. I had planned to use the challenge to bring variables into their Logo use, since we had not presented variables yet. It seemed that these students were way ahead of me.

I stopped and asked, "How many of you are using variables already?" Almost every hand went up. Peter confidently proceeded to show me he had "discovered" how to use variables for length, width, and color in his FILL procedure - something far more sophisticated than we had anticipated.

This is just one of many examples of why Logo has been the language (and educational computer environment) of choice for over four years at Sewickley Academy, in Sewickley, PA. We would like to think we have a model program of using Logo to enhance the quality of education we offer at our school.

No One Said It Was Easy

We have found, though, that it is not easy to reach this point. Implementing the use and philosophy of Logo on a schoolwide basis, as well as tying into the way students use their home computers, is a challenging task, to say the least.

Sewickley Academy is a private N - 12 school outside of Pittsburgh with a population of about 580 students. The school has a part time computer coordinator for the entire school (yours truly), and a part time Senior School computer teacher / coordinator. We have one lab for Lower / Middle School use and two labs for the Senior School, with about a dozen other computers distributed around the school for individual classes, teacher use, and the like. There are enough Apple computers in the labs to provide one Terrapin Logo station for at least every two students. We also use word processors, data bases, science simulations, and other application programs.

Although students are exposed to Texas Instrument's Logo in nursery school and kindergarten, we wait until third grade to start our formal Logo program, combining it with keyboarding skills. Logo "classes" then continue through the sixth grade with sessions for the entire class at least once a week. An early decision was made that all teachers would conduct the Logo computer sessions, with the hope that they would better see how to integrate its use into their classes.

We have struggled through several approaches to supporting the teachers and providing some direction for the Logo studies and investigations. The classroom teachers have received a number of inservice sessions over a period of several years. However, as the program has progressed, it has become evident that teachers who are not immersed in Logo have a difficult time retaining their skills, much less advancing them. As the students have gotten three years of Logo under their belts, some of the teachers have quickly found themselves feeling inadequate, despite their sincere efforts to "stay up."

The Sewickley Solution

The best solution to date has been the development of a team teaching approach, where I act as consulting "Logo expert" and sometimes second instructor in the lab. In addition, I found it necessary to create our own support materials, as nothing on the market was suitable. We wanted activities and resources to support the teachers with guidance in presenting Logo skills, yet continue with the exploratory spirit of Logo as skills were mastered.

The materials I developed begin with a collection of sequenced activities which lay out basic computer and Logo skills in levels, followed by extension activities for each level. These acgivities consist of exploring ideas, project challenges, Logo "tips," and extra skills for those interested students.

The goal is to have each student reach a certain level of competence with Logo skills which are appropriate and comfortable for them individually. Then we want to release the students to explore ideas of their choosing or to pursue project goals. After a period of time when the recently mastered Logo skills have been used to their maximum (from a time or interest standpoint), new skills are introduced and practiced. Then the students are launched off exploring from a new level. We have found that most students stagnate and turn away from Logo without some support, ideas to build on, and direction.

Following such an approach, the most interested and talented students are able to delve into particular challenging areas appropriate to them. At the same time, other students can explore ideas supported at much less involved skill levels. It is neither necessary nor appropriate to constantly push a student to higher skill levels, unless it is of the student's choosing. I am believing more firmly than ever that students should be allowed to explore Logo through its breadth around one skill level, or alternatively through its depth of skills - *whichever suits that particular student at the time.*

Pursuing the use of Logo as an exploratory tool is just one way in which we see its usefulness. We are now starting to get better integration into classwork with our own support materials in place. Last year, one fourth grade class researched Martin Luther King and made a Logo documentary of text and pictures of his life. Each frame of text and the corresponding picture were done as procedures which I organized with a "slideshow" driver procedure. In this class, we used the Logo editor much as a word processor.

A fifth grade math class converted scale drawings of their homes to Logo pictures (using procedures) and then wrote a FILL procedure which filled each room with different colors. A lot of good math and Logo concepts came from this one project. We have had classes make drawings and procedures to match their reading and math activities, and we have other ideas in the works, such as more use of scientific microworlds.

Higher and Higher

We don't stop in the lower school, though. We are making more frequent use of Logo in the science program in seventh and eighth grades. In the past few years, we have completed projects of solar system research for a Logo guide through our planets, used a Logo program for cartography, programmed unit cells of crystals (showing growth), explored a frictionless world (the classic dynatrack), and used little utilities such as temperature conversion procedures.

At the senior school level, we use several weeks of Logo at the start of our structured programming class. Logo enables the student easily to learn modularity, understand the use of an editor, and explore programming concepts with quick graphic response. Teachers at the school are now investigating the use of Logo in the physics and mathematics courses as well. One challenge with the senior school program is to deliver the students to the teachers with the level of Logo competence needed for the style and depth of exploration they would like. We are still grappling with this problem.

Logo at Home

Sewickley Academy is launching an innovative and aggressive program of getting as many Apple computers into the homes as possible to support the innovative uses of computers in our overall program. I am promoting to parents that the Logo language be purchased with every home computer. During the 1985-86 school year, I sponsored several Logo awareness sessions for parents (explaining our use and providing hands on time), and then coordinated a purchase program for the parents. I was able to receive a discount from Terrapin, Inc., for our bulk order. Plans are to continue to expand on this cooperation with parents. We want to have students take their Logo projects and ideas home where they can explore more without the constraints of limited access to school computers.

Our program is still not where I would like it. We are just now becoming creative with the integration ideas. Too many of the teachers still feel weak in the finer points of Logo. Some students get "tuned out" early. We are just now using the complete set of support materials I developed. However, we have come a long way since the start and are working well towards Logo becoming THE exploratory computer language throughout the school.

(Ed. note: Dave made a presentation at Logo 86 about the Sewickley approach and materials. To obtain a copy of the handouts from that presentation, send a long stamped self-addressed envelope to Dave Chesebrough, Sewickley Academy, Sewickley, PA 15143. Also, the Sewickley Logo material is scheduled for publication by J. Weston Walch in early 1987. For more information, call the publisher at (800) 341-6094.)

Dave Chesebrough is the computer coordinator for Sewickley Academy and the author of the Logo Success Kit.

Tipps for Teachers

by Steve Tipps

Fraction Line Frolics

Although fractions appear in many ways in everyday life, the mathematical ideas of fractions, ratios, proportions, and division confuse and distress many students, both young people and adults. During a calculator workshop recently, several students were quite amazed that the fraction 1/2 was the same as 1 divided by 2. But why were they puzzled? What kind of experiences had they had with fractions previously?

Working with fractional areas of pies, cakes, and cookies is effective. I call this level of fraction work nominal. Students learn to name the parts of the whole. Certainly, calling the names has worth. But students seldom seem to get beyond that level. They don't seem to have experiences with ratio ideas, for example. How might Logo be used to provide some more worthwhile experiences?

Last month in "Tipps for Teachers," Logo was used to create fractions and fractional parts of regions. Another way of demonstrating the values of fractions is with a Logo number line. The fraction number line looks like an ruler with many subdivisions. With the Logo fraction tools, students can explore different fraction and different units.

Fraction Line Tools

The first tools which are needed will set the position of the turtle and draw the line. For convenience of most most screen sizes, the line has been made 200 turtle steps long.

```
TO SETUP
CLEARSCREEN
PENUP BACK 20 LEFT 90
FORWARD 100 PENDOWN RT 180
END
```

```
TO DRAW.LINE
SETUP
FORWARD 200 BACK 200
END
```

DRAW.LINE can also be made with the FORWARD.BACK or FB procedure which is variable. This makes the procedure quite useful in other procedures as well.

```
TO FB :DISTANCE
FORWARD :DISTANCE BACK :DISTANCE
END
```

```
TO DRAW.LINE
SETUP FB 200
END
```

After the line is drawn with DRAW.LINE, the next task is to divide the line into equal parts. Two procedures are used for this task. MARK makes tick marks. MARK.LINE creates a number of equal size units along the top of the line. The turtle goes back to the starting place.

```
TO MARK
LEFT 90 FB 15 RIGHT 90
END
```

```
TO MARK.LINE :NUMBER
MAKE "UNIT 200 / :NUMBER
REPEAT :NUMBER [ FORWARD :UNIT MARK ]
BACK 200
END
```
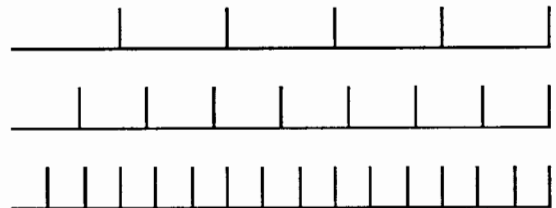
MARK.LINE can be used to mark the line into many units. By changing the color of the line each time, the students can explore the possible multiples.

MARK.LINE 2 creates two equal divisions. Using the command MARK.LINE 4 subdivides the units into quarters. MARK.LINE 8 and MARK.LINE 16 extends the dividing process. Beginning with MARK.LINE 3 or MARK.LINE 7 or MARK.LINE 25 is a demonstration of division by many numbers. Sometimes students fail to understand that fractions and division are not limited to halves, thirds, and fourths.

Fraction Turtle

Exploration of equal units is a prelude to using the turtle to show fraction values on the number line. A new Logo procedure makes the turtle into a fraction turtle.

```
TO FRACTION :NUMERATOR :DENOMINATOR
FORWARD :UNIT * :NUMERATOR / :DENOMINATOR
LEFT 90
FORWARD 10 BACK 20 FORWARD 10
RIGHT 90
BACK :UNIT * :NUMERATOR / :DENOMINATOR
PRINT :NUMERATOR / :DENOMINATOR
END
```

Before using FRACTION, use DRAW.LINE and MARK.LINE to set up a new line. The number of equal units is unimportant to Logo, but, for easy view, the fractions represented by MARK.LINE 2, 3, or 4 might be good.

The FRACTION procedure requires two input numbers to designate the desired fraction. The first input gives the numerator of the fraction and the second the denominator.

> FRACTION 1 2 is one half.
> FRACTION 2 5 is two fifths.
> FRACTION 7 16 is seven sixteenths.

In response to the inputs given, the turtle moves along the line to the value of the fraction of the unit. The size of the unit is taken from the :UNITS global variable set up in MARK.LINE. The turtle makes a mark on the line, then returns to its starting position. Finally, the decimal value of the fraction is printed on the text screen.

```
?DRAW.LINE  MARK.LINE 5
?FRACTION 3 5
0.6
```
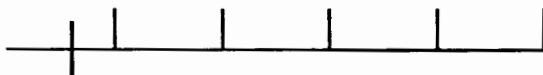

One, More or Less

FRACTION relates the common fraction to a place on the number line to a decimal value. These three aspects make it excellent for comparing the value of the fraction in a visual as well as a numerical way. Students often have a difficult time seeing that 1/2 and 2/4 and 3/6 and 15/30 are all the same value. But the fraction turtle keeps going back to the same place and printing .5 for each one. Values for 1 are also important to explore with a variety of inputs. Students need to see that FRACTION 10 10, FRACTION 13 13, FRACTION 72 72, and the hundreds of others are all equal to 1. Fraction equivalents are one excellent use of FRACTION.

Comparing unequal fractions is another use of FRAC-TION. Often textbooks have a work page which asks students to place "<" (less than) or ">" (greater than) between two fractional expressions. Many students have no feeling for the relative size of the fractions. Before teaching them how to get the least common denominator and multiplying, let them explore inequalities as FRACTION moves along the line. Which fraction is greater or less is determined by the position of the turtle. Before moving the turtle, students can estimate which is the larger value. Then, use the fraction turtle to find out which fraction was larger.

ESTIMATE	EXPERIMENT	REWRITE
1/2 ___ 1/3	1/2 ___ 1/3	.5 > .333
3/8 ___ 1/5	3/8 ___ 1/5	_____
3/7 ___ 4/9	3/7 ___ 4/9	_____
3/5 ___ 4/7	3/5 ___ 4/7	_____
6/11 __ 5/9	6/11 __ 5/9	_____

The decimal values of the fractions are also printed for comparison. The decimal values can be rewritten as another way to express the inequality.

Improper fractions are often confusing for many students. In fact, some students vow that it is impossible to put a fraction such as 5/3 on the number line. They have only experienced fractions with the numerator smaller or equal to the denominator.

With the FRACTION procedure, students are able to see exactly what happens with fractions such as 5/2 or 13/4. They will be surprised and perhaps have to rethink their understanding if the improper fraction requires more units than they have marked on the line.

Where Is My Fraction?

A good guessing game is also possible with the fraction line. Draw a clean fraction line using LINE and MARK.LINE. Then, the PUT.RANDOM procedure zips the turtle to the location of an unknown fraction. The object is to guess the fraction and its decimal value.

```
TO PUT.RANDOM
FD :UNIT * (1 + RANDOM 5) / ( 1 + RANDOM 5)
END
```

The positions in PUT.RANDOM are limited to halves through fifths. Guessing the position may not be too hard after some practice. (Ask students why the 1+ is used in both the numerator and denominator. Is it needed in both places for the same reason?)

There are several ways to check the guess. One way would be to MARK the position, the move back to zero. Then use FRACTION to try to hit the marked position. A ZERO procedure is easy to write. Of course, the zero position is in accord with the original line length of 200.

```
TO ZERO
SETX -100
END
```

Another way to check the fractional guess would be by asking the turtle where it is, fractionally speaking. The WHERE? procedure reveals where the turtle is.

```
TO WHERE?
PRINT [ THE TURTLE IS LOCATED AT ]
PRINT (XCOR +100) / :UNIT
END
```

This value is compared to the fraction printed in a simple PRINT command. If the guess was 3/5 and the turtle was actually at 3/4, the activity would have three parts: putting the turtle in a random spot, printing the value of the guess, and asking where the turtle actually is. Comparison of the fraction input to the decimal answer is beneficial.

```
?PUT.RANDOM
?PRINT 3/5
0.6
?WHERE?
0.75
```

After several guessing experiences, the range of possibilities in PUT.RANDOM could be adjusted to be more difficult.

Fractions, More and Less

Another activity for the fraction line is adding or subtracting fractions. The FRACTION procedure always moves the turtle back to zero on the number line, but PUT.RANDOM stays at the place representing the fraction. A new procedure to maintain the position of a fraction is needed.

```
TO ADD.FRAC :NUMERATOR :DENOMINATOR
FD :UNIT * :NUMERATOR / :DENOMINATOR
END
```

ADD.FRAC 1 4 moves the turtle one fourth of the way along the the first unit. Another ADD.FRAC 1 4 causes the turtle to scoot to the position 1/4 + 1/4 or 1/2. Now the student can add fraction after fraction and watch the result. The result can be estimated on the number line. The exact value can be calculated from the position of the turtle with WHERE?

The location of the turtle is printed in decimal form. Therefore, when you ADD.FRAC 1 2 and ADD.FRAC 1 6, WHERE? produces 0.666667. If the students want to subtract, have them create a SUB.FRAC procedure similar to

ADD.FRAC but with BACK instead of FORWARD. (Or create a MOVE procedure like ADD.FRAC which can be used for adding or subtracting depending upon whether the input is positive or negative.) Use ZERO to get back to zero for a new problem.

To Multiply or Divide

These fractions line tools are intended to extend the experiences student have with fractions. They do not replace concrete manipulatives, but they may allow for more rapid experimentation with many units and many fractions. Repeated manipulation of fractions is essential for firm understanding.

