THE NATIONAL LOGO EXCHANGE

The Logo Newsletter for Teachers

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Teachable Logo Moments: Jimmy Comes to Class

by Louise Robinson

"Jimmy, how did you do that?" asked the 22-year-old graduate student.

Jimmy, 6 years old, had accompanied his mom to her evening graduate class, Logo in the Curriculum, and was printing his Logo project on the printer.

Jimmy's mom had approached me earlier about the possibility of bringing him to class occasionally. Parameters were set and permission granted. As the Logo "coach," I had no idea such a valuable teaching aid was being added to my course!

Good Evening, Class

The evening started off quietly enough. Jimmy played TURTLE.TARGET at the computer (his mom had done some pre-computer activities with him before coming to class) while we discussed the first few chapters of *Mindstorms*. He listened as I gave the evening's challenge to the graduate students: to create, save, and print a picture. The students and Jimmy went right to work.

The graduate students, with all the courage they could muster, drew with preconceived plans and chose "conservative" commands such as FD 10 and FD 30 ... everyone used numbers 50 or less.

Not Jimmy! His drawing, without a plan, went like this: FD 100 RT 23 FD 1000 LT 36 FD 10000 etc., until he had almost filled the screen.

The graduate students helped each other print out their first "masterpieces." They commented on how quiet the printer was ... mostly just humming, with an occasional staccato of printing noise. I explained to them that the noise level was related to what was being printed; most of their drawings had just a few relatively short lines.

How Did You Do That?

It was Jimmy's turn to print out his picture. The printer broke into a cacophony of activity! That's when the graduate students turned to him in amazement and asked, "Jimmy, how did you do that?" Jimmy replied, "I'm not sure, but I just kept moving the turtle, trying different numbers."

Always being one to capitalize on the "teachable moment," I concluded the class meeting with a discussion about how children are more willling to take risks that adults. I could have tried to convince the graduate students of this fact, as a result of my Logo teaching experience with young children. However, I didn't have to; Jimmy had done it for me! (There's nothing like being in the right place at the right time. I hope Jimmy will be able to come again!)

Let's Get Serious

Most undergraduate and graduate college students who take Logo courses hope to teach Logo to children and to other teachers. Those of us who teach such courses need to give serious consideration to how we approach the class.

Teachable Moments continued

My experience is that most college students have little difficulty learning Logo primitives and procedure writing. The real challenge lies in communicating the Logo philosophy and providing them the opportunity to show evidence of understanding and to apply it within the curriculum. My contention is that this is the most difficult (and the most important) task for the professor.

In my courses, I try to accomplish this is a variety of ways. The most obvious one is creating a Logo environment in the college class. Here are some ideas.

1. Allow students to choose their partners.
2. Implement and stress well-known Logo sayings, such as:
   "Try it!"
   "Ask three before me."
   "Tape it, walk it, turtle talk it."
3. Combine direct instruction with individual coaching.
4. Encourage student input for all decisions on assignments and evaluation procedures.
5. Stress that errors are not mistakes, but simply new problems to solve, then demonstrate that you mean it!
6. Provide a variety of Logo resources in class for students to consult if they "get stuck."
7. Consider not giving quizzes or objective type tests. Start each class wih a review of the class work from the previous session. Use a variety of evaluation techniques weekly.
8. Allow each student to create a personal Logo project during the semester and to share it with the rest of the class at the end of the course.

I'm constantly reflecting on ways to improve my college level Logo courses, and adding new ideas to the above list. Jimmy has caused me to consider seriously the idea of inviting children with no previous Logo experience to attend my classes.

Thanks, Jimmy! Whoever said, "Learning shall flow from the older to the younger," never met you!

(Ed note: Have you experienced a "teachable Logo moment" in which the lesson plans went out the window and spontaneity reigned? We invite you to share these special moments with other NLX readers. Send your notes to Teachable Logo Moments, NLX, PO Box 5341, Charlottesville, VA 22905.)

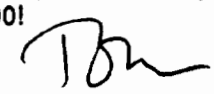
Louise Robinson is a professor at Indiana University of Pennsylvania, where she teaches graduate and undergraduate Logo courses. She is also a third grade teacher in the university laboratory school.

From The Editor
by Tom Lough

Guest Editorials: Logo Teacher Training

Teacher training is critical to the success of teaching with Logo. Sensitive Logo trainers such as Louise Robinson provide examples of successful experiences. But are these experiences the rule or the exception? I have asked two other teacher trainers to give their perspectives and suggestions in this month's editorial column. I encourage you to correspond with them and share your viewpoints and responses.

FD 100!



Elaine Blitman:

"I just got assigned as my school's computer specialist, and I don't know a thing about computers!"

"The principal told me I'd better learn Logo over the summer because our school is getting ten computers in the fall, and Logo will be part of the curriculum!"

Most conscientious teachers spend large amounts of "leisure time" and their own funds to keep abreast of new research, technology, content, and methods. Some school districts encourage their teachers by giving in-service courses, stipends, and salary benefits to those who keep up-to-date.

Other systems, however, mandate changes in curriculum or assignment, expecting the staff to become competent on their own initiative. This sort of treatment tends to set up ambivilant feelings in the most enthusiastic of educators, but most of them dutifully meet expectations (take the course, set up a Logo program, etc.) to the best of their ability.

Quite often, however, what classroom teachers get for their extraordinary effort is a variation of an all too prevalent negative theme: *Teachers don't know how to teach and now they can't teach Logo, either.* This theme has even been expressed in workshops and discussions at national computer education conferences, when one would think that professional encouragement and appreciation for classroom teachers should be expressed.

Not only is this type of generalization unfair, it's untrue! There are excellent teachers already using innovative techniques for helping children learn to think, who are now helping them learn to think with Logo. If Logo isn't being taught as well as it should be in some

Guest Editorials continued

instances, I feel the teacher-training courses (and especially the follow-up support) should be assessed, not the teachers!

If Logo is to create a revolution in education, teachers who are learning it must be taught with the spirit and philosophy of discovery, exploration, and problem-solving, and above all with a positive attitude by their own instructors toward their students' accomplishments. Given the structure of the usual university or district in-service course, with requirements for a certain number of credit hours, papers, evidence of competence, or "covering" a certain amount of course material, this is difficult, but not impossible.

A creative instructor can make requirements fit the needs of individual teacher-students, and also instill the desire to continue discovering ways to teach and learn Logo with one's own pupils when the course is over. Follow-up opportunities with an instructor and/or colleagues must be available for teachers after the course is over.

Most courses provide sufficient (and sometimes an overwhelming amount of) information, including bibliographies of materials, books, and newsletters. All of these are helpful, but teaching is often a lonely business.

What teachers really need after their training and during classroom experience with children and Logo is constructive encouragement: exchange of ideas about methods that work and those that don't; classroom management hints; technical problem solutions; insight into children's reactions; reinforcement of the Logo philosophy; and the knowledge that others are interested and eager to assist in creating a successful Logo program in that individual's classroom.

Research tells us that we should reinforce the positive aspects of those behaviors we want to nurture in children; *surely* those same principles apply to computer education for classroom teachers!

Mary Lou Miller:

Logo teachers are often products of their training ... some are good, some could care less. But, with appropriate organizing within the school, the needs of the students can be served.

When I first began working with Logo four years ago, Abelson's book ws the only resource available. At that time, a few teachers were using Logo with their students and showing their peers the fantastic capabilities of the language. As the popularity increased, the amount of materials grew so that today there is such an abundance of materials it is difficult to make appropriate selections.

With the increase in popularity of the language, school districts began to include Logo as part of the computer curriculum. With Logo now being taught in many schools, I am seeing different types of Logo teachers emerging. One group consists of those enthusiastic teachers who are trying to create the "microworlds" for students.

Another group consists of those who have been given a "crash course" in Logo (e.g., a three hour workshop), handed a curriculum guide, and then told to integrate Logo into the curriculum. These teachers have such minimal knowledge of the language and such insufficient training that they either postpone teaching it until the last minute at the end of the year, set aside just one or two weeks where they will teach Logo once a day for that time period, or merely forget about it altogether.

From my perspective, not everyone is meant to be a Logo teacher. An enthusiastic teacher well versed in the language who believes in the Logo philosophy could provide the primary instruction in Logo to the students, with the classrom or content teachers designing the follow-up activities. Organizational teaching techniques such as this help can help students go beyond the syntax and use the language as a tool to develop thinking and problem-solving skills.

Assisted by the guiding hands of knowledeable instructors, I feel very strongly that Logo will continue to thrive in our schools and be one of the many tools available to assist us with the important task of teaching problem-solving skills to our students.

Elaine Blitman is the K-2 supervisor at Punahou School, 1601 Punahou Street, Honolulu, HI 96822. She has taught a number of Logo courses for teachers and is the co-author of a series of Logo charts and cards published by Scott, Foresman and Co.

Mary Lou Miller is an instructional computing teacher in nine school districts for the Monroe-Orleans BOCES, 3599 Big Ridge Road, Spencerport, NY 14559. She also teaches summer computer courses at nearby Nazareth College.

Logo Note

Logo in the Schools, a special double issue of the journal *Computers in the Schools*, contains 30 articles by Logo workers of many different orientations. This highly recommended volume of over 300 pages is available in softcover for $7.95, with a minimum order of 5 or more copies. If you are involved with Logo teacher training, this is an excellent resource to consider. For more information, contact Haworth Press, Inc., 28 East 22nd Street, New York, NY 10010, or call (212) 228-2800.

Tipps for Teachers

by Steve Tipps

Community Builders

Take a walk around the school with your students. What do you see? Buildings and trees and houses and parks and roads are likely sights. When you come back to the classroom, children bring with them experiences which can enrich language, math, science, and social studies.

Follow-up with a map making project. Map making incorporates skills from all the curriculum areas. The topic in last month's column was making classroom maps with Logo. This month, Logo projects are suggested for constructing neighborhood or community maps.

Turtle Maps

An early map activity included in many instructional books for Logo is a map drawn on an acetate sheet. The sheet is taped over the screen. The turtle is then moved around the screen from the grocery store to the pizza place to the laudromat and back. Students enjoy this activity as they begin to move the turtle.