Exploration is not over when students have drawn lines, marked them, seen fractions marked and converted, guessed where the turtle is, or added values. While working with the fraction line tools, students should be challenged how to show multiplication and division of fractions as well as addition and subtraction. I will leave this as a challenge to you now...

Steve Tipps is the West Professor of Education at Midwestern State University in Wichita Falls, TX, and has been involved with Logo since 1982. He conducts Logo workshops for school systems throughout the United States, and is a popular conference speaker. His CompuServe number is 76606,1623.

Teacher Feature

by Rebecca Poplin

Featuring: Paola Williams

Imagine if you can the lovely Hawaiian island of Oahu. On a serene rolling campus in a residential part of Honolulu, there's a beautiful and special pri- vate school called Punahou. Serving a multinational population of about 3700 students K-12, Punahou is a model of computer use and the scene of one of the earliest Logo implementations.

It is in this environment that Paola Williams is the computer teacher / coordinator for grades K-8. Although all Punahou elementary teachers use com- puters and many are experts, Paola is unique in that she spends all of her day working with teachers, children, and computers. In the Kelley Computer Center, Paola works with about 900 K-7 students during the year and consults with eighth grade teachers. She sponsors a seventh and eighth grade computer club which will put out a junior high newsletter (using the computer, of course). As if those jobs don't keep her busy enough, Paola also conducts teacher workshops and develops new curriculum during the summer!

A Productive Summer

It is the summer curriculum development that has been Paola's most recent exciting enterprise. The purpose of the project was to develop curriculum related to math and technology. Working with math teacher Ann Kennedy, Paola incorporated computers and calculators in four special math units. The results of their work are being used in the sixth grade at Punahou this year. They conducted a follow-up inservice in October and will work on adding several more units to the first four. The units include off-computer activities, field trips, and investigations as well as computer and calculator activities and tools. In addition to Logo, Paola and Ann used the PFS: series of applications to enrich the curriculum.

Bull or Bear?

One of the projects was an extensive study of the stock market. Students studied stocks, devel- oped their own portfolios, and charted their pro- gress. The teachers and students developed their own data base using Logo to store information about the stocks they chose. A spreadsheet program they designed calculated percentage of gain or loss.

To Market, To Market

A second unit of study involved a market basket analysis problem. Students visited the computer facilities at a grocery store, outlined the way they would use the spreadsheet, and did a lot of unit pricing. Students discovered much to their surprise that items in convenience stores are gen- erally more expensive than supermarkets despite their smaller size. They also found that the same chain in different locations in Honolulu charges different prices for the same item. Theories about this phenomenon were abundant.

Home Financial Management

Correlated to the market and stock market units was a study of using the computer for management of home finances. Students determined the family structure, decided whether their spouses had careers, and drew jobs out of a box. Then they used computer and calculator programs to unravel the family budget. Not surprisingly, the sixth graders tended to be some- what unrealistic about money, especially about how far it will go.

Dream Bedroom

A fourth project designed during the summer was that of the dream bedroom. Students created bedroom floor plans using Logo and then investi- gated costs of their designs. Comparisons were done between types of floor coverings. Students had to calculate the square footage and analyze the information gathered about floor covering costs to do the comparisons. Paola created Logo tools to assist the

calculations. Most of the students had a swimming pool in the middle of the bedroom floor!

Just the Beginning

The four units in math and technology were so much fun that more are planned. Health appraisal, reaction times, nutritional information, and travel are just a few of the topics Ann and Paola plan to probe. In the meantime, Paola is working with the new LogoWriter software Punahou has purchased. She is developing language arts projects in Logo doing plurals and teaching the computer the rules of English and helping students use a wide variety of tools. If you are interested in further information about the units Paola and Ann developed, please write to:

Paola Williams
960 Honokahua Place
Honolulu, HI 96825

If you know of teachers who should be featured in this column, please write to Rebecca Poplin, 2421 Fain Street, Wichita Falls, TX 76308

Rebecca Poplin uses Logo to teach junior high computing and mathematics in Wichita Falls, TX.

Teaching Tools

by Glen Bull and Paula Cochran

Geoboard Tools

A geoboard is a wooden board with rows of nails or pegs. Rubber bands can be stretched around the pegs to form geometric figures. Geoboards are used as laboratories for the exploration of patterns, length, size, color, and coordinate geometry.

```
o   o   o   o   o   o   o   o

o   o   o   o   o   o   o   o

o   o   o   o   o   o   o   o

o   o   o   o   o   o   o   o

o   o   o   o   o   o   o   o

o   o   o   o   o   o   o   o

●   o   o   o   o   o   o   o
```

Logo can be used to create tools which can facilitate exploration with geoboards. In the example that follows, Logo does not replace the hands-on activity, but complements it.

Precomputer Activities

In one fifth grade math book we explored, coordinate geometry was used to introduce students to the concepts of graphing, symmetrical figures, congruent figures, and similar figures. The book supplied lists of coordinate pairs for students to translate into drawings on graph paper.

An alternate activity would be for students to develop their own figures using a geoboard. A geoboard has the advantage that a line is easily moved to see a different effect. Exploration is encouraged because the points of the rubber band can be shifted to produce a different figure.

After a design on the geoboard has been completed, the pattern of pegs can be translated into a list of numbers (coordinate points) by the students. For example, in the figure on the preceding page, the description of the upper right-hand peg would be of the form [X Y], where X is a number telling how many pegs in the horizontal direction to count from a reference (perhaps the lower left peg), and Y tells how many to count in the vertical direction. These lists of numbers permit students to go from one medium to another -- from rubber bands and pegs to codes on a piece of paper. Going from one medium to another is the equivalent of playing turtle in Logo. Moving your body through the steps that the turtle will take on the screen is a form of associated learning.

There are several ways that this type of learning can be encouraged. One group of students can design a figure on the geoboard and translate it into a list of numbers. Then a second group of students can attempt to use the list of numbers to recreate the original figure. Mistakes can come at two places: in the encoding of the original design into numbers, or in the decoding of the numbers by the second group.

Two groups of children communicating in this way provide a metaphor for more than math. Recent research suggests that cooperative learning can be more effective than individual efforts. The discussion of these efforts can continue into social studies class, and the study of negotiation and diplomacy. Even when all parties are acting in good faith, the original design does not always get transmitted accurately.

The lists of numbers used to code geoboard coordinates can also be used as a means of information storage and retrieval. It is possible to save a particularly good design and recreate it later. The idea of storing favorite figures in a notebook, and reproducing them later extends the idea of shifting from one medium to another. It also shows the power of coding.

After students have worked with geoboards and developed a repertoire of designs translated into numbers, other concepts can be introduced. Students may spontaneously express a desire to change the scale of a figure. For example, can a small eagle be turned into a large eagle? One approach is to tinker with the rubber bands on the geoboard. When a small figure is turned into a large figure, is there is any correspondence between the two lists of coordinate numbers?

A teacher can guide students into these questions, and suggest ways of arranging the figures to make the relationships more evident. With advanced students, the question can be posed: "Is there a reliable method for changing a small figure into a large one?" This leads students in a search for formulas and scale factors which can be used to multiply each number in a list to enlarge the design.

There are a number of other transformations which can be applied. For example, what is required to shift a figure left or right, or up or down on the geoboard? What happens to the coordinates of the figure if this is done? What is required to flip a figure and reverse the direction it faces, or to rotate it 90 degrees? These simple questions are easily expressed in English. Answers may take longer. In the process of searching for them, students may encounter the notions of variables, multiplication and scaling, offset, and a host of other ideas.

Logo Tools: A Third Medium

When the students have developed a number of coordinate lists that represent geoboard designs, and have begun to ponder the concept of transformations such as scale and direction, the computer can be introduced as another tool and used in several ways. For example, a spreadsheet, such as VisiCalc or its successors can be used to reduce the computational overhead in manipulating the numbers.

Logo can also be used to facilitate exploration of geoboards. Thus far, we have discussed two media: rubber bands stretched between pegs on a geoboard, and lists of numbers which represent the positions of the pegs. The graphics screen in Logo provides a third medium.

Here is a Logo tool for graphing a list of coordinates. It consists of two procedures: the master procedure is called GRAPH, with a subprocedure called GRAPH.WORK, which does all of the work.

> If you are using Terrapin Logo, omit the brackets around [STOP] in GRAPH.WORK. You will also need to define the SETPOS procedure found at the end of the column.

```
TO GRAPH :LIST
PU SETPOS FIRST :LIST
PD GRAPH.WORK BF :LIST
END

TO GRAPH.WORK :LIST
IF EMPTYP :LIST [ STOP]
SETPOS FIRST :LIST
GRAPH.WORK BF :LIST
END
```

These are Logo tools. It is not at all necessary that the children understand how the procedures work internally, any more than it is necessary for them to understand the assembly language code that makes up FORWARD or BACK. The tools can be used as though they were built-in commands.

(Many versions of Logo allow a teacher to bury tool procedures.) The procedure works like this:

?GRAPH [[0 0] [15 5] [35 45] [55 5] [70 0] [0 0]]

A list of coordinates can be put in the form of a procedure. This eliminates the necessity of retyping the list every time it is used, and helps with debugging.

TO HAT.LIST
OP [[0 0] [15 5] [35 45] [55 5] [70 0] [0 0]]
END

To produce the same graph as before, type:

?GRAPH HAT.LIST

The coordinate numbers can be printed as well as graphed.

?PRINT HAT.LIST
[0 0] [15 5] [35 45] [55 5] [70 0] [0 0]

Transformations

The figure we provided is a small one. If you want to make it larger, here are some additional Logo tools which allow you to magnify any figure. MAGNIFY.X stretches the figure horizontally, and MAGNIFY.Y stretches the figure vertically.

You need to be careful typing in the commands for the MAGNIFY.X and MAGNIFY.Y procedures. Experiments with our proofreaders have demonstrated that it is all too easy to make a typing mistake with these procedures, and reverse or leave out an FPUT, FIRST, or BF. (In Terrapin Logo, it is necessary to omit the brackets around [OP []].)

TO MAGNIFY.X :X :LIST
IF EMPTYP :LIST [OP [ ]]
OP FPUT (FPUT ((FIRST FIRST :LIST) * :X) BF
FIRST :LIST) MAGNIFY.X :X BF :LIST
END

TO MAGNIFY.Y :Y :LIST
IF EMPTYP :LIST [OP [ ]]
OP FPUT (LPUT ((LAST FIRST :LIST) * :Y) BL
FIRST :LIST) MAGNIFY.Y :Y BF :LIST
END

The magnification tools can be used to change the scale of a figure. For example, to stretch a figure sideways, use the MAGNIFY.X tool. You need to provide as input the amount by which you want to magnify and the list of points describing the object. The following example doubles the width of the hat figure.

?GRAPH MAGNIFY.X 2 HAT.LIST

Stretching the width of the figure can be used to produce some interesting effects. It is like working with Silly Putty. Once students produce a satisfactory change that they wish to keep, the new coordinate numbers can be recorded. Using the PRINT command with MAGNIFY.X also demonstrates that it has doubled the value of every horizontal coordinate. In other words, the number 15 in the second pair becomes 30, the number 35 in the next pair becomes 70, etc.

?PRINT HAT.LIST
[0 0] [15 5] [35 45] [55 5] [70 0] [0 0]

?PRINT MAGNIFY.X 2 HAT.LIST
[0 0] [30 5] [70 45] [110 5] [140 0] [0 0]

The MAGNIFY.Y procedure stretches the height of a figure.

?GRAPH MAGNIFY.Y 2 HAT.LIST

MAGNIFY.X and MAGNIFY.Y can be combined to stretch the figure in both directions at the same time.
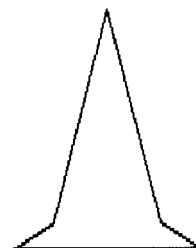
?GRAPH MAGNIFY.X 2 MAGNIFY.Y 2 HAT.LIST
Sometimes you will want to change the horizontal and vertical dimensions of a design by different ratios. In those cases, the MAGNIFY.X and MAGNIFY.Y tools are handy. However, if you want to change the overall size, the SCALE tool combines both MAGNIFY.X and MAGNIFY.Y to change the entire scale of the figure at once, and saves typing, too.
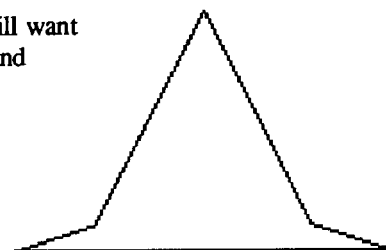
TO SCALE :SIZE :LIST
OP MAGNIFY.X :SIZE MAGNIFY.Y :SIZE :LIST
END

?GRAPH SCALE 2 HAT.LIST

Despite the names of MAGNIFY.X and MAGNIFY.Y, these tools can be used to reduce the dimensions of an object as well as enlarge them. Try them using numbers such as 0.5 and 0.25.

That raises a second issue. You do not have to call the procedures MAGNIFY.X and MAGNIFY.Y. We chose those names because we thought they were descriptive. However, they also require a bit of typing. They could also be GROW.X and GROW.Y or anything else meaningful to your students.

Back to the Geoboard

Once a design has been transformed and changed on the Logo screen, it is time to go back to the geoboard. Students need the new lists of coordinates. These can be obtained using PRINT.

>?PRINT SCALE 2 HAT.LIST
>[0 0] [30 10] [70 90] [110 10] [140 0] [0 0]

These numbers can be copied on a piece of paper. They can also be run off on the printer. This may be useful for elaborate figures which produce long lists of coordinates.

It is important to test the new coordinates with the old medium of pegs and rubber bands. Going back and forth between the medium of the Logo screen and the medium of the geoboard makes the students examine the numbers used to code the transition. In a sense, these numbers are a bucket which can be used to carry the design from the computer to the geoboard. It is also important to go between the different media for the same reason that it is important for a child to play turtle by moving his or her body through space. It is possible to understand an idea in more than one way, and working with different dimensions helps children to make connections. Musicians, artists, and athletes understand that knowing and doing are not the same thing.

Procedures Required for Terrapin Logo

If you are using Terrapin Logo, you will need to type in the following SETPOS procedure.

TO SETPOS :LOCATION
SETXY FIRST :LOCATION LAST :LOCATION
END

If you are using Version 1 of Terrapin Logo, you will also need an EMPTYP procedure.

TO EMPTYP :LIST
OP :LIST = [ ]
END

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TO BEGIN :PROCEDURES

by Elaine Blitman
and Barbara Jamile

"Look what I made!" rings out as children create patterns and pictures with turtle graphics. Wanting to preserve or share this work soon leads to the need for instruction in procedure writing which goes beyond knowing how to use TO and END. To avoid poorly written procedures which resemble a run-on sentence, teach and build procedure writing skills.

Writing Procedures

A well-written procedure is concise, easy to debug, and does a specific job. Some suggestions for good habits:

1. Choose a name that is descriptive and brief. A meaningful name such as TRIANGLE or SAIL is more easily remembered than a nonsense name of ZZXZ or PHEB. Brevity cuts down on typing time. TRI may be preferable to TRIANGLE, or BOAT to EXCALIBUR.SPEEDBOAT.

2. Each procedure should do one specific job. Use of a procedure as a building block for more complex procedures is easier if extra commands are excluded. For instance, FLOWER should contain only the instructions for making the flower. If commands that move the turtle into place or set pen colors are not included, FLOWER can be easily reused elsewhere.