Turtling with the map can be done with regular distance and direction commands or a **DRIVE** procedure, such as that found in *Learning with Logo* (Dan Watt, McGraw-Hill, 1983). A simpler procedure without recursion could also be written. Using this procedure as a template, children elaborate by adding more options.

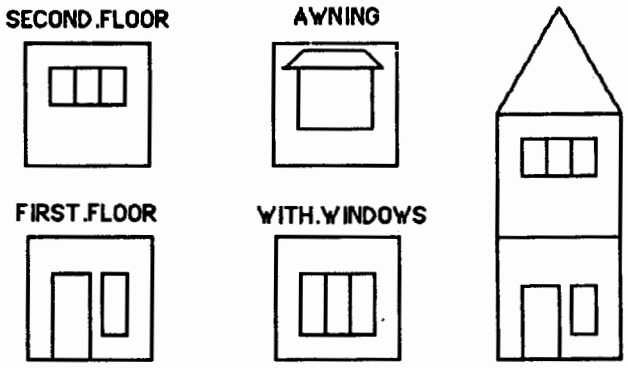
```
TO MOVE
MAKE "KEY READCHAR
IF :KEY = "G [ FORWARD 5 PRINT "GO ]
IF :KEY = .....
IF :KEY = .....
IF :KEY = .....
END

REPEAT 100 [ MOVE ]
```

MOVE is powered by single keys which can be labelled with stick-on covers. The strengths and limitations of single key Logo procedures have been discussed previously in this column (See "The Issue of Instant" in the December 1983 NLX). I suggested that **R** and **L** are not very good keys for **RIGHT**and **LEFT**. **R** is on the left side of the key board, and **L** is on the right. The kinesthetic learning for **L** and **R** is wrong. The concepts of clockwise and counter-clockwise may be better ideas to emphasize.

The map you use can be the actual neighborhood of the school. Draw a simple road map on acetate and invite the children to add things to the map with washable projection markers. The same acetate can also be used on the overhead projector for class activities in mapping.

Houses

Houses are one of the first projects which many people tackle, whether they are 4 or 64. A square house with a triangle roof almost always appears at an early stage in Logo learning. This protohouse can be elaborated in many ways. Mark Mariotti, of Jefferson County, Colorado, challenged his students to make other kinds of houses. When I visited his class, the problems ranged from getting the door just right to building a picket fence to putting curtains in the windows. These houses were glorious examples of Logo at work. Each team of programmers had their own goals and their own approach to house building.



Mark had also helped the children increase their awareness of their environment. Denver is full of grand, old homes with grillwork and gargoyles. He had photographs and diagrams of architectural details on the

Tipps continued

bulletin board as beautiful reminders of new challenges for Logo. Almost every community has some area which is preserved or restored or which should be. Look around for houses in your community which should be cherished.

Public Places

Another source of inspiration would be the schools, hospitals, churches, libraries, and monuments in the community. Delores Lutz, of Charlottesville, Virginia, had the students in her fifth grade class create a travelogue of Washington DC. Programming teams selected the Washington Monument, Lincoln Memorial, Congress, or the White House to render with Logo. Text was added to describe what the children saw on a field trip.

A trivia quiz could also be made about the history of the community.

```
TO QUESTION.1
PRINT [ WHAT IS THE OLDEST BUILDING IN TOWN? ]
MAKE "ANSWER  READLIST
IF :ANSWER = [ POST OFFICE ] [CORRECT.1  THROW
      "TOPLEVEL ]
HINT.1
QUESTION.1
END

TO CORRECT.1
PRINT [ THE POST OFFICE BUILDING WAS BUILT IN
      1887. ]
PRINT [ THE LIBRARY IS NOW IN THE OLD POST
      OFFICE BUILDING. ]
PRINT [ IT WAS MOVED THERE IN 1983. ]
PRINT [ LOOK AT THE FRIEZE ON THE FRONT OF
      THE LIBRARY.]
PRINT [ DO YOU SEE ANY ONE YOU RECOGNIZE? ]
END

TO HINT.1
PRINT [ ONCE A PLACE OF LETTERS,  NOW IT'S A
      PLACE OF BOOKS. ]
END
```

Simple quiz templates like this one should result in a huge list of trivia questions for parents at the next parent's visitation. (How would you randomly generate questions for parents? A hint is to make a procedure which calls a second procedure named with **WORD "QUESTION. RANDOM 50** if you have fifty questions.) Children soon find out that they can write questions on every topic.

Formulating and phrasing questions is an important study skill. The teacher's task is to encourage involvement of students rather than creating quizzes and tests for students.

Community Construction Sets

Another project is to create a community construction set of Logo procedures. A construction set contains pieces which can be used to build a bigger project. Sounds like Logo already, doesn't it?

Look at an Erector set with standard pieces which can be used to build many things. Lego™ pieces have the same modular nature. Jane Toth and Donna Lanyi report on a Logo project such as this in their *TurtleTips* column in this issue.

The most famous electronic construction set is Pin Ball Construction by Bill Budge. With this great program, you build your own Pin Ball machine. Rocky's Boots and Robot Odyssey, both from the Learning Company, have much the same structure.

The Logo community construction set would be made of procedures needed to draw your community. The list from the field trip could be used to start: house, apartment building, school, church, factory, filling station, etc. Natural features would also be needed: trees, parks, ponds. Procedures for each piece would be written so that **HOUSE** would draw a house and **CHURCH** would draw a church.

The acetate sheet could be used for laying out the roads. Instead of just driving the turtle around this time, the students would "build" buildings along the roads.

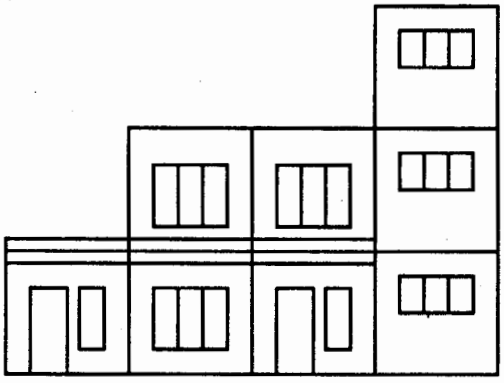
The procedures could be programmed ahead of time by the teacher. Janet Tevendale of Charlottesville made a community construction set like this for her third graders. Or, making the procedures could be a student project. I prefer the latter, but the way you handle this depends on the goals and the time devoted to it. You might provide only a few examples as motivation for their work.

After listing the pieces needed for the community, the class may need to decide on a scale for them. Houses, apartments, stores, and factories differ in size, but they are usually in scale. A basic unit might be a 20X20 turtlestep square if you are going to try to show several streets the screen. A construction set for a single street might utilize a 30x30 square or larger as the unit.

A house might be a simple protohouse with triangular roof. An apartment building might be several units stacked beside each other and on top. A factory could fill a whole block. Decisions about these construction pieces and how they fit together are the important problems in this project. These decisions are

Tipps continued

exercises in modular thinking. Look for units in existing buildings. How are the windows arranged? Where are the doors? Does the same window pattern occur several times?



For children in the upper elementary grades, community construction is a good way to deal with issues of zoning and community planning. Why are stores built on main roads? Why are houses put together in a different part of town? What are the advantages of having people live downtown? Issues of climate and terrain are also important to consider.

A visitor from the city planning office would be a good resource after children have worked with various community arrangements. Charts and maps from the planning office provide a real life view of the process.

A community construction set was created for second graders at Thomas Jefferson Elementary in Falls Church, Virginia. Indian communities and a kibbutz were part of the social studies curriculum. The teachers offered Logo as another means of planning and constructing the communities.

Community Workers

One of the benefits of a project which takes many hands is that everybody learns from everybody else. Whether the learning is among the children in one class, shared between several classes, a combined fifth grade-second grade project, or a cooperative effort by teachers, the problem solving, arguing, and solutions are better than achieved by a single programmer.

The shared project is crucial in creating the kind of learning community which Papert envisions. Individual projects are still important, but isolation is not desirable. After all, Logo community builders are building two kinds of communities.

Steve Tipps is the West Professor of Education at Midwestern State University in Wichita Falls, TX. He conducts Logo workshops for school systems throughout the United States and Canada.

Logo Teacher Feature

by

Rebecca Poplin

Featuring: Sebastian and Sandra Reisch

Sebastian and Sandra Reisch make their home in rural Ontario, Canada. Their house is built around a 150-year-old farmhouse that they have remodeled and expanded. It sits atop a gentle hill overlooking the land that they farmed when their children were growing up. Both Sebastian and Sandra are now employed by the Northumberland/Newcastle Board of Education, which serves an area about an hour's drive from Toronto. Sandra teaches first grade in a special French immersion program. Sebastian teaches mathematics and computer science in high school.

For the Reisches, the long trek from Ontario to Charlottesville, Virginia, was just another step toward learning how Logo could help them in their classrooms. They came to the University of Virginia in the summer of 1984 to take a Logo course taught by Steve Tipps and Glen Bull.

Sebastian and Sandra came to Logo from different directions, and have continued with Logo at opposite ends of the educational spectrum.

Sebastian has been interested in computers from the very beginning; in 1969 he became one of the first teachers of computing in his area. He searched for anything and everything he could get his hands on to learn more about computing.

One of the discoveries Sebastian made was the work of Richard Pattis, a Stanford professor who developed Karel the Robot as a teaching tool for his Pascal students (Pattis, Richard E. *Karel the Robot*. New York: John Wiley & Sons, 1981). Karel's language is very Logo-like in that he is moved on the screeen on a system of streets and avenues with moving and turning primitives. In addition to turning and moving, Karel picks up "beepers" at different locations. Actually, Karel's language is a subset of Pascal, with Pascal structures but no variables.

Initially, Sebastian's students wrote programs and moved Karel around without a computer. Later on, using Logo, they implemented Karel's language on the computer. They wrote a translator, a compiler, an editor, and a linking program as a major group project for the class. Sebastian might participate in a research project with Rina Cohen at the Ontario Institute for Studies in Education in Toronto. They are interested in comparing two groups of college preparatory mathematics students, one group using Logo and the other using traditional methods.