3. Simple, easy-to-read commands make it easier for children to debug procedures. Use REPEAT and subprocedures such as SQUARE whenever possible. Encourage the children to look for the shortest and most easy-to-understand way to write. For example, when placing the turtle, they may find SETPOS [50 50] or SETHEADING 100 FD 70 preferable to something such as RT 90 FD 50 LT 90 FD 50.

Off-computer preparation for procedure writing allows students to work more efficiently at the computer. While some children prefer to explore directly on the computer, and some like to manipulate objects, many students like to use pencil and paper and first draw a rough sketch of their picture on quarter-inch graph paper. The squares approximate 10 turtle steps. By counting the squares, students can more easily estimate approximate distances on the screen when they are at the computer. The turtle twirler (see September LX, page 16) can help determine directions and angles.

Students may also make an "outline" of their superprocedure and subprocedures. For instance, if making an airplane, the superprocedure may be called JET with subprocedures of BODY, WINDOW, RWING, LWING, TAIL, and EMBLEMS. A quick conference to check these plans before a student gets on the computer can save hours of debugging.

If the wait to use the computer is very long, many of these procedures can be tentatively written out on paper. At the computer, the procedures can be entered, tested, and debugged. Once children are aware that plans can be made off

the computer, you may see notebooks full of ideas waiting to be tried when they next "boot up."

Children will soon discover there is no need to recreate previous work if it was saved as a procedure. Periodically saving work also reduces the risk of losing it through power outages, accidental erasure, or crashes. As awareness grows of these advantages, children choose procedure writing as the easy way to do a Logo project.

The product isn't as important as the process of problem solving. It's helpful for the teacher to review the process with students and to point out how techniques can be transferred from one problem to another. Such transference doesn't happen automatically. There are many ways to solve a problem depending on individual style and approach. Encourage students to recognize and share varying viewpoints for problem solving to build understanding of their own experience. This may help to increase the repertoire of thinking skills as well.

Make the Computer Do the Work

Students can use the computer to make their work easier. With LogoWriter, for example, commands can be repeated without retyping. Put the cursor on a line already typed and press RETURN. The turtle follows the same commands again! All of the commands typed since the program was booted are still there to be reused. Move the cursor with the "up" arrow so that the lines scroll down. It's easy to revise a line using <Delete> and inserting new elements.

To help younger children understand how they can recycle instructions, construct a monitor screen from paper or cardboard. Show the "front side" and "flip side" with a window below each to represent the command center. Write the command lines on a separate piece of paper to sandwich between front and flip sides. Pull it up and down in the command window, demonstrating that the commands disappear, yet are still available to use.

These techniques can also be used with Commodore Logo on those commands still visible on the text screen.

Front Side
- - - - - - - ??? - - - - - - -

FD 50 RT 120
FD 80 RT 115
FD 60

REPEAT 5 [FD 20 RT 144]
LT 60 PU FD 20 PD

Command Center

Flip Side

to a
tone 951 40
end

to square
repeat 4 [fd 50 rt 90]
end

FD 50 RT 120
FD 80 RT 115
FD 60

REPEAT 5 [FD 20 RT 144]
LT 60 PU FD 20 PD

Command Center
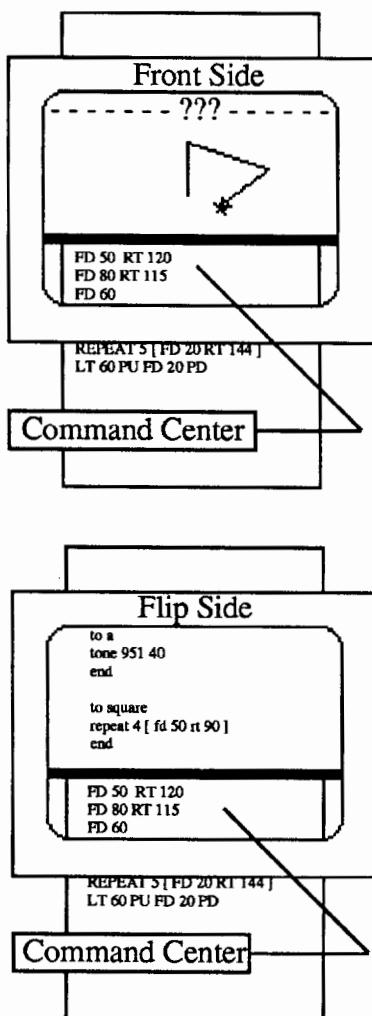
Apple versions allow for the repetition of the last line (Ctrl Y in Apple Logo, Ctrl R in Apple Logo II, and Ctrl P in Terrapin) and revisions of the line before pressing RETURN.

The SELECT, COPY, and PASTE functions are helpful for writing procedures in LogoWriter. Explore a Logo idea in the direct mode. When it works satisfactorily, type (APPLE KEY) 1 to use the SELECT mode. Highlight the command line that will become the body of the procedure. Next, type (APPLE KEY) 3 to COPY the line into the clipboard. Go to the flip side of the page and type (APPLE KEY) 4 and the line that was copied is not PASTEd on the edit screen. Type TO and the name of the procedure, END at the end, and you've taught the computer to do something new.

The computer can be used to calculate directly or within a command. To find the number of degrees needed to draw a polygon with 13 sides, type SHOW 360/13 and the answer will appear: 27.6923. Another way to do this is to type REPEAT 13 [FD 20 RT 360/13]. The calculation will be done and the figure will be drawn at the same time.

We hope that these ideas will be of value as you help your students explore the power of Logo procedures.

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Logo LinX

by Judi Harris

Paper, Process, and Polyhedra: When the Product Isn't a Picture

Did you ever catch a "culprit" with a folded paper "fortune teller" in your classroom? They are constructed (often when you are not looking) something like this:

Start with a square piece of paper, and fold the corners [A, B, C, D] to the center. This produces four more corners [E, F, G, H].
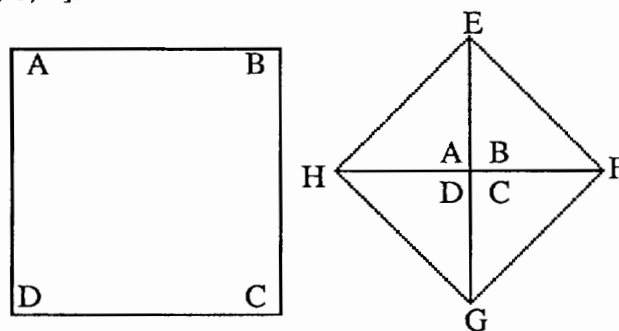
Turn the paper over, and fold the four corners [E, F, G, H] to the center, producing additional corners [I, J, K, L]. Turn the paper back over.
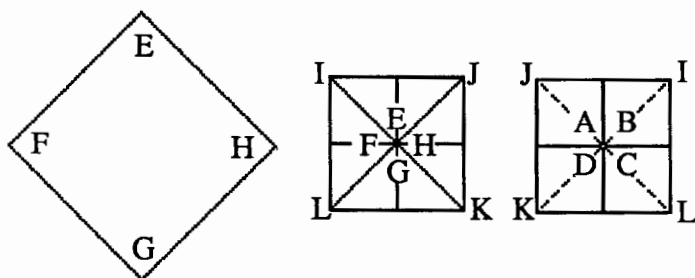
To make the paper figure, push the corners [I, J, K, L] down, while opening up the corners [A, B, C, D]. Once constructed, different sections of the object are labeled with colors, names, numbers, and fortunes. The construction is then consulted (during recess time, you hope) in ritualized counting and question sequences, to reveal the future (or the secret admirers) of the answer-seeker. Traditionally, this folk craft is called "origami," and this particular object is the "salt cellar" or "pig's foot," but to many children, it is simply "awesome."

Add to this popular pastime the paper airplane and the inflatable folded paper box (which can be popped, if you dare, at just the right unsupervised moment,) and you have the basis for disciplinary action -- or a fascinating investigation into the properties of polyhedra, and the transformation of two-dimensional drawings into three-dimensional shapes.

More on the Medium

Does the medium determine the means? The method? The end? Fortunately, it doesn't have to. Logo need not be confined to exploration in two dimensions. In fact, the pictures that students create with Logo don't have to be the endpoint in their investigations; they can be the planning models of later, off-computer construction.

Tests of spatial ability often include paper and pencil tasks which require the test taker to look at a drawing of a three-dimensional object, then choose the appropriate corresponding "unfolded" view. Since so much of required school work is two-dimensional, it is little wonder why these types of activities (presented, of course, in two dimensions) are difficult for children, while the construction of paper airplanes is not. Logo can help to link the dimensions experientially, if it is used as an architectural tool, or model-maker.

I recently worked with a sixth grade class that was immersed in a schoolwide interdisciplinary study called "Shapes, Patterns, and Structures," the brainchild of a most talented science coordinator, Mrs. NancyLee Bergey. These otherwise sophisticated youngsters seemed to have trouble with every kindergartener's favorite activity: building. Since polyhedral constructions are the bases of many organic and inorganic structures (from sub-atomic to macro levels), we planned a sequence of geometric investigations that we hoped

would provide the needed hands-on experience with three-dimensional building, at a level that would be cognitively sophisticated, tactily dependent and, of course, fun.

The Third Dimension

"But my II+'s won't run ExperLogo! How can we work in 3-d at my school?"

All the peripherals you need, really, are a printer and a polyhedra primer. The challenge to the class seemed simple.

"Use Logo to draw any three-dimensional figure, unfolded, in separate or connected pieces. You may use the wooden polyhedra models for inspiration, or you may design your own 3-d shapes. Then print your paper model, cut it out, and construct the shape with tape or glue. If the 3-d object needs adjustment, revise your Logo procedures and repeat the construction until it meets with your approval."

It was fascinating to watch the students cooperatively plan, draw, and dispute such attributes as relative side length, surface area, number of vertices -even volume. They hauled out the scrap paper, calculators, seldom-touched origami kits and paper-folding books to tackle this peculiar challenge. They constructed leaning pentahedra, tetrahedra with uncooperative edges, and partially-crushed cubes (hexahedra,) but also nearly perfect rhombicuboctahedra, truncated octahedra, and hexakaidecahedra, piece by piece.

Soon, the computer center and their classroom were decorated with polyhedra in all shapes, sizes, and stages of construction. The students first used *Polyhedra Primer* (Pearce & Pearce, Dale Seymour Publications, 1978) to identify the objects that they had already designed and assembled, then later as a source of more complicated three-dimensional construction challenges. The multisyllabic names caused many giggles, but also an interest in the relationships between individual syllable meanings and the geometric components of the constructions. Fortunately, the book shows the polyhedra in 3-d form, so that it was a source of inspirations, not solutions.

Logo as Model Maker

All of this activity was framed as a "planning stage" to the students. The next step in the project was to use the model(s) of their choice to help them to reconstruct similar polyhedra with balsa wood and glue or plastic straws with pins or string.

They then were able to manipulate the same edges and vertices of the constructions in three dimensions that they had just commanded the turtle to draw in two dimensions. This new perspective seemed to help them to focus on vertices as meeting-places of angles, which, in 3-d, didn't necessarily sum to the "total turtle trip" that they knew so well. It also seemed to create a heightened awareness of surface area and volume, as many of the groups decided to add tissue paper sides to their plastic straw polyhedra. Mrs. Bergey suggested that they test the strength of their constructions, and the generalizations that they derived about the relationships of structure to stability made the physicist in her proud.

When the End Is the Means

As usual, this adventure was quite instructive for me, too. So many of the turtle graphics projects that I suggested to my students had placed the picture as the final product; that structure had become almost implicit. How refreshing, then, to see the children using the Logo environment as an architectural tool, and a bridge between problem solving in two different physical realms!

Perhaps we need to devote as much thought and energy to the variety of means by which we suggest children solve problems as to the types of problems themselves. Logo itself certainly doesn't dictate a finite set of "appropriate" applications or exploratory methods. It is my hope that the projects described in this column each month have helped, and will continue to help you and your students expand and elaborate upon different methods and topics to investigate through Logo.

Since much of two- and three-dimensional geometry is credited to the ancient Greeks, I'll close with a bit of advice from one of their greatest teachers:

Do not then train [children] to learning by force and harshness; but direct them to it by what amuses their minds, so that you may be better able to discover with accuracy the peculiar bent of the genius of each.

--Plato

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MathWorlds

edited by A. J. (Sandy) Dawson

What Makes a Good Intervention?

The subtitle for this month's column is taken from a paper Liddy Nevile presented at the Second International Conference for Logo and Mathematics Education held this past July in London. Of course, there is not a single answer to Liddy's question. The three illustrations below, however, do provide some "fresh" replies to the question, and in so doing give a few suggestions of how to extend Logo to secondary and college level students.

Isometric Intervention

For the past few years, Liddy Nevile and her colleague, Colin Fox, have been exploring what they call "real microworlds for learning as opposed to those which merely enable users to do neat things." [3, p.201] They have worked at creating convenient and easily accessible means for Australian teach-

ers to use Logo in new ways. They were concerned with creating Logo experiences which would assist students in acquiring an intuitive grasp of mathematical constructions.

Though mathematical constructions may seem trivial to some, large numbers of students seem unable to visualize and draw mathematical figures, thereby limiting their pursuit of mathematics. In response to this, Nevile and Fox designed a microworld for isometric drawing. "Operating it is simple, as there are, at first, six basic actions which generate the shapes." [3, p. 205]

UP DOWN LEFT.IN LEFT. OUT RIGHT.IN RIGHT.OUT
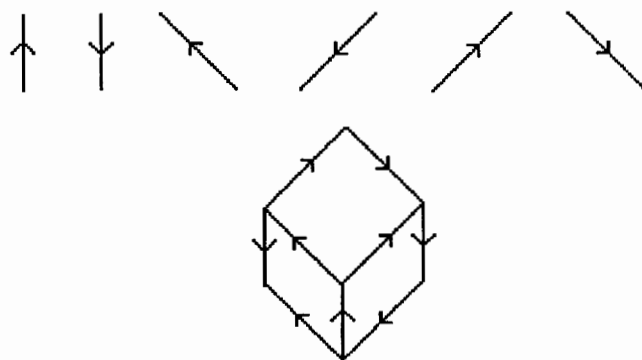
In addition to helping students gain insight into three dimensional objects, Nevile hopes that the use by teachers of such microworlds in the secondary school "... which relate to topics... traditionally difficult to teach, these teachers might feel there will be legitimacy in using Logo for this purpose, and that... they will thus be initiated into Logo." [3, p.207] I hope so too.

Cycloidal Representations

A different kind of intervention was created by Uri Leron and Uzi Armon. They used an experience which many Israeli elementary school children have and transformed it for exploration by secondary and tertiary students. Children in elementary school use trundle wheels to measure distances. While doing this, if they watch carefully the path traced by the mark on the wheel, they would "see" a cycloid.

The question Leron and Armon focused on was "what path is traced by a point fixed on the circumference of a rolling circle?" The title of their paper at the Logo and Mathematics Education conference was, "How to Explain a Cycloid to a Turtle?"[1]

In addition to answering the question, Leron and Armon commented on the issue of local and intrinsic representations versus more standard global and extrinsic representations. Their main point in this regard is that they "...wish to study various representations and the relationships between them, rather than pledging allegiance to one. Understanding is best when we are at home with several representations and can choose at will the one which best suits the situation at hand.