Teacher Feature continued

Sandra has been a teacher of French for thirteen years. At first, she was an itinerant teacher, giving 20-minute daily lessons in grades 1-10. Eight years ago, she was selected to work in a French immersion program for first grade English-speaking students whose parents wanted them to become bilingual. She teaches all the customary first grade subjects, except that she teaches in a language which is not her students' native tongue.

Although she was aware of computers through Sebastian's interest, it was not until Logo became available that she felt computers had something to offer her. Two years ago, she began using a French version of Logo with a customized Instant program she wrote.

Sandra's version of Instant has several interesting features. She uses the French words for ball, box, and hat for circle, square, and triangle, and has developed an erase command which erases the previous line of the child's drawing.

Sandra maintains a sense of overall curriculum sequence in her teaching. For example, she tells her students that, when they go to second grade, they will be working with the turtle's cousin who doesn't know how to do ball, box, and hat, so they will have to teach the cousin these new words.

One of Sandra's many projects for the coming year is developing a data-base dictionary for her first graders.

A visit with Sebastian and Sandra Reisch provides a wonderful illustration of the diverse uses of Logo in schools. Although the contexts in which they use Logo are very different, Sandra and Sebastian have in common a great enthusiasm for what Logo can and has done for their students. They also share an intense desire to learn and grow and to share their ideas.

Sharing ideas is a big part of what the NLX does for teachers. If you have ideas you would like to share through this column, or if you know of teachers who should be featured, please contact:

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

ExperTelligence announces *French ExperLogo* for the Macintosh. For more information on this French version of ExperLogo, write to ExperTelligence, 559 San Ysidro Road, Santa Barbara, CA 93108, or call (805) 969-7874.

Logo Disserts:

Dissertations Dealing with Logo

by Barbara Elias

Computer educators involved in Logo instruction for adult audiences may find the results of an observational study by S. C. Murphy of interest. Murphy investigated the planning, programming, and debugging strategies of 25 adults (20-year-old female undergraduate students, for the most part) , in a series of Logo programming sessions, *without* instructor assistance.

Following a tutorial session, subjects spent about five hours in programming sessions of 1 or 3 hours each. The tutorial, with assistance, was designed to acquaint subjects with Logo in the immediate mode, and to prepare them to use the edit mode to write a simple procedure as well as a procedure which used variables.

Programming sessions were scheduled for each subject, individually, with the researcher present only to observe and record behaviors. An Apple II+ microcomputer was used in developing chosen programs. Paper, pens, pencils, markers, a compass, and a ruler were available for use. No instructor assistance was available; however, three Logo textbooks, notes, and self-made materials could be used.

Each subject was observed for about five hours, or until an original recursive procedure was written. Behaviors were recorded in planning, programming, debugging, and testing categories. Exit interviews helped determine reasons for preferred behaviors.

Results indicate that planning, programming, and debugging strategies covered a range of behaviors. Planning strategies exhibited ranged from copying procedures from the text to using text materials as a resource. for creating original procedures. Debugging strategies were noted in three categories: building (which used primarily the immediate mode), adjusting (which used the edit mode), and typographical corrections. About one-third of the subjects used no debugging strategy. There was little change in strategies throughout the programming sessions.

Those who created new information were also in the group who used debugging. Two subjects created recursive procedures unassisted. All reported that learning on their own was a rewarding experience.

>>>Murphy, S. C. (1984.) *Adult Processing Characteristics When Using the Logo Computer Programming Language* (Doctoral dissertation, University of Texas at Austin, 1984). *Dissertation Abstracts International*, 44, 1977-A.

Barbara Elias is an assistant professor in the Education Department of Virginia State University in Petersburg, VA, and a doctoral candidate at the University of Virginia.

Listful Thinking

by Glen Bull and Paula Cochran

Words, Names, & Starmaps

In last month's editorial, Tom Lough discussed the importance of names. We're not quite ready to change the title of our column to "Nameful Thinking", as he suggested. However, we will take that as a cue for a column on names.

Colorful Names

Logo allows you to use names for numbers. Most versions allow you to change the color of the turtle's pen. The command below sets the turtle's pen color to blue in Apple Logo. (If you are using Terrapin Logo, substitute PC for SETPC.)

```
?SETPC 5
```

However, the number 5 represents a different color in Commodore Logo, while there is no pen color 5 at all in IBM Logo. There's no particular virtue in requiring students to remember that 5 means "blue" in one dialect of Logo. In fact, using the color words themselves might do more to complement academic goals. Here's a procedure that will allow us to use the word BLUE, instead of using the number 5.

```
TO BLUE
OUTPUT 5
END
```

Now when we say BLUE, the computer thinks "5"

```
?PRINT BLUE
5
```

This allows us to use the word BLUE instead of having to remember that 5 represents BLUE.

```
?SETPC BLUE
```

At this point, we have to confess. This column is really about the OUTPUT command. We just used OUTPUT to make the name BLUE. One of our brighter students objected to making BLUE in this way. Here's how she wanted to make BLUE. (We'll call it BLUE.2, to avoid confusion.)

```
TO BLUE.2
SETPC 5
END
```

She argued that this approach was more efficient, because you only have to type one word to change the pen color. She would be correct, if we were only going to use BLUE to change the pen color. However, our BLUE can also be used to set the background color as well. (If you are using Terrapin Logo, substitute BG for SETBG.)

```
?SETBG BLUE
```

Of course, you don't want to type in the names of the colors from scratch each time. Instead, create procedures for all the colors. Then save the procedures on your disk in a file called COLOR.NAMES.

```
?SAVE "COLOR.NAMES
```

Now whenever you or your students are working on a project that uses different colors, you can load in the COLOR.NAMES file and use the names of the colors, instead of their numbers. We suggest that teachers create a Logo Class Tools disk that contains files of useful procedures such as this.