"Of particular interest are methods of moving between standard and turtle representations. Using the powerful

methods of the calculus, we can move from the Cartesian (global) equations to turtle (local) procedures by differentiation.... In some cases, however, there are more elementary ways, that can be interesting mathematical activities with younger people. [Here] ... we develop one such example: a pure turtle procedure to draw a cycloid." [1, p.73]

The two procedures which Leron and Armon derived to generate a cycloid are as follows: [The derivation is given in their article.]

```
TO CIRCLE              TO CYCLOID
CIRC 0                 CYC 0
END                    END


TO CIRC : A            TO CYC : A
IF : A = 360 [STOP]    IF : A = 180 [STOP]
FD 1 RT 1              FD  SIN : A  RT 1
CIRC : A + 1           CYC : A + 1
END                    END
```

Here we have, then, a second "good" intervention to engage both students and teachers in the investigation of some slightly more sophisticated mathematics.

Specialized Tools

The third illustration arises from Patrick Mendelsohn's work in France. Mendelsohn argues that it is oftimes not desirable to have students always begin to learn programming by learning basic commands (such as FD, RT etc.), but for students to instead "...start learning programming by combining high level specific commands." [2, p. 162]

Mendelsohn's report to the Logo and Mathematics Education conference described how he is testing this hypothesis with some 10 and 14 year old children. He created two situations involving higher level specific commands. The situations and one task for each are described below:

Situation 1: Elementary Forms

SQUARE.R   SQUARE.L   SQUARE.M   SQUARE.C

STEPASIDE
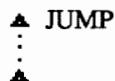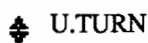
In addition, there is a set of commands to move the turtle to various regions of the screen.

CENTRE   TOP   BOTTOM   LEFT   RIGHT

Rather than creating Logo procedures which draw objects (a prescription), Mendelsohn wants children to work more on describing complex forms. Using the higher level specific commands of Situation 1, students are encouraged to

"describe" the common "hopscotch" figure below. [One possible procedure for describing this figure is provided.]


```
TO HOPSCOTCH
BOTTOM
REPEAT 3 [ SQUARE.M  JUMP ]
REPEAT 2 [ SQUARE.R  SQUARE.L
JUMP SQUARE.M  JUMP ]
BOTTOM
END
```
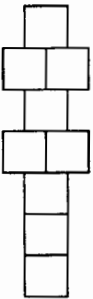
Similarly, Situation 2 forms were used to generate a tennis court, among other things.

Situation 2: Elementary Forms

RECTANGLE.R :SIDE :SIDE2   RECTANGLE.L :SIDE1 :SIDE2
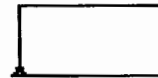
RECTANGLE.M :SIDE1 :SIDE2   RECTANGLE.C :SIDE1 :SIDE2
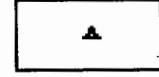
STEP.ASIDE :STEP   JUMP :STEP

Using these elementary forms, children described the tennis court as follows:

```
TO TENNIS.COURT
RECTANGLE.C 100 70
RECTANGLE.C 100 40
RECTANCLE.C  70 40
RECTANGLE.C   0 70
RECTANGLE.C  70  0
END
```
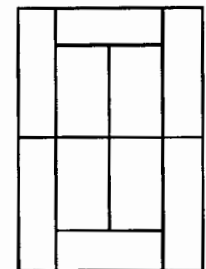

A brief summary of Mendelsohn's results are contained in his article. [2]

Reflections

What conclusions can we draw from the interventions described above? Two of the interventions suggest the use of "non-pure" turtle commands as a way of engaging learners which may enable them not only to gain insight into mathematical ideas (Nevile), but also to provide them with a way of learning programming which does not bog them down in minute, prescriptive details (Mendelsohn).

Both these points are important ones to consider. Perhaps in being "true" to the manner in which Logo was originally conceived, we have lost sight of the learner. Commands like FD and RT may not be the most powerful commands for learners to gain insights and intuitive grasps of mathematical concepts. Higher order commands which allow children to *describe* objects rather than *prescribe* procedures may, in the

long run, produce learners who have a better understanding of mathematical concepts and programming skills. This is a thought worth pursuing and investigating.

Leron and Armon's material does not contradict this, because they are arguing that, at some point, learners should feel equally facile using different representations. In teaching a turtle to draw cycloids, Leron and Armon invite us all back to an understanding of the mathematics behind any description, an invitation we can hardly refuse if we want to bridge Logo and mathematics. Moreover, for me, their Logo procedures to draw cycloids catches some of the aesthetic qualities of mathematics - - simple, elegant procedures which do so much! Elegance in Logo procedures is also a worthwhile goal!

Next month I will talk some more about functions and variables as means of building the Logo - mathematics bridge, a topic Paul Goldenberg explored in last month's column. This time, the focus will be on the secondary school level and how a Logo treatment of functions and variables can mesh with the traditional school mathematics curriculum.

References

Note: All articles below appear in Hoyles, C., et al. (eds.). *Proceedings of the 2nd International Conference for Logo and Mathematics Education*, University of London, July 1986.

1. Leron, Uri, and Uzi Armon, "How to Explain a Cycloid to a Turtle?" pp.72-77.

2. Mendelsohn, Patrick. "The 'Computer Programming Objects' Project: From Prescription to Description of Geometrical Figures." pp. 162-171.

3. Nevile, Liddy. "Logo Microworlds in Mathematics." pp. 201-208.

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SpecialTalk

by Paula Cochran and Glen Bull

Access to the computer keyboard for handicapped children is one of the primary concerns of the educators and clinicians we work with. Alternative access to the computer must be established when use of a standard keyboard is ineffective or impossible.

Sometimes, solving an access problem requires a complex solution. Special diagnostic teams, including physicians, physical therapists, occupational therapists, education specialists, speech-language pathologists, and rehabilitative engineers, are beginning to specialize in recommending and implementing computer based systems to meet the communicative and educational needs of handicapped

individuals. New technology has made access to computers possible for even severely impaired children and adults. And, of course, this includes access to Logo!

It is important to have something interesting to do with the computer after the access problem is solved. Logo is one of the ways to challenge and stimulate children and adults who are using alternatives to the traditional keyboard for computer control.

Sometimes, solving a keyboard access problem requires a very simple solution, such as providing a single switch. We want to describe one such solution in this month's column.

Electronic Conferencing

As some readers know, a group of special educators and clinicians was brought together last summer here at the University of Virginia for an institute co-sponsored by IBM. We are still in touch with each other as we continue to try out ideas from the Institute that needed to be refined in real classrooms and clinics. This interaction is accomplished through an electronic network via computer and modem. The online "discussion" below illustrates how an electronic conference can work.

The following excerpts from our correspondence include directions for adapting a joystick so that it can be used with any switch which terminates in a standard mini-jack.

Basically, this means that if you have a child who can activate a single switch, that child could access a computer. The switch can be plugged into the joystick, and the joystick plugs into the computer (through the game port). Naturally, the group has also been developing Logo programs which take advantage of single-switch capabilities. We will be sharing those as well, in future columns.

Although the directions provided by Carolyn following were written for an IBM PCjr joystick, the technique can be adapted and used with any joystick, as the later comments from Nick suggest.

Wiring a Joystick for Single Switch Use

The cast, in order of appearance:

Bonnie Nelson:	Teacher in a noncategorical preschool program, Mountain View School, Roanoke, VA.
Glen Bull:	University of Virginia.
Carolyn Haykin:	Teacher in a severely / profoundly handicapped classroom, Woodbrook Elementary School, Charlottesville, VA.
Betsy Calvert:	Teacher in a classroom for severely / profoundly handicapped adolescents, The Kilmer Center, Fairfax County, VA.
Nick Lape:	Director of Communication Services, Southside Virginia Training Center for the Mentally Retarded, Petersburg, VA.

Aug24/86   Bonnie Nelson: Carolyn Haykin gave me excellent info on how to wire a joystick. I am reprinting her instructions here. Materials: IBM PCjr Joystick, female mini-jack (socket for mini-jack), solder and soldering iron.

First, drill two holes in the case of the joystick, and insert the mini-jack sockets. (If you are going to need just one switch, just drill one hole.)

Look at where the push buttons come into the case. Each push button has two prongs on the back of it. One button has a green wire and a brown wire attached and the other has a brown wire and a yellow wire. Your sockets have an inner and outer connection. The outer connection is the one opposite the largest prong.

I don't think it matters what you hook to what as long as you run a wire from one connection to the prong with the brown wire and a wire from the other connection to the prong with the yellow wire for one socket. Mine is connected with one socket outer connection attached to the yellow wire prong and inner connection attached to the brown wire prong. The other socket is hooked up inner connection to the brown wire plug and outer connection to the green wire prong.

Don't disconnect the brown, yellow and green wires when you are attaching the wires from your sockets. This is off the cuff, but I hope you can understand it. Let me know if I can help more.

Aug24/86   Bonnie Nelson: Carolyn, I am looking into the joystick, and every thing you said is very clear. My socket prongs are the same size (no inner outer distinction), but I don't suppose this is a problem. MY PROBLEM is my soldering iron seems so big and I keep worrying that I can't get the stuff to land on the wires in that tiny little space down there. I've also come close to heating up a brown or green wire.

Is it possible to take out the black box behind the push buttons, wire the things, and snap them back? Also, did you anchor the sockets to the box before or after soldering the wires? If you answer that you did all this in that cramped interior, please describe the size of the soldering iron you used. Thanks again for your marvelous assistance.

Aug25/86   Glen Bull:

Sailor's Prayer:

O Lord, the ocean is so large
and my boat is so small ...

Joystick-Wirer's Prayer:

O Lord, my solder iron is so large
and my switch is so small ...

Bonnie, I think it's great that you're wiring your joystick. I usually find that it works better if I take things apart before I solder them, but then I don't always get them back together.

P.S. I hear Cheryl Wissick is an expert solderer, if she should happen to visit. Oh, she's coming there this Wednesday! What a coincidence.

Aug26/86   Betsy Calvert: Bonnie- what would we do without the old BULL humor on this system- it really does jolt me out of my 6 A.M. stupor sitting here half asleep typing before I go to work!! Get Cheryl to show you how to solder your joystick and then she can help me when I see her this weekend!

Aug27/86   Bonnie Nelson: WELL I JUST WANT YOU TO KNOW THAT I DID IT. AND IT DOES WORK! First of all you do need to dismantle some of the insides and it's a good idea to look at them from many angles first. Also, I had to buy a smaller soldering iron and smaller solder that would drip down the long skinny iron... Much better than playing chase and find lumps of misplaced, excess solder as I was doing before.

Aug28/86   Glen Bull: Congratulations, Bonnie! It's a very satisfying feeling to know that you've got the capability to modify a joystick, (or whatever) even if you don't ever need to do it again. Looks as though Carolyn's directions are pretty good also.

Three thoughts about soldering:

1. It's best to have an iron with a small, flat tip.
2. It helps if the diameter of the solder is small (as you suggest).
3. If you have a wet sponge handy, use it to wipe the tip of the iron frequently to keep it nice and shiny (so it heats up the connector quickly).

Sep09/86   Nick Lape: Bonnie, I've been playing around with a couple of old joy sticks (found two in an ad for 5 bucks each) myself. I had the same struggles you did but found out a couple of things:

1. You can push the switches out of their casings (push from inside so they dangle outside), do your soldering away from the other wires, and then push the buttons back into position.
2. I used a heat sink (small aluminum scissors looking thing) that I clip between the place I am soldering and the place I am afraid that I'll damage. The heat sink (you can use a pair of pliers but you usually have to have a third hand) absorbs most of the heat that gets away from your soldering job and keeps it away from other joints, etc. Good luck with your switches.

Next month, we'll take a look at using Logo with joysticks and switches.

Paula Cochran is an assistant professor in the Communication Disorders Program of the University of Virginia's Curry School of Education. She is interested in Logo applications for language arts and special populations. Glen Bull is a professor in the University of Virginia's Curry School of Education, and teaches Logo courses at both the graduate and undergraduate level. His CompuServe number is 72477,1637.

LXionary
A Lectionary of Selected Logo Readings

with Commentary and Opinion
by Bill Craig

(Ed. note: Griff Wigley has written the LXionary since March 1984. He is now involved with educational telecommunications. We will miss him at the LX, but look forward to working with him online in the future. Thanks, Griff, for your stimulating contributions over the past two and one-half years! Taking over the LXionary is Bill Craig. Bill reads widely about issues in educational computing, and has a particular interest in Logo.)

I hope that the name of the author is the only change you will notice in this column. I want to continue Griff Wigley's tradition of summarizing timely Logo literature and providing insightful commentary. As Griff did, I encourage you to participate in the column. Therefore, I may provide more questions than answers in my remarks.

In an editorial in the December 1983 / January 1984 issue of *The Computing Teacher*, David Moursund expressed his support of the use of Logo in educational computing. But he also shared some reservations about the way Logo was being "sold" and how it typically was being used. That article should be read by all who train teachers or who supervise computer education programs. You may not agree with Moursund, but you need to consider the issues. Then you are prepared to think about the points that Moursund makes in "Logo Revisited."

>>>"Logo Revisited." by David Moursund, *The Computing Teacher*, March, 1986.

Moursund wrote this editorial after attending the West Coast Logo Conference in November 1985. He mentions that the speakers at the conference made up a "Who's Who in Logo." His most important points include the following:

1. There are three components in training teachers for working in a Logo environment. The first is an understanding of the philosophy of Discovery Based Learning and Individualization. While Moursund believes that most elementary school teachers individualize to some extent (such as for reading groups), few extensively use discovery based methods. The second component is problem solving. Again some teachers involve students in problem solving in parts of the mathematics or science curricula, but these experiences do not dominate most classrooms. The last (and the least?) component is training in Logo hardware and software.

2. Most of the early users of Logo were the teachers who were already involving students in discovery based learning and problem solving . For these teachers, training in Logo hardware and software (the third component) was probably sufficient.

3. The more typical teacher needs training in all three components. The amount of training needed may exceed both a school district's resources and the teacher's time.

4. If we accept the above statements, we need to change our thinking about the way Logo is taught. Logo will be taught only by the few teachers who have the required Logo skills. In other words, Logo is not for all teachers. Moursund believes that there are good instructional materials available for using Logo, but considerable training is needed before most teachers can take advantage of these resources.

Moursund made these points at a West Coast Logo Conference panel discussion attended by Seymour Papert and David Thornburg, among others. He admits surprise at encountering little disagreement with his positions. He was forced to conclude that many leaders of the Logo community believe that Logo is not for everyone and that it is not realistic to expect that Logo will be used as a tool by all students in all parts of the curricula.

I have read this article many times and have had different reactions each time. Let me summarize my most recent thoughts.

It is valuable to define components of a Logo training program as Moursund has. And I believe he is correct in stating that problem solving using a discovery based method is consistent with what is commonly accepted as the "Logo philosophy." My guess is that Moursund is also correct in his belief that this philosophy is what initially attracted most of us to Logo.

But I am disturbed by the assertion that it is unrealistic to spread the use of Logo to a large number of additional teachers. We should not wonder what happened to the revolution if we believe that the use of Logo is the domain of only those who have been previously schooled in and are comfortable teaching with a discovery based problem solving approach.

Moursund refers briefly to the elementary school curriculum by stating that " the overall nature of the elementary school curriculum ... makes discovery learning and individualization difficult." This is a crucial point. I am more optimistic than Moursund that we can provide meaningful training for our teachers. However, I am not convinced that our current curricula are conducive to the types of Logo experiences we envision.