Nickel and Dime

The OUTPUT command can be used any time we want to change a number into a name. For example:

```
TO NICKEL
OUTPUT 5
END
```

We can combine our NICKEL with the names of other coins.

```
TO DIME
OUTPUT 10
END
```

This allows us to use Logo with word problems.

```
?PRINT NICKEL + DIME
15
```

Listful Thinking continued

It's in the Stars

You and your students may already be gazing at the nighttime sky occasionally, in anticipation of Halley's comet this spring. You may be working on a science unit about stars, in order to prepare them for the big event. Now that you've been properly introduced to the OUTPUT command, let's use it to make a Logo star map.

Some versions of Logo, such as Apple Logo and Apple Logo II, have a built-in command, DOT, which will put a dot on the screen. In other versions, such as Terrapin Logo, it's easy enough to make your own procedure that does the same thing. (If you are using Terrapin Logo, type in the DOT procedures at the end of the column before you go on.) The DOT command works like this:

```
?DOT [50 0]
```

This command should have placed a dot on the graphics screen 50 spaces from the center. Type this command in. What does it do?

```
?DOT [0 50]
```

You should see a DOT on the screen 50 spaces *above* the center. The DOT commands takes a list of two inputs. (You knew that we would get around to lists sooner or later!) The first item in the list gives how far over the dot is placed. The second item in the list tells how far up the dot is placed. What happens if you use negative numbers?

```
?DOT [0 -50]
```

Be sure that the minus sign is next to the 50, without a space in between. You can use the DOT command to make a starmap. Here is the beginning of the Big Dipper.

```
?DOT [-120 40]
?DOT [-55 70]
?DOT [-20 55]
```

Instead of typing out the star positions one at a time, we are going to make a list of star positions. First, we will put three stars in this Big Dipper procedure. We'll add the the rest later.

```
TO BIG.DIPPER
OUTPUT [ [ -120 40 ] [ -55 70 ] [ -20 55 ] ]
END
```

We'll use a modified version of a procedure called INSPECT to sprinkle the stars across the sky. INSPECT prints the first item in a list, then prints the next one, and so on until the list is empty. (If you are using Terrapin or Commodore Logo, omit the brackets around the word STOP.)

```
TO INSPECT :LIST
IF :LIST = [ ] [ STOP ]
PRINT FIRST :LIST
INSPECT BUTFIRST :LIST
END
```

Here's how INSPECT could be used to inspect a shopping list.

```
?INSPECT [ EGGS MILK BREAD ]
EGGS
MILK
BREAD
```

Of course, we could create a procedure with a shopping list in it.

```
TO GROCERY.LIST
OUTPUT [ EGGS MILK BREAD ]
END
```

Now we don't have to type out the list each time we want to use it.

```
?INSPECT GROCERY.LIST
EGGS
MILK
BREAD
```

We can also use INSPECT to examine the list of star positions in the Big Dipper.

```
?INSPECT BIG.DIPPER
-120 40
-55 70
-20 55
```

Sprinkle a Star Map

If everything is working OK so far, you're ready to create a procedure to sprinkle the stars across the sky. The SPRINKLE procedure is exactly like INSPECT except for one change. It uses DOT instead of PRINT.

```
TO SPRINKLE :LIST
IF :LIST = [ ] [ STOP ]
DOT FIRST :LIST
SPRINKLE BUTFIRST :LIST
END
```

Listful Thinking continued

Now try the SPRINKLE procedure with the Big Dipper list.

```
?CLEARSCREEN
?SPRINKLE BIG.DIPPER
```

If everything worked, the SPRINKLE procedure should have sprinkled the first three stars of the Big Dipper across the screen. If that happened, we can go on to add the other four stars in the Big Dipper.

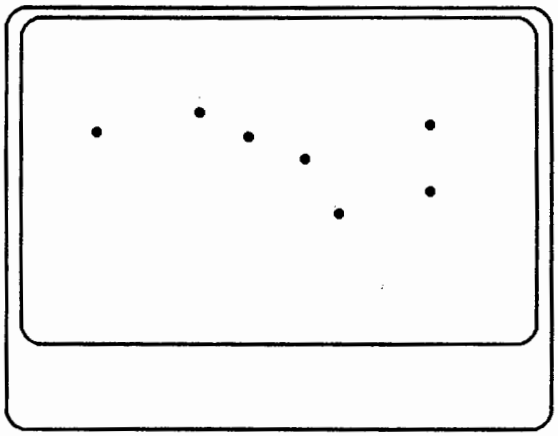
When you edit the BIG.DIPPER procedure and add the rest of the star positions, don't press the RETURN key when you reach the end of the editor line. Instead, keep on typing until you reach the end of the list in the procedure below. In many versions of Logo an exclamation point will appear as you go past the end of the editor line. This shows that Logo thinks of the two rows of numbers as part of the same line.

```
TO BIG.DIPPER
OP [ [-120 40][-55 70][-20 55][30 40][55 -10][120 5][120 60] ]

END
```

Try out the complete BIG.DIPPER.

```
?CLEARSCREEN
?SPRINKLE BIG.DIPPER
```



Now that we have the Big Dipper up in the sky, we're ready to make the stars twinkle. Before we can make all the stars twinkle, we need to make a single star blink.