Teachers have the option of changing teaching styles, but few believe that they have the option to change the curriculum. Given that, should we be reshaping our traditional curricula before we attempt to reshape our teachers? Or should we be exploring effective uses of Logo in traditional curricula, with more traditional teaching styles?

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Testudinal Testimony

by Douglas H. Clements

Research on Logo and Social Development

First grader Darius never talked aloud, was slow to complete his work, and had been placed in a "socialization group" to "draw him out of his shell." When the computer arrived, Darius spent nearly 90 minutes with the machine the first day. Immediately thereafter, his teacher noticed that he was completing seatwork without prompting. Then he would slide his seat over to the computer and watch others program in Logo.

A bit later, he stood beside the computer, talking and making suggestions. When others had difficulties, he was quick to show them the solution. Soon, others started getting help with Logo from him. In brief, Darius moved up to the high reading group, skipping the third preprimer. He began completing twice as much work per day as he had previously. He participated eagerly during class discussions and — as a "crowning achievement" — was given a 10 minute "time out" because he wouldn't stop talking (Logo Studies, 1985)!

Are such results merely happy circumstances, or replicable benefits of certain Logo environments? To begin to answer this question, this and next month's columns will review research concerning social-emotional development within Logo environments. This month, we will focus on four fundamental aspects of social competence. Next month's discussion will include the "emotional" side of social–emotional development. The month after that we'll consider the importance of social cognition, or "thinking together." Each month, implications for creating Logo environments that facilitate social-emotional growth will be drawn.

Social Initiation and Participation

Initiation and participation involve children actively seeking and maintaining interactions with the social environment. Consistent with other instructional computing research (e.g., studies of CAI; Clements, 1985; Clements & Nastasi, 1985), it appears that the introduction of Logo environments does not disturb a classroom's social interactional patterns (Bowman, 1985). Fire Dog (1985) surveyed 29 teachers of over 600 students in grades 1-12. Teachers reported that children exposed to Logo programming were more likely to interact with peers. Teachers were clearly in consensus that a large part of the students' benefit derived from the social aspects of Logo, including group problem solving, sharing, social acclaim by peers, and social acknowledgment of expertise or ingenuity.

Interestingly, a profile of the most clearly academically improved students indicated that those who responded most strongly to Logo had certain definable characteristics. They were more likely to be loners or social isolates; they were more likely to be independent and slightly disruptive; and they were more likely to be students whose educational achieve-

ment might be inhibited by factors other than their basic potential. Thus, Logo may present an opportunity to underachievers who are viewed by others as social isolates (Fire Dog, 1985; Logo Studies, 1985).

A large longitudinal investigation of the use of Logo in the classroom demonstrated that Logo can heighten peer interaction (Carmichael, Burnett, Higginson, Moore, & Pollard, 1985). This is even more impressive given that these teachers received little or no technical and curriculum support from the project staff, because the object was to study "normal" educational conditions. (This characteristic, along with exploratory nature of the research, should be considered in interpreting the findings.)

Teachers unanimously agreed that the computer could be a powerful facilitator of social interaction. While extended close contact with the same partner generated tension and conflict in some pairs, when students were asked at the end of the study if they enjoyed working with partners, 78% to 86% of the students responded "yes" or "sometimes." The latter answer probably reflects students' need to work individually sometimes as well as in pairs. When asked if they would also have liked to work alone, 58% to 79% responded affirmatively. Apparently, students desired both the opportunity to share and solve problems together and to control their own activities and test their abilities independently.

Observational research from Bank Street demonstrated that 8- to 11-year-old students tended to talk to each other more about their work when they were doing programming tasks than when they were doing noncomputer tasks (Hawkins, Sheingold, Gearhart, & Berger, 1982). They did talk to each other when working on other classroom tasks (e.g., mathematics or language arts), but the subject of their conversations was often not related to what they were doing. It could not be ascertained what part the novelty or relative scarcity of computer resources played in generating these differences. Similarly, Kinzer, Littlefield, Delclos, and Bransford (1985) found that students working in Logo exhibit more learning-oriented interactions than do those in non-Logo classrooms.

In sum, Logo environments appear to have the potential to facilitate social interaction, as well as positively focus that interaction on learning.

Social Problem Solving

Social problem solving is the ability to apply problem solving skills effectively to real-life situations, reflected in the ability to work and play cooperatively. Several research projects observed collaboration in Logo work. Students in the Bank Street research engaged in more collaborative activity during computer than noncomputer tasks (Hawkins et al., 1982). Hoyles (1984) observed that the longer pairs of 12-year-old students worked together on Logo, the more the students adjusted flexibly to the needs of their partners and the task.

Carmichael et al. (1985) noted that extended pairings may also lead to conflicts. However, they concluded that the computer activities became a powerful medium for developing problem solving skills based on real needs, rather than on

hypothetical situations without any immediate relevance to children.

One study conducted with first and third graders indicated that children work cooperatively more often on computers —with either Logo or CAI drill— than off (Clements & Nastasi, 1985). Interestingly, they also got into more conflicts (possibly because they interacted more). However, children working with Logo, compared to children working with CAI materials, were more likely to resolve these conflicts. Exposure to CAI, in comparison, generated more oppositional and play behaviors in off-computer tasks. After experiencing CAI drill, children might have found their off-computer drill work wanting for excitement!

In a similar vein, Lehrer and Smith (1986) reported that students working together on Logo tasks spent a significant proportion of their time resolving conflicts. Opportunities to experience and resolve conflicts are necessary for the development of social problem solving competencies. Therefore, Logo contexts may enhance the development of specific social problem solving skills.

Social Sensitivity

Social sensitivity is the awareness of others' feelings, a concern for their needs, and a willingness to share and help. Teachers have said that the greatest impact of computers in the classroom is that children tend to help each other more (Becker, 1983). Hawkins et al. (1982) reported that the Logo context was the one where children more consistently identify certain of their peers as resources for help. Clements and Nastasi (1985) found that children working with Logo were more likely to help each other than children working with CAI drill.

This help often takes the form of teaching. Fire Dog's teachers reported that Logo programming tended to increase teaching, consulting, and sharing in students (Fire Dog, 1985; Logo Studies, 1985). Kull (1986) observed first graders engaging to a considerable degree in peer tutoring, often modeling this on their teachers' strategies (and therefore using a guided questioning approach). Such peer teaching sensitized students and broke down traditional grade level barriers, according to Carmichael et al. (1985).

Carmichael also suggested that students using Logo may become more sensitive to others' feelings. Elementary students working with Logo learn to listen, be critical in a constructive fashion, and appreciate the work of others. Although somewhat diffuse and as yet unreplicated, these observations tend to indicate that Logo can positively influence social sensitivity.

Adaptation to Situational Demands

This category includes cooperation or compliance with teacher directions or rules, independent compliance (working alone on a teacher–assigned task), and paying attention to organized classroom activities. Only a few relevant results have been reported. Several reports have cited positive impacts on students' attention span and concentration (e.g., Fire Dog, 1985; Carmichael et al., 1985). Clements and Nastasi (1985)

found that exposure to CAI, but not Logo, resulted in a transfer effect wherein primary grade students exhibited oppositional behavior in off–computer drill and practice tasks.

Summary and Implications

The development of social competencies during the school years has obvious relevance to overall social-emotional adjustment. However, research has shown that it also affects academic success and students' later participation in society. Thus, social development should be a major goal of every educator. It appears that Logo has—at the very least—the potential to serve as a tool in encouraging prosocial interaction, social problem solving, and social sensitivity. What hints can we gather about realizing this potential?

• An important question is: How might children best be grouped for Logo work. Students in Webb's (1984) study programmed successfully in groups of three. Most researchers found that programming in pairs is most advantageous (e.g., Carmichael et al., 1985; Clements, in press; Noss, 1984).

• Some teachers believe that mixed-ability groups are not effective, as brighter children tend to "take over," and some students hide behind their partner's competency (e.g., Carmichael et al., 1985; Noss, 1984). However, there are always exceptions; teachers need to make decisions in each case.

• It is helpful to monitor each pair's activity.

• Children in pairs for an extended time may experience tension and conflict. Flexibility of pairings may be helpful. Weekly student Logo journals that include both cognitive and social reflections helps keep you aware of problems.

• Students should be given time to work alone, as well as in pairs, so to balance interdependent and individual needs.

• It is advisable to encourage cooperation and eschew competition that rewards the first to complete a problem; the latter constrains sharing (Carmichael et al., 1985).

• Even if children do work alone, teachers should encourage interaction. In a study by Strand et al. (1986), the teacher's encouragement of collaboration ("Ask your buddies if you have problems") was instrumental in facilitating peer interaction. Similarly, Leslie Thyberg's "ask three before me" rule has been adopted successfully by numerous teachers. Of course, placing the computers in arrangements such as semicircles may encourage sharing and helping.

It would be desirable for students developed emotionally, as well as socially, due to their work with Logo. That's what we'll look at next month.

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Logo Disserts:
Dissertations Dealing with Logo
by Barbara Elias

What effect does the programming language studied have on teachers' attitudes towards the use of computers in education? This is the focus of a study by Laura Ruth Winer on the effects of learning Logo and BASIC, two of the languages most often used in education. Reported differences between Logo and BASIC, on philosophical as well as technical grounds, may influence teacher attitudes regarding computers.

Winer utilized a method based on Personal Construct Theory to collect data for this study. This method involves using constructs in the design of assessment instruments which come from the target population being studied. Such instruments include those concepts common to the group and are thought to be more meaningful and contextually relevant. In addition, they reduce experimenter bias and subjectivity.

A total of fifteen elements (uses of computers), and fourteen constructs (pairs of terms for bipolar ratings) made up the attitude questionnaire. Elements included simulation, graphics, drill and practice, programming, problem solving, and computer literacy. Examples of constructs are such pairs as involvement / no involvement, active / passive, product oriented / process oriented, complicated / simple, and satisfying / frustrating. Use of the instrument, therefore, would involve consideration of each application of the computer along the several dimensions defined by the constructs.

In a field test of the instrument, questionnaires were distributed to more than 300 inservice teachers at the beginning and near the end of a quarter term. These teachers were enrolled in ten sections each of Logo and BASIC courses at a university. Data were analyzed from 122 questionnaires returned at the start of the courses and from 119 at the end.

No significant differences were found in the teachers' attitudes on the uses of computers examined in this study. On nine computer uses, including demonstration, drill and practice, problem solving, and simulation, no differences were observed. There were, however, some minor differences to report on the other five uses of computers. The Logo group was generally more favorable to computer literacy, graphics, programming, and word processing, while the BASIC group was more positive towards use of computer managed instruction.

Perhaps the most important implication of this study is that teachers appear to be receptive to a broad range of computer applications in the classroom. This provides the potential for applications beyond programming: the use of the computer as a tool for teaching and learning.

>>>Winer, Laura Ruth (1986). *A Personal Construct Theory Based Method for Questionnaire Development: A Field Test with Teacher Attitudes towards Educational Computing.* (Doctoral dissertation, Concordia University, 1986).

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More About LogoWriter

by Sharon Burrowes

Have you yet encountered LCSI's latest version of Logo? If not, you are in for a number of pleasant surprises. LogoWriter provides most of the features of "traditional" Logos while offering capabilities many Logo users have long dreamed of having. (Ed. note: For more details, see the review in the September 1986 LX.)

This article is the first of a series of four that will explore LogoWriter in increasing depth. Each article will be divided into three parts. The first part will contain some ideas for those responsible for training others in the use of Logo-Writer: teacher trainers, computer coordinators, or building specialists. The second part will include some tips for those of you making the switch from traditional Logos to Logo-Writer. The third part will focus on ideas for using Logo-Writer in the classroom. (Since the excellent LogoWriter support materials are designed for middle school students and teachers, this part of each article will include ideas for extending LogoWriter to primary and secondary students.)

Teacher Trainers

If you have the responsibility of training others in the use of Logo, then you have no doubt spent long hours finding or developing appropriate materials. When you open the LogoWriter package, you will be delighted to find ready-made materials suitable for student and teacher alike! In fact, there is so much material that you may not know where to begin.

First, it is important to keep in mind that the center of the LogoWriter print materials is the Teacher's Manual. In order to make maximum use of the package as a whole, each teacher using LogoWriter needs to become familiar with this manual's layout and contents. From this focal point come suggestions on how to use the other materials in the package and ideas for teaching specific topics.

Perhaps the best way for teachers to get involved with LogoWriter is to begin with the first booklet, "On Your Mark, Get Set, Go." Working through this booklet and the associated activity cards gives a solid introduction to the capabilities of LogoWriter. Whenever possible, teachers should also work through the second booklet, "Word Adventures," to become familiar with the text processing capabilities of LogoWriter.

My experience to date is that the above approach is quite sound in familiarizing teachers with LogoWriter. However, a number of relatively minor problems have arisen in the training that we have done. By reading about them here, you can alert those you train. My special thanks for the specific list below goes to my elementary coordinator, Josie Drushal, who is currently dealing with classrooms throughout our school system as they begin using LogoWriter.

1. In general, students younger than fourth grade do not read the booklets carefully enough, and so need a good bit of guidance and attention as they work through the booklets.

2. In "On Your Mark, Get Set, Go," the use of <Esc> to save is introduced before the *Namepage* command. The error message produced by trying to save an unnamed page can be avoided by instructing students to:
   a. Get a new page.
   b. Name the page immediately.
   c. Then proceed with the chosen activities.

3. *Label* can cause problems because text typed in *Label* mode cannot be erased using the *Delete* key. You must type over a letter you don't want with exactly the same letter. Thus to delete the letter M, you move the cursor over the M and type M again! Extra attention needs to be given to this idea before students become frustrated when they make errors.

4. Teachers should be aware that new primitives are introduced on the Activity cards as well as in the Teacher's Manual. Primitives introduced on cards are starred in the manual.

5. There is a large conceptual leap on page 17 of "Word Adventures," when *Select*, *Cut*, *Copy*, and *Paste* are introduced. This is particularly true for students who have had no exposure to word processing. Here is a suggested sequence of activities that may help:
   a. Read over page 17.
   b. Do the first three "light green" activity cards.
   c. Do the Secret Code activity that starts on page 18.
   d. Then do the rest of the activity cards for that booklet.

The LogoWriter package provides some excellent ideas for student projects. However, you will quickly discover that the LogoWriter system works best if each student has his or her own Scrapbook disk. This is especially true when students begin working with the *Shapes* page.

The time involved in preparing a disk for every student can be quite significant. Keep this important logistical factor in mind as you schedule introducing LogoWriter to teachers and students. Think carefully about what type of LogoWriter disk you want to provide for students. The Disk Manager allows you to make four kinds of disks:

1. LogoWriter only
2. LogoWriter with tools
3. LogoWriter with tutorials
4. LogoWriter Scrapbook (with Help page)

It is probably best to make the kind of disk that you want to give students and then use the "Copy a Disk" option on the Disk Manager.

If you do not have the Home Copy license option, you may want to provide Scrapbook disks that contain the tools and/or the tutorials pages. The Disk Manager does not give you that option, but you can make a Scrapbook disk containing whatever files you want and then use the "Copy a Disk" option found on the Disk Manager. (Details on how to create a Scrapbook disk containing Tools and/or Learn pages are given at the end of this article.)

Making the Switch

If you are familiar with any earlier version of Logo, then LogoWriter will undoubtedly challenge you to think in new ways. When you begin using LogoWriter, the first obvious difference is the Command Center. Unlike other Logos (except Macintosh Logo), everything you type is accessible until you clear the Command Center. Your first challenge, then, is to stop typing so much! Keep reminding yourself that you can repeat any command or sequence of commands simply by using the arrow keys to move the cursor over the command you want to use and pressing <Return>. You can also modify any previously typed line and then press <Return> to run it. Once you get used to this capability, you'll wonder how you survived without it previously!

The next feature on which you need to focus is the "Page" concept. As you look at the LogoWriter screen, you see that the Command Center is separated from the rest of the screen by a solid bar. The space above the bar is called the "Page". The front of the Page can be used for graphics and text. Now you can mix text and graphics more freely than ever before! The back of the Page (accessed by the *Flip* key) is used for text only. You can put *any* text there, but if the text begins with "TO" and ends with "END" LogoWriter assumes that you intended to write a procedure. Because LogoWriter does not modify this text, you can even format procedures!

Remember that a Page has two sides, and that the Command Center is not part of a Page. These ideas are important for understanding and using LogoWriter.

The first problem that you may encounter with LogoWriter is likely to be saving. Saving is accomplished by pressing the <Esc> key. There is no explicit "save" command. Keep in mind that the entire Page is saved -- graphics and text on the front, text on the back -- in a single "file" which LogoWriter calls a Page. The Command Center is *not* saved with the Page. Unlike previous versions of LCSI Logo, LogoWriter overwrites a previously saved Page without a warning.

Additionally, you *must* save a page before leaving it. If you are used to "traditional" Logos, you will most likely find yourself pressing <Esc> when you really didn't mean to overwrite your Page on the disk. While this automatic saving feature is excellent protection for beginners, it may be a little more difficult for "old hands" to make the transition. One way to avoid the problem of accidentally overwriting previous work is to immediately change the name of a Page using the Namepage command as soon as you select it. Then, if you save by accident, your original Page won't be wiped out!

In future articles, we'll look at some other specifics that may give you problems in making the transition to LogoWriter. However, one general comment is appropriate now. Don't try to translate all of your favorite Logo projects line for line to LogoWriter. In general, that will lead to frustration. Give yourself some time to get used to the new environment. Often, programs from traditional Logos have shorter, more elegant implementations in LogoWriter once you learn how to use its power.

In the Classroom

If you have never used any Logo in your classroom, then LogoWriter will provide many exciting moments for you and your students. If you have been using Logo, then you will be amazed at how much more easily your students will become involved with LogoWriter. The frustrations students have traditionally experienced, including printing pictures, saving work, and understanding the editor are no longer problems.

If you are introducing the LogoWriter print materials to your students, read the appropriate section of the Teacher's Manual before you introduce each booklet. Some potential problems in getting started are mentioned above in the "Teacher Trainer" section. Take some time to look them over before planing your LogoWriter lessons.

Are you a primary teacher whose students cannot manage the written materials? Don't worry! LogoWriter is quite accessible to very young children. You will simply need to spend some teaching time introducing concepts found in the booklets and on the Activity cards to your students.

However, you might also consider using LogoWriter to enhance the teaching of other subject areas. For example, you could have your students use the word processing capabil- ities of LogoWriter to practice their spelling words. They need only to follow these simple steps:

1. Start LogoWriter and put in a Scrapbook disk.
2. Type NP "their.initials.
3. Type HT
4. Press the <Up> key (see your keyboard stickers).
5. Begin typing!

They will need to know how to use the arrow keys and the <Delete> key so that they can make corrections. Be sure to instruct them that the cursor must be to the right of a letter that they want to delete.

6. When they are finished, they press <Esc>.

You can then check their work on disk and put the corrections on the Page as you check!! Some teachers use the flip side for notes and comments to their students.

If you are interested in a more traditional use of Logo, you might want to enter an "Instant" program for your students to use. To do this,

1. Start LogoWriter and select NEWPAGE
2. Type NP "STARTUP
3. Now press the <Flip> key and enter these procedures:

TO F	TO B	TO U
FD 5	BK 5	PU
END	END	END

TO R	TO L	TO D
RT 10	LT 10	PD
END	END	END

4. Now press <Esc> to save the Page.

When you boot the disk, the page named STARTUP is automatically loaded and students can experiment with turtle movement using F, B, R, L, U, and D.

How about older students? They too become excited about LogoWriter. In fact, LogoWriter is a superb choice for a "computer literacy" class. It provides easy success for students of every ability. Both programming and applications (word processing) can be taught using the same software, so there are no new keys to learn! Don't underestimate the electricity generated as even seniors in high school complete their first "turtle project". Keep in mind that older high school student may have had little or no exposure to computers. They need to experience success and gain confidence if the computer is to become a comfortable part of their lives.

Begin with a simple project, like drawing initials. Using Turtle-Cursor mode decreases the frustration of older students, who may have experienced only coordinate geometry.

Perhaps you feel learning about applications is more important for secondary students. Then begin with the word processor. Have students write a short paragraph and print it ... but mention along the way that you can add graphics. With a brief demonstration of Shapes and Stamp, you will find those paragraphs elegantly decorated!

Be prepared for lots of questions from secondary students ... but also be prepared to encourage them to explore. Don't hesitate to say that you are learning too, and point them towards a manual!

Conclusion

This article has covered a lot of territory. I hope you aren't overwhelmed! If you are like me, you will continually learn more about LogoWriter as you work with it on your own, with students (of all ages), and in the classroom.

In any case, if you have ideas that you think would be helpful to share with others, please drop me a line and I'll include them in future articles.

Happy Logowritering!!

Steps for creating a LogoWriter Scrapbook containing Tools and/or Learn pages.

1. Create a disk containing the files you want (Tools or Learn).
2. Create a Scrapbook disk.
3. Now, you are going to transfer the files one at a time.

Transferring Tools: If, for example, you want to transfer MATHTOOLS,

    a. Select MATHTOOLS from a LogoWriter Master disk.
    b. Take the LogoWriter Master out of the disk drive and put in the Scrapbook disk.
    c. Press <Esc> to save MATHTOOLS on the Scrapbook disk.

Transferring Learn Pages: This is a bit more tricky. First, transfer the two tool pages called "-" and "_" to your Scrapbook disk using the same steps used to transfer Tools above. Now use these steps to transfer Learn pages:

    a. Select a Learn page from the LogoWriter Master disk.
    b. Immediately hold down the <Stop> key. Keep holding it down until the message stopped appears in the Command Center.
    c. Check to be sure that the name of the Page at the top of the screen is the same as that which you loaded. (If it says "Workpage", try again.)
    d. Insert the LogoWriter Scrapbook disk and press <Esc> to save the Page.

Sharon Burrowes is a computer coordinator for the Wooster (OH) Public Schools, and the author or co-author of numerous books and articles on Logo. Her address is 807 College Avenue, Wooster, OH 44691, and her CompuServe number is 73007,1645.

LIFT's
Teacher to Teacher

by James Fry

Computer Science Can Be Fun!

This month's review covers another in the new exciting resources becoming available on Logo. This resource is the first volume of a three volume series at a more advanced level of Logo.

Computer Science Logo Style, Volume 1, Intermediate Programming, by Brian Harvey, 1985, published by The MIT Press, 28 Carleton St., Cambridge, MA 02142. $19.95.

Target Audience: The author states, "This book is for people who are interested in computer programming because it's fun." However, it is recommended that you have some working knowledge of Logo and the Logo editor.

Content: Volume 1 is a series of lessons that have come from Brian's many years of working with computers and Logo. Brian states that his objective for this first volume of the series "is to make the goals and methods of a serious computer scientist accessible, at an introductory level, to people who are interested in computer programming but are not computer science majors." I believe Brian has accom- plished that goal with this first volume.

The programming examples in this series of lessons have been written in Logo Computer Systems Inc. (LCSI) versions of Logo, such as Apple Logo, Apple Logo II, Atari Logo, and IBM Logo. If you have MIT versions of Logo, you can convert most of the examples, except some in the final chapters, so they will work.

Volume 1 contains 15 chapters along with appendices on versions of Logo and hints for teachers. Also included is a general index and a very handy index of defined procedures. The volume contains an exploration of Logo including procedures, variables, predicates, recursion, debugging, iteration, demons, property lists, and data files.

Strengths: Of all the strengths of this volume, the one I prize most is that it makes learning and using a computer FUN! Isn't that what Logo should be about? I remember my very first experience with Logo. I thought, "Now here is something that is really fun to play with and also very intellectually exciting." I think educators forget about having fun with computers and tend to concentrate on what objective they need to meet in the curriculum.

If you are like most people I know working with Logo, you have questions about many different programming techniques. Brian covers many of the more common Logo problem areas in recursion and list processing.

Brian has a few important "words of wisdom" about programming. "The trick in learning to program, as in any intellectual skill, is to find a balance between theory and practice." Do you agree? His book provides the theory; you must do the practice.

It would be a mistake to read this book without ever touching the computer. Likewise, don't be so eager to get your hands on the keyboard that you just type in the examples and skip over the text!

If you are a person who enjoys computers and programming, then this book should be one of your "regulars."

James Fry uses Logo with his Chapter 1 remedial mathematics students at Novi Community School, Novi, MI, and is a co-founder of the LIFT group. His CompuServe number is 76317,565.

East Coast Logo Conference

The 1987 East Coast Logo Conference will be hosted by the University of Virginia, in association with Meckler Publishing Corporation and the Logo Exchange magazine. Scheduled for April 2, 3, and 4, at the Stouffer Concourse Hotel in Arlington, VA, the conference will focus on Logo classroom applications and the extensions of Logo into areas of related technology.

To receive conference details, send your name and address to:

East Coast Logo Conference
Tom Lough
University of Virginia
Curry School of Education
Charlottesville, VA 22903

The Adventures of Jacques and Elsie

drawings by
Linda Sherman

In our September cartoon, Jacques was making a comment to Elsie upon their first encounter with the Logo turtle. Our favorite caption was submitted by Andy David of Chicago, IL.

"Isn't it amazing what a little artificial intelligence will do for a fella?"

In this month's cartoon, Jacques and Elsie observe a rather surprising event. What is he exclaiming as the Logo turtle takes off?
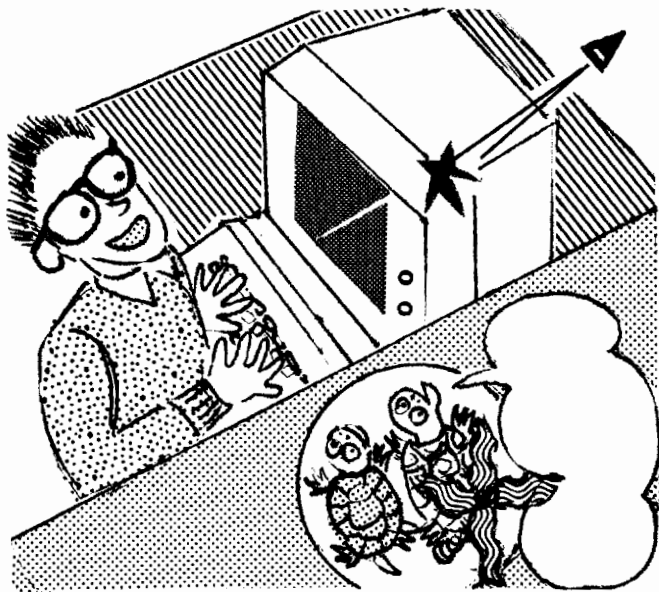
Please send your caption suggestions no later than November 20, 1986 to: Jacques and Elsie, Logo Exchange, PO Box 5341, Charlottesville, VA 22905. Include your name and address so that we can give proper credit should your caption be chosen.

All captions become the property of Meckler Publishing. None can be returned.

Linda Sherman is a freelance author and artist living in Shipman, VA, with her husband and two-year-old son.

Q and A

by Jim McCauley

Q. What is your favorite Logo primitive?

A. What a delightful question! I write about list processing a great deal, since many of the questions that come to me are on that topic. I must confess that my favorite Logo primitive is a turtle graphics operation called TOWARDS.

In case you don't recall (see Robs Muir's challenge in the September LX), TOWARDS accepts a list of two numbers (the X and Y coordinates of a screen location) and returns a number that is the heading the turtle must take to point "towards" that spot.

I love TOWARDS for many reasons. First, it is one of the few *operations* in the world of turtle graphics; most of the other turtle primitives are *commands*. If you have done a lot of turtle graphics with students, TOWARDS is a good way to introduce them to operations.

TOWARDS implies relationship. It makes it possible for the turtle to react to something else in its environment. It is the base upon which simulations are built. The first time I ever saw a student use TOWARDS was in a program that caused the turtle to "hunt" a dot of light jumping about the screen in a random fashion. It was amazingly lifelike. Later, another group of students used TOWARDS to create a program that caused the turtle to behave like a satellite in orbit.

Second, TOWARDS reminds me of an event that taught me a lot about the kinds of choices that professional programmers have to make. It occurred while Atari Logo was being designed. This implementation has four turtles and a very special primitive called WHEN. The WHEN primitive "talked" to special hardware inside the Atari computer that enabled the turtles to detect when they collided either with other turtles or the trails left by the turtles' pens. I had feverish dreams of the nifty projects that would be possible if the turtles could sense each other's positions with POS, chase each other with TOWARDS and detect encounters with one another with WHEN.

I was stunned to hear that TOWARDS would not be included in Atari Logo. I asked Brian Harvey, one of the implementors, about the planned omission. He pointed out that it was an "expensive" primitive, in terms of memory space. All of Atari Logo had to fit into a 16K ROM cartridge, and bytes were at a premium. I confess that I continued to pester him about it, arguing for all the projects that would go by the wayside if it wasn't included. With wonderful patience, he explained that it really came down to a choice: if they put in TOWARDS, they would have to leave out the most important features of the editor! I gulped and fell silent, grateful that I wasn't the person who had to be responsible for such decisions.

It turned out later that TOWARDS could be added to Atari Logo by *writing* it in Logo, as many of you did with Robs' September challenge. Brian was kind enough to send me the code, however, and I wrote several multiple turtle games and simulations with it.

As new versions of Logo come out, watch for several versions that feature both multiple turtles and TOWARDS. (LogoWriter has multiple turtles now, but no TOWARDS; I'll bet a future version will include it.)

If you are fortunate enough to have Sprite Logo for the Apple // or ExperLogo for the Macintosh, try teaching turtles to play tag. It's a delightful project, a great way to illustrate the use of TOWARDS and a fascinating glimpse into students' (and your own) problem solving processes. It is also the source for many other projects, especially simulations (predator / prey behavior, for example). Think about it!

Each month, I will answer a selected question related to Logo. If you have a question, send it along with a stamped self-addressed envelope to:

Jim McCauley
Logo Exchange Q and A
876 East 12th Avenue, #4
Eugene, OR 97401

Jim McCauley is a graduate student at the University of Oregon, studying with David Moursund, and has written Logo articles for many national publications. His CompuServe number is 70014,1136.

IntLXual Challenges

by Robs Muir

Curriculum Vitae

"...the curriculum is nothing less than the statement a (school) makes about what, out of the totality of man's constantly growing knowledge and experience, is considered useful, appropriate, or relevant to the lives of educated men and women at a certain point of time." --Clark Kerr, foreword to *Curriculum*, 1981.