How can we make a star blink? First we turn off the star; then we turn it back on again! Here's how to turn off a star. (In Terrapin Logo and Commodore Logo substitute PC for SETPC.)

```
?SETPC 0 DOT [-120 40]
```

If that turned off the star, you can turn it back on by SETPC (or PC) once more.

```
?SETPC 1 DOT [-120 40]
```

Twinkle Twinkle

We can combine both sets of instructions (off and on) into a single BLINK command. (If you use Terrapin or Commodore Logo, substitute PC for SETPC, and omit the WAIT command.)

```
TO BLINK :STAR
SETPC 0 DOT :STAR
WAIT 10
SETPC 1 DOT :STAR
WAIT 10
END
```

Here's how to use the BLINK command.

```
?BLINK [-120 40]
```

Did the star turn off, and then back on again? Now that we have a way to make a single star blink, let's make a whole starfield twinkle. To do that, we'll randomly pick a star and make it blink. Then we'll randomly pick another and do the same thing. As we do that over and over, the starfield will twinkle.

From past columns we have a procedure to pick an item from a list. (If you are using Version 1 of Terrapin Logo, you will need additional procedures to make PICK work. These additional procedures are found at the end of the column.)

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

We can use PICK to pick an item at random from a list.

```
?PRINT PICK [ JOHN SUE MARY SAM DAVE ]
 SAM
```

The same principle can be used to pick a star at random from the Big Dipper.

```
?PRINT PICK BIG.DIPPER
55 -10
```

Since PICK chooses randomly, the star coordinates it chooses for you may be different from the

Listful Thinking continued

ones it chose for us. Try this several times. If you are satisfied that PICK is randomly choosing stars from the list, you are ready to use it with BLINK.

?BLINK PICK BIG.DIPPER

Now we can make a TWINKLE command.

```
TO TWINKLE :STARS
REPEAT 100 [ BLINK PICK :STARS ]
END
```

To see the stars twinkle, just type:

?TWINKLE BIG.DIPPER

You should see stars twinkling! Make a Logo wish! We'll see you next month.

Terrapin Logo Procedures

Dot Tools

To compensate for the aspect ratio of the video monitor, the turtle skips every fifth step when it is traveling vertically (2, 7, 12, 17 22, etc.) and does not make a dot. The DOT command in Apple Logo compensates by moving up one turtle step at those positions. In other words, if you specify DOT [10 12] in Apple Logo, the dot actually is placed at [10 13] instead. The following set of Dot Tools provide a dot function in Terrapin Logo. They compensate for the problem of dots falling "in the cracks" every fifth step by using an approach equivalent to the one employed in Apple Logo. That is, if DOT [10 12] is specified, the DOT actually appears at DOT [10 13].

```
TO DOT :POSITION
PU HIDETURTLE
SETXY FIRST :POSITION LAST :POSITION
IF IN.CRACK? FD 1
PD POINT
END

TO IN.CRACK?
OUTPUT LOCATION = INTEGER LOCATION
END

TO LOCATION
OUTPUT ((ABS YCOR) - 2) / 5
END

TO ABS :NUMBER
IF :NUMBER < 0 OP -1 * :NUMBER
OP :NUMBER
END

TO POINT
FD 1 BK 1
END
```

Procedures required for PICK with Version 1 of Terrapin Logo.

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

TO ITEM :NUMBER :LIST
OUTPUT ITEM.LOOP :NUMBER :LIST 1
END

TO ITEM.LOOP :NUMBER :LIST :COUNT
IF :LIST = [] OP []
IF :NUMBER = :COUNT OP FIRST :LIST
OP ITEM.LOOP :NUMBER BF :LIST :COUNT + 1
END

TO COUNT :LIST
OP COUNT.LOOP :LIST 0
END

TO COUNT.LOOP :LIST :NUMBER
IF :LIST = [] OP :NUMBER
OP COUNT.LOOP BF :LIST :NUMBER + 1
END
```

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. Paula Cochran is a doctoral student at the University of Virginia. She is interested in Logo applications in language arts and speech-language pathology.

BACK 10

OOPS!! In the NLXtra last month, we announced a number of Logo related publications now available from the London University Logo Group, but neglected to include their address! Here is the entire notice reprinted, with the necessary address.

Celia Hoyles, of the London University Logo Group, announces the availabilty of the following publications on Logo. (All prices are listed in English pounds due to the uncertainty of the monetary exchange rates.) *The Interim Report on the Logo Mathematics Project 1983-4*, £8.50 plus postage and packing: £7.06 air mail or £2.10 surface mail. *Proceedings of the Logo and Mathematics Education Conference, March 1985*, £5.00 plus postage and packing: £7.06 air mail or £2.10 surface mail. *Creating a Mathematical Environment through Programming: A Study of Young Children Learning Logo*, by Richard Noss, £10.00 plus postage and packing: £10.00 air mail or £5.00 surface mail. Celia Hoyles, London University Logo Group, University of London Institute of Education, Department of Mathematics, Statistics and Computing, 20 Bedford Way, London, England WC1HOAL.

NLXionary
A Lectionary of Selected Logo Readings

with Commentary and Opinion
by Griff Wigley

"Exciting Effects of Logo in an Urban Public School System," by Peter Fire Dog, *Educational Leadership*, September 1985.

>The author reports on the research conducted during the three years of one of the largest Logo efforts in the ocuntry. (A total of 250 K-12 teachers are currently involved.) The project attempts to have teachers use Logo in their classrooms to engage all types of students in learning. Typically, this means one or two computers in a corner of the classroom occupied all day long by pairs of students while regular instruction continues. This averages out to be approximately 40 hours of Logo per student per year.

>The research suggests that (1) different kinds of social, emotional, and congitive effects of Logo develop over time, and (2) classroom environmental factors related to student learning are many and complex. Not exactly eye-popping revelations, but a closer look at the data is a bit more interesting.

>The top effects when measured in January of 1984 were:

1. enthusiasm about learning
2. sharing, teaching, consulting
3. frequency of interaction with peers
4. logic, structured thinking, problem solving
5. likableness, sense of acceptance, belonging

>In May of the same year, the top effects were:

1. likableness, sense of acceptance, belonging
2. sharing, teaching, consulting
3. logic, structured thinking, planning
4. pleasure in work
5. frequency of interaction with peers

>But those effects that showed the greatest *improvement* from January to May were:

1. spelling and writing
2. rate of learning
3. homework, class assignments
4. level of achievement
5. reading, reading comprehension

>I would have liked the author to comment more on this latter phenomenon of Logo impacting spelling, writing, and reading. It may have some parallels to Stanley Pogrow's *Higher Order Thinking Skills (HOTS)* project in Arizona (reported in the same issue of *Educational Leadership*) in which Chapter I students make significant gains in basic skills through the use of problem solving / thinking skill software ... especially since Pogrow has frequently made critical comments about Logo.

>A more important finding, I believe, is that an analysis of student subgroups revealed no patterns for significant improvement. In other words, in comparing the lowest and highest achievers, males and females, working vs. middle class, socially accepted vs. isolates, etc., the rates of improvement were about the same.

>Likewise, none of the usual student characteristics (disruptiveness, initiative, independence, cognitive style, emotional development) typically associated with student academic success or failure were found to be predictive of who will show major improvement with Logo. Fire Dog sums it up best:

"From a research perspective, the tentative conclusion is fairly straightforward: Logo effects seem to be both wide ranging and substantial, and appear to be available to students from almost any type of learning, social, or motivational background. Logo clearly represents an innovative way to create opportunities for academic success and enrichment for most students."

(Ed. note: Peter Fire Dog also presented a talk entitled "Logo Effects in Public School Classrooms," at the Logo 84 conference at MIT. For more information, write to Peter Fire Dog, University of Minnesota, Department of Sociology, 267 19th Avenue South, Minneapolis, MN 55455.)

"Pulling in the Reins on Freewheeling Logo," by Alan Alterman, *Classroom Computer Learning*, September 1985.

>This is a practical follow-up to the article I highlighted last month, "Logo Today: Vision and Reality," by Uri Leron, in *The Computing Teacher*, February 1985. Alterman explains five of his strategies for structuring the teaching of Logo in a one computer classroom while simultaneously fostering natural exploration and discovery. While most of his approaches will not be new to long-time Logo teachers, they do provide a tidy summary for the teacher newer to Logo. His classroom management strategy is the best I've come across.

Griff Wigley is a co-owner of Family Computing, Inc., a facilitator in the Faribault (MN) Public Schools, and a school board member of Prairie Creek Community School.

TurtleTips

by
Jane Toth and
Donna Lanyi

Turn your classroom into an instant mass production facility! Although primary students can master Logo primitive commands, we've found that they aren't capable of the time commitment necessary to produce fully developed pictures. Primary students need immediate success and gratification. Susan Wood from St. Francis School in Goshen, Kentucky, sent us some excellent ideas to speed up picture completion for younger students, K - 2.

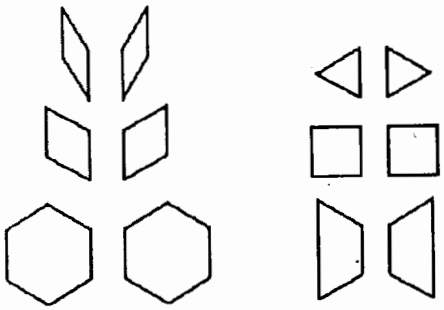
The Turtle Teacher

Susan has designed her own version of an "E-Z Logo." She felt that her children needed to relate programming to the physical world around them. Using pattern blocks seemed natural because of their popularity, invitation to creativity, and adaptability to the computer. The children have long been familiar with pattern blocks, and how they fit