A recent reading of some books focused on the development of university curriculum in America has prompted me (again) to do some thinking about what it is we do in schools each day. After all, universities don't have a monopoly on the problem of codifying and maintaining a comprehensive course of study. The only difference in this regard between the pre-collegiate world and the post-secondary one may be in the degree in which the faculty has any influence in shaping the institution's offerings.

If we accept the premise that curriculum is curriculum at all levels, apply some of the following quotes to our daily lesson plans in first grade or tenth grade. Why do we teach what we do? How much of what we teach is truly relevant? More importantly, at least for the readers of this journal, where does Logo fit in the curriculum?

In his inaugural address as president of Harvard in 1869, Charles William Eliot stated, "The university (curriculum) must accommodate itself promptly to significant changes in the character of the people for whom it exists. The institutions of higher education ... are always a faithful mirror in which are sharply reflected the national history and character." (Given the current popular perception of contemporary education, a cynic might consider this a resounding condemnation of modern culture!)

For those of us who are Logo activists, here's one to reflect on from a recent historian of Indiana University. "The curriculum reflects the society ... it does not significantly affect or change that society." Hmmm.

On the other hand, "The university has exerted a formative influence upon society: as the matrix within which the culture of professionalism matured; as the center to which practitioners trace the theoretical basis of knowledge upon which they establish authority; as the source of a usable history, economics, political science, and sociology for individuals who in the course of rapid movement require instant ideas."

With such a confusion about the relationship of "what we teach" to "who we are," I wonder what to make of that looming discipline, COMPUTER SCIENCE.

I hope things are better where you are. Here in California, we still haven't defined what high school computer science is, even less what skills a teacher must have to be qualified to teach computer science! And, heaven help us, there are lots of high schools faining to offer a body of courses purported to constitute computer science. Currently, the state (so much for faculty input!) recognizes only mathematics or business certificates as valid for teachers of computer science. More comprehensive guidelines are promised!

I expect that the competencies for high school computer instructors will be modeled around some perceived view of collegiate computer science. Never mind that universities aren't sure whether computer science is a "high tech trade school" designed to churn out workers for hungry corporations or a discipline best classified as a "pure" science.

With all this, I've finally decided why *I* want to introduce students to computers. It's decidedly not so they can learn "times tables" more efficiently or do well in the AP test in computer science. (Yes, Virginia, there is an ETS.) I want to see computers in schools because ... THEY ARE FUN! I know it is an unprofessional reason, but, darn it, isn't that why we got hooked on computing engines? Isn't that why you spend so much time in front of your monitor?

The Far Side of Fun

Enough of the stuffed shirts! Let's put some fun back in educational computing! This month's challenge is a call to arms for all fun-loving Logophiles.

What is the antidote to an overdose of serious, efficient, structured computer science?

Answer: Humorous, purposefully inefficient, intentionally unstructured programming.

How do you put the fun back in flowcharting?

Answer: You can't.

But if debugging is an important part of learning, surely there is some value in intentionally making mistakes to illustrate some aspect of good programming style. What is the most poorly written Logo program you've ever seen from your students? Or from yourself? Here are some examples.

How not to draw a square:

```
TO BOX
SETPOS [ 0 0 ]    SETPOS [ 50 0 ]
SETPOS [ 50 50 ]  SETPOS [ 0 50 ]
END
```

Turtle graphics BASIC style. Whatever you do, don't try to rotate it. Now go wild with a circle.

```
TO CIRCLE :SIZE
LABEL "WILD
PU RT 0.5 FD :SIZE PD
FD 1 BK 1  PU BK :SIZE PD
IF HEADING = 0 [ THROW "TOPLEVEL ]
GO "WILD
END
```

Here's a Logo parody of structured programming. Remember, always declare and initialize variables.

```
TO BOX :X :Y
; BEGIN
; Use lots of REMarks.
; Declare the variables
MAKE "EXDIST 0  MAKE "WHYDIST 0
; Set initialized variables to starting values.
MAKE "EXDIST :X  MAKE "WHYDIST :Y
DRAW.BOX :EXDIST :WHYDIST
; END
END

TO DRAW.BOX :EX :WHY
; Proper indentation is important for readability.
REPEAT 2 [    FD :WHY RT 90
              FD :EX RT 90 ]
END
```

A culture is built around shared beliefs, experiences, and attitudes. The Logo culture is no exception. What is your contribution to wrongheaded Logo? Send your program, real or invented, to IntLXual Challenges, c/o Robs Muir, 1688 Denver Ave., Claremont, CA 91711. We'll put them all into a Logo booklet (The Worst of Logo?) and distribute them to all contributors, just for fun. Please include a self-addressed, stamped envelope.

Remember, the curriculum to teach tomorrow may reflect the culture you build today. Or is it the other way around?

Robs Muir is a physics and computer science teacher in Claremont, CA, and an instructor at the Claremont Graduate School. His Bitnet address is MUIR@CLARGRAD and his CompuServe number is 70357,3403.

International Logo News

Dennis Harper
Logo Exchange International Editor

Global Comments
by Dennis Harper
Institute of Education
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Singapore 1025, Republic of Singapore

North America and Australia are certainly different places than Africa, but how different are Logo users throughout the world? The North American and Australian columns discuss Logo conferences and issues such as research, cognitive theory, and Logo publications. The African column reports on a six-week Kenyan project that introduced Logo to junior high school students. When I read the African column, it took me back to the "olden times" of Logo, times when teachers first discovered Logo and told of the enthusiasm it generated. It was refreshing to read about a school just learning Logo and struggling with its structure and philosophy.

Last month, I began a series of discussions about problems of implementing Logo into developing nations. In the October LX, the problem of teacher training was addressed. This month, I would like to take a look at conditions in educational hierarchy that often lead to problems in implementing computers into education. Although some of these conditions are present in all countries, I will emphasize problems that are especially persistent in developing nations.

I suppose money can be blamed for much of the "evil" happening in ministries of education. Educational administrators and decision makers in developing countries generally have salaries far below those in the developed world. Educators throughout the world generally earn less than those in the private sector. When a computer company offers to send, at no cost, a ministry official in charge of coordinating the nation's educational computing effort to the US or Europe or Japan for a "conference," they may be giving this person something he or she normally cannot afford. Giving free computers or software, lavish meals, free loans of equipment to conduct workshops, etc., has the tendency to make the official beholden to that particular company. Once the company convinces the official that this country should use only its brand of hardware or software (everything must be standardized you know), the country is well on its way to many problems. With the competition quieted, the company is free to sell off outdated machines and programs. Newer equipment and better programs from other companies cannot be used because they are not compatible.

This is happening on a vast scale throughout the world. I have heard on many occasions the statement, "We owe them something. Look what they have done for us." Of course, the ministries of education owe to only one group -- the children who will be the future of the nation. However, when you are earning $800 per year and basking at a Hawaiian conference using your new portable computer, it may be a bit hard to think about or care about what is best for the children or the country.

Other problems include bickering and jealousies that can occur in ministries. Being in charge of software, hardware, facilities, training, etc., are all part of typical political power grabs. Helping students learn how to use computers becomes secondary to saving face and keeping one's domain and "power" intact.

Few developing countries have a national plan for computer education (actually I don't know of any, although some are working on it). Communications between the schools, teacher training colleges, and ministries are often nonexistent. Plotting to have your chosen machine or software used, taking glory for your teacher education program, or secretly guarding your plans for advancement and power do not foster good communications.

The answers to these problems could be in the teachers and students themselves. In the US and some other countries, the teachers and kids have a say in what they want to do. In many centralized education systems, the government tells the teacher what to teach, which computer to use, and what to do with the computer. This snuffing out of the creative potential of the teachers and students may well have disastrous effects on the country's ability to survive in the information age of the 21st century.

Dennis

Africa
by
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This month's African column will report on a Logo experience recently conducted at the Aga Khan Academy in Kenya. The report that follows was written by Mubina Hassanali Kirmani, a Kenyan Ph.D. student at Harvard University's School of Education. She received a grant from the Aga Khan Foundation to carry out the project.

For those readers unfamiliar with the English school designation, form 1 would be equivalent to seventh grade (12-13 year olds). Junior forms (form 2) would be equivalent to junior high school or middle school (12-14 year olds).

For more information about this project, contact Mubina Hassanali Kirmani, 11 Peabody Terrace, #6001, Cambridge, MA 02138, USA.

Logo in Kenya

The goal during the six weeks summer internship at the Aga Khan Academy was to introduce Logo and word processing to junior forms. The following actions were performed:

- Introduced Logo graphics to two of the form 1 classes.
- Conducted word processing sessions in all of the form 2 classes.
- Conducted Logo sessions with the math teachers.
- Conducted word processing sessions with the language teachers.
- Gave occasional word processing sessions to teachers and students from the French and Kiswahili departments
- Viewed and evaluated USA software with teachers from math, English, French, Kiswahili, physics, and geography departments.
- Introduced Logo to the art department, and to senior students in form 3 to assist in the preparation of Logo project for the school Open Day.

Methodology: The initial pedagogical approach was aimed at implementing Logo as a tool for creative and critical thinking. Students would be given an opportunity to select and develop their own styles of problem solving.

The main constraints for using an exploratory method for Logo were the limitation on time, accessibility of computers, and the need to complete the syllabus. It became necessary therefore to relate Logo to the scheme for math planned by the teacher for those six weeks.

Two approaches were attempted, one with each of the two form 1 classes. One included teaching of pure Logo programming by the intern. In the other, Mrs. Charaniya, the math teacher, integrated Logo into the teaching of mathematical concepts laid in the syllabus. Mrs. Charaniya observed the lessons conducted by the intern. Each lesson was followed by meetings to discuss how the math teacher could proceed

with the integrated approach in the next class. A total of three lessons per class were conducted each week. Three computers for the class of about 35 students were made available for each Logo session.

The lesson format followed by the intern was:

- The introductory part of the lesson gave an opportunity to different students to set up the computers in the classroom to get them acquainted with technical aspects.
- The next part of the lesson focused on instruction on Logo. Concepts, such as procedures, variables, and recursion, were introduced.
- Logo problems based on the new knowledge were assigned to student groups.
- The last few minutes of the lesson were spent disassembling the equipment and taking it back to the computer laboratory.

A similar method was used by Mrs. Charaniya in the other class except that she related Logo to various topics in mathematics. She also covered this material during some of the other lessons in the week with the class taken by the intern. While the students worked on projects, the role of the intern and the teacher was to move from group to group observing and providing support when necessary.

Analysis of the effects of Logo: A general impression that both teacher and the intern formed of the Logo sessions was that initially there was a mixed reaction from students to the new technology. The first half of the project went slowly, but, as students gained confidence, they increased their pace of work.

After the Logo sessions, the math teacher commented that certain geometrical concepts such as properties of regular polygons and three dimensional figures, which are generally found difficult to teach 13-year old students, could be more effectively communicated through Logo.

Drawing with the turtle exposed students to a different kind of experience compared to drawing with geometrical instruments. Many of the students were observed twisting and turning their bodies to take the perspective of the turtle in order to get the correct angles of the figures. They were learning to solve problems through putting themselves within geometrical situations.

Initially, students were afraid to make mistakes. As they gained proficiency in using the editor, they worked more confidently, quickly getting into the editing mode to debug their programs. The editing potential of Logo made them more relaxed and they could afford to amuse themselves with their "mistakes." A classic example was an African hut project where, instead of making the turtle turn 30 degrees at the top corner of the square, they directly called up the triangle procedure to draw the roof.

Recursion proved to be very creative and a fascinating topic for most students. The turtle created complex graphics, quite unlike what the students had anticipated from their simple programs. Out of curiosity, some groups attempted different recursive programs with different angles. They watched the screen intently as the turtle traced beautiful patterns. When

overwhelmed with what they had created, they drew the attention of the teacher and the intern. A great amount of pride was shown in demonstrating the successful programs. There was also a tendency for students to move from group to group to peer at what was happening on the screen.

Problems: On the whole, students were found to be receptive to new concepts. Logo got them engaged intellectually and physically. At the end of the six weeks, the math teacher concluded that it had indeed proved to be a positive experience, both for her and for most students. However, there were some problems and issues raised during the project. The problems that were encountered can be broadly classified into space, time, social organization, and teacher's role.

One of the major problems that was faced was a shortage of space in the computer room. There was no way of accommodating the whole class and no other arrangement for a bigger room could be made. This meant having half the total students in their classroom. This brought concerns by teachers on how the two groups of students could be managed. There was also the issue of discipline of the group that was left unattended. A teacher could also not be immediately available in case an individual or a group required guidance.

Though it was a useful exercise for students to learn to set up the equipment, it proved to be too time consuming during Logo sessions. A total of almost 7 to 10 minutes was used at the beginning and end of each lesson. Assigning double periods for Logo would have perhaps eased the problem.

There being a shortage of computers, it became necessary to limit the time each group had at the computer. Students therefore had to work under great time pressure. The students with incomplete tasks were expected to resume during the following session and this disturbed their continuity of work.

Working in groups around the computer provided a rich environment for peer interactions and learning. However, there were some instances observed which brought about questions on some of the effects on learning through group work.

During Logo sessions, for example, those students who were more capable of operating the computers tended to dominate the keyboard. There were also cases when students with high mathematical ability quickly calculated and responded to the correct numerical input that had to be given to make the turtle react in a certain way. The slow learners were, therefore, deprived of producing solutions at their own pace. Attempts were made to make sure that all students in a group had an equal opportunity at the keyboard. Advanced students were seen at times being frustrated by slow learners. The problem was partly solved towards the end of the project by reor- ganizing groups so that students with equal abilities were grouped together.

As teachers began to use the interactive technology in their lessons, they were faced with a wide variety of questions. What would be an appropriate teaching strategy to effectively integrate computers into the classroom? Should it be exploratory, structural, or a combination of both? We wondered how to determine what areas would be and would not be beneficially taught through the computers and how to organize individual and group activities. What would be the best strategy for supervision? How can teachers keep track of feedback? How much of feedback should come from computers and how much of it should be received from teachers? Are work and record sheets necessary, and if so, how should they be developed? What evaluation methods should teachers use in order to determine the effects of learning at the computers?

Suggestions for future work: The work during the six weeks concentrated mainly on the teaching of geometry. Math teachers have, apart from the graphical aspects of Logo, been exposed to the advanced functions of numbers, words, and lists which could be well applied to teaching arithmetic and algebraic topics.

Useful sessions in Logo are presently being provided after school hours by the head of the math department. An exploratory approach may be incorporated during this time to allow individual students to develop their own styles of problem solving.

Programs to teach Logo to teachers and students in other departments may prove valuable. Where applicable, the programming potential of Logo can then be used to develop software for different subjects.

An attempt was made to use Logo during art and craft sessions in the school, followed by an exhibit on how graphics can be used to create African textile designs. Further attempts should be made to explore uses of Logo in other disciplines.

Logo is a fun language. It is also a language which makes it possible to understand the thought processes of a learner. With this consideration it may be worthwhile to organize sessions where students and parents are encouraged to work together. This would help parents get a better understanding of their children's learning abilities and may consequently provoke interests in other areas of schoolwork. Sessions may be organized during weekends when computers can be made available.

In conclusion, the overall progress obtained under the guidance of the director, Mr. Brian Wray, was impressive. Even before this project, teachers had begun to use computers as a tool for teaching in their classrooms. It was a challenge to work with teachers, many of whom, apart from being receptive to the innovation, had gained an ability to decipher the difference between beneficial and not so beneficial applications, and could critically view the long term applications of such a technology on education. There was always a high demand for computers both from students and teachers: a clear indication that a strong momentum had picked up.

Logo New Year's Party

Been looking for something to do during the New Year's holiday? Why not attend the British Logo User Group New Year Party? It will be held December 30, 1986, through January 2, 1987, in Dundee, Scotland. For details, write to K. R. Johnson, AAAI, University of Edinburgh, Edinburgh, Scotland EH1 1HN, or call (+44 31) 225-4464, ext. 212.

Australia
by
Anne McDougall
Faculty of Education
Monash University
Clayton, Victoria 3168 Australia

Australia's annual national educational computing conference is organized by the Australian Council for Computers in Education, and hosted by the computer education group of a different state each year. The Fourth Australian Computers in Education Conference, with the theme "Computers in Education: On the Crest of a Wave?," was hosted by the Computer Education Group of Victoria and held in Melbourne August 24-27.

The "Crest of a Wave?" theme led to some wonderful graphic work for the conference posters, registration booklets and so on. The design shows a (very Australian?) beach scene, with swimmers and surfers, using various means of support, riding the waves towards the shore. On the sand are many adults basking in the sun, while around them children are busily building sand castles, some of them shaped remarkably like computers. And, of course, in the foreground, moving steadily across the scene, is a turtle!

Australia has had a National Computer Education Program for 1984-86. This funding, combined with that from state education departments, has resulted in unprecedented growth in educational computing throughout the country for several years now - a wave of activity of a magnitude rarely seen in educational innovation. This wave has gained its energy and momentum from a variety of social, political, industrial, and educational sources, and as the three-year period draws to an end, it seems appropriate to examine our situation as we ride "on the crest of the wave." Are we surfing strongly there, in control of our movements, speed, and directions, or are some of us being swept along somewhat more quickly and with less control than we would like? Not all of us want streamlined surfboards; are those of us who are more comfortable with drifting rafts or inflatable surf mats, or even flailing along with our own little arms, able to find the support that we need? Are we all moving in the same direction? Should we be? This, then, was the theme around which the conference was structured; it provoked some careful and worthwhile thinking and discussions during the conference, and we hope that this is continuing afterward.

Two of the keynote speakers were of particular interest to Logo people. Bill Higginson from Queen's University, Ontario, presented a most thought-provoking address entitled, "A Question of 'Surfvival'? Issues, Principles and Questions about the Educational Computing Wave," as well as seminar sessions on "Computers and Mathematics Education" and on his recent major Logo research project, "Computers, Children and Classrooms."

Steve Ocko, coordinator of educational research at the Lego / Logo laboratory at MIT, presented a talk and some film clips of the work of that project, to a quite delighted audience;

both Lego and Logo are widely used, separately, in this country, and it was evident from the excited activity at the Lego / Logo stand in the conference exhibition that the combination has much appeal here.

A stream of Logo papers ran throughout the conference. This began with Chris Bigum's presentation, "Logo, Some Critical Reflections," suggesting that the focus on children's learning and relevant classroom variables in Logo work to date has obscured a different role for Logo, and considering Logo as a catalyst for making schooling and its practices problematic. John Oakley, in "Is there More to Logo than Piaget and Powerful Ideas?" argued that a democratic teaching style and the creation of a favorable psychosocial environment are prerequisites to the full implementation of the cognitive aspects of Logo teaching. Bill Atweh illustrated some of the artificial intelligence capabilities of Logo with procedures that allow the user to define a set of rules to generate a grammar in his paper, "A High Powered Program in High Powered Language."

Two papers reported on Logo work at the elementary school level. Sue Chambers' presentation, "So Papert Was Right?" reported the results of a large scale study providing evidence that general thinking skills are enhanced in elementary school children learning Logo. Linda James described her "Logo Study" with a group of grade 6 children, in which approaches to debugging and transfer of skills were studied particularly.

In "Towards a Theory of Microworlds," Tony Adams examined definitions and properties of microworlds, developing a methodology designed to allow construction of a curriculum around the central concept of microworlds. I presented my recent work on "Children's Difficulties in Perceiving Structure and Using Subprocedures in Logo."

Tony Gilding and Jon Pearce, in "Logo and the Exploration of Some Concepts in Science," described a course in which tertiary environmental science students used Logo to model concepts in biology and chemistry, and outlined the procedures used to monitor the students' perspectives of what they were learning and the way they learned. In "Microworlds as Teaching Tools in the Classroom," Liddy Nevile and Colin Fox showed some of their work exploring mathematical ideas, particularly three dimensional drawing, with Logo.

For interested LX readers, the bound conference proceedings (with the beach scene on the cover) can be obtained for Australian $35, which includes postage and handling, from:

Executive Officer
Computer Education Group of Victoria
PO Box 88
Balaclava, Victoria 3183
Australia.

North America
Michael Friendly
Psychology Department
York University
Toronto, Ontario M3J 1P3 Canada

Logo Writings

I took a timeout from everything recently to finish my advanced Logo book before the new school year began. My deadline was upon me and two chapters still desperately needed work. At last, I was ready to print the final copy. I coaxed and cajoled my ancient dot-matrix printer for three days straight, feeding it a constant supply of re-inked ribbons and clearing the paper jams which occurred every 50 pages or so. Well, it's done; a five-pound baby book lovingly sent off to my publisher! But I am still thinking about books...

Several other Logo books which go beyond the elementary level have recently appeared or are in the works. These are important developments because, until recently, all the books were pitched at the introductory level and tended to reinforce the popular perception that Logo was a language for students to use to make pretty pictures. However, teachers and students need good examples of how Logo can be used as a tool for learning in a wide range of curriculum areas (including mathematics, problem solving, physics, language, artificial intelli- gence and cognitive models).

The second volume of Brian Harvey's *Computer Science Logo Style* went on sale just before the Logo 86 Conference. With a subtitle, *Projects, Styles, and Techniques*, Brian presents 10 significant Logo projects at the intermediate to advanced level, ranging from cryptography and games to programming utilities (pretty-printing and translating Logo procedures) and pattern matching. The pattern matching procedures are among the most comprehensive I've seen anywhere, including several Lisp books. Brian uses these in the last chapter to develop a rather complete version of ELIZA, the well-known DOCTOR program which simulates a conversation with a non-directive therapist. (Ed. note: A more complete review will appear in a future "Teacher to Teacher" column.)

I look forward to Brian's third volume, *Advanced Topics*, which will take up a number of applications in computer science and artificial intelligence at the university level. I understand that some of the computer science topics to be covered include data structures, automata theory, finite mathematics, and computational geometry. If Brian maintains his book per year pace, it will be out next summer. Brian's books are published by MIT Press.

Anyone with an interest in language should look for *Exploring Language*, by E. Paul Goldenberg and Wallace Feurzeig, also from MIT Press, scheduled for release sometime in Spring, 1987. This delightful book starts with simple Logo procedures to generate "life sentences," such as GOSSIP:

```
TO GOSSIP
OUTPUT (SENTENCE WHO DOESWHAT WHO)
END

TO WHO
OUTPUT PICK [CHRIS DANA LESLIE SANDY DARYL]
END

TO DOESWHAT
OUTPUT PICK [ KISSES [MAKES EYES AT] OGLES ]
END

TO PICK :LIST
OUTPUT ITEM (1+RANDOM COUNT :LIST) :LIST
END
```

From there they develop Logo ideas to explore complex sentence patterns ("The book that the small boy that the baker scolded read..."), forms of poetry, and the structure of words in English and other languages. One intriguing demonstration Paul showed at Logo 86 was to map sentences in English, Italian, Finnish, Hungarian, etc., to the characters C, and V for consonants and vowels, so this sentence could look like: VCV VCCCVCVVCC CVCVCCCCVCVVC CVVC CCVCVC ...

When you do this with translations of the same text into different languages, the differences in consonant-vowel patterns become visually apparent. The book presents many such novel ideas for exploring the patterns of letters, sound, and meaning in language.

Another lovely book using Logo in the service of language studies is Mike Sharples' *Cognition, Computers, and Creative Writing*, published by Ellis Horwood in the United Kingdom and Halstead Press in North America. This book discusses the development of writing processes in children and adults, and describes computer tools to analyze and explore the writing process.

Of particular interest is a Logo implementation of what Sharples calls *phrasebooks* and *boxes*, which let teachers and kids apply the list processing power of Logo to language without any of the over- head of programming. A *box* is like a Logo list which can contain words, phrases, or the names of other boxes (like nested lists). A *phrasebook* is like a property list or a dictionary you can use to store any pairs of words, phrases, or Logo actions. Sharples illustrates constructing sentences, poetry, stories, quizzes, and adventure games in a way that requires very little in the way of programming knowledge for the learner.

I just received an advance copy of a computer science text for high school and university level by Michael Burke and L. Roland Genise titled, *Logo and Models of Computation*, which will be published by Addison-Wesley. The authors assume little prior familiarity with Logo, but use Logo as the basis for discussing the ideas of evaluation and the computational process, variable scoping, and recursion.

There are a number of intriguing projects sketched, including object oriented programming, rational arithmetic, and symbolic differentiation. According to the preface, students who later learned AI and Lisp were heard to say, "This is just like Logo!"

When I give workshops to teachers on Logo, I am frequently asked how they can use Logo in their teaching. These books provide some significant answers to that question.

LogoWriter News

There is some exciting news from Minnesota! Under 1983 legislation which allocates significant funding to foster technological innovations in educa- tion and provide high quality software to school districts, the state has licensed LogoWriter from LCSI for *every one* of the nearly 900 elementary schools in Minnesota! This choice was based in part on the liberal site licensing policy for LogoWriter and the direct support for teacher training provided by LCSI, and in part by the perception of teachers and trainers that LogoWriter was significantly easier for teachers to begin to use quickly in their classrooms.

The Staff Development Department of St. Paul Schools, under the direction of Geraldine Kosberg and Michael Hopkins, has been involved in curriculum-based Logo projects for over four years, and, together with LCSI staff, have developed a comprehensive series of workshops, and an expanding support structure for teachers in the St. Paul schools. Michael Hopkins reports an interesting change that has taken place in the workshop dynamics and planning, from a leader-controlled to a collaborative effort between them all, as more expertise developed within the teacher group. That sounds like just the way Logo ought to work!

Stay in Touch

Send me your thoughts on this column, and news of North American Logo activities. If you have access to a computer network (e.g., ARPANET, BITNET, etc.), send email to FRIENDLY@YORKVM1.BITNET, or on Compu-Serve, [72777,253]. Send "ordinary" mail to me at the masthead address. Thanks!

West Coast Logo Coast Logo Conference

The West Coast Logo and Telecommunications Conference will be held March 6 and 7, 1987, at the Los Angeles Airport Hilton Hotel. Teachers, administrators, and others who use the Logo language or who have an interest in telecommunications are invited to attend. A major focus of the conference will be the integration of Logo into the curriculum. For more information, write to:

West Coast Logo and Telecommunications Conference
Pepperdine University
3415 Sepulveda Boulvdard
Los Angeles, CA 90034
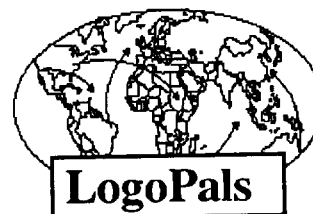
LogoPals

by Barbara Randolph

Hi everyone!

The word is getting around about our LogoPal program! Exciting times for everyone!

Next month, I will begin including LogoPal "ads" from students in this column. If you have students who would be interested in writing directly to other young people who use Logo, then have them write to me, with some information about themselves. I will either match them with another student or, if desired, I will include an "ad" about them in this column, so that others can write to them.

If you would like to do something along this line with your entire class, then find out about the UVA Logo Class Penpal Network. Participating teachers and classes are matched with counterparts based on their grade level, computer model, and Logo experience. For information and application blanks, write to:

Logo Class Penpal Network
UVA Curry School of Education
Ruffner Hall
Charlottesville, VA 22903

There are many ways of establishing communications with others besides the mail. How about telecommunications? I'd like to tell you of two opportunities for you and your students. All you need is a computer with a modem, a telephone line, and a little money.

For those with accounts on CompuServe, the Students' Forum is a super meeting place for young people from all over. Just type GO STUFO after you log on.

Also, don't miss the Logo Forum on CompuServe. Type GO LOGOFORUM.

Michael Gelman, a student in Wayne, NJ, has set up his own telecommunications system: a Logo bulletin board! For 1200 baud service, dial (201) 595-5357. Or write for registration materials.

Michael Gelman
19 Darlington Drive
Wayne, NJ 07470-2805

See you next month!

unadulterated, *adj.* clear, simple; pure, undiluted; genuine, true. See PURITY, TRUTH. *Ant.,* see MIXTURE, EXAGGERATION.

Roget's College Thesaurus

Terrapin™ Logo, from the original Logo people, is the Logo of choice in the educational environment. Terrapin has developed the *LogoWorks*™ series of curriculum support materials and is designing a host of Logo tools and applications for its new *Logoware*™ series. So you can be sure that Terrapin Logo is the best possible Logo to use as a foundation for *your* choice of Logo activities—to suit *your* classroom needs. Plus, with Terrapin's 10-Paks, 20-Paks, networked version and district pricing, Terrapin is the best value for your money. Terrapin Logo. The original, unadulterated Logo. It makes sense!

Terrapin Logo
The Original Logo People

Terrapin, Inc., 222 Third Street, Cambridge, MA, 02142, (617) 492-8816

** Teacher's Pet **

"...the best robot I've ever seen..."
–Seymour Papert, M.I.T. LOGO '85 Conference, Cambridge, Massachusetts.

"We have found the Valiant Turtle's presence has increased the interest level of students and teachers in Logo, facilitated the understanding of Logo commands, and changed personal interaction during Logo work, providing students more time to share and discuss their observations."

–June 1986 review in *The Computing Teacher* by Jim Ellickson-Brown, Mountain View Elementary School and Doris Mimnaugh, 4th grade teacher, Wilson Elementary School, Corvallis, Oregon.

Meet Valiant Turtle, state of the art in Logo programming! Controlled from your Apple II+, IIe , IIc, IBM PC, PCjr or Commodore 64 computer by an infra-red beam, the Valiant Turtle requires no cords or wires to move. Create a design on the screen and watch Valiant draw it on paper! Watch as Valiant executes your commands in three dimensions. Plan some fancy footwork and choreograph a dance in Logo!

Valiant Turtle is the ideal learning tool for students learning Logo as well as a great introduction to the world of robotics. Valiant is simple to use and easy for even the very youngest Logo learner to understand. Complicated and sophisticated ideas are presented in simple, graphic form. Students build artificial intelligence concepts and learn to think about space and spatial relationships.

Valiant Turtle operates with most popular versions of the Logo language. Watch through Valiant's transparent plexiglass dome as the Valiant Turtle draws with extreme accuracy with its built-in pen. Valiant comes completely assembled with easy-to-read instructions and control software. Because its so easy to set up and use, the Valiant generates much enthusiasm in the classroom! Young imaginations fly whenever Valiant Turtle enters the room!

The Valiant Turtle is available from Harvard Associates, Inc., 260 Beacon Street, Somerville, Massachusetts 02143. Harvard Associates provides full technical support for the Valiant. For more information, or to order your Valiant Turtle, please call (617) 492-0660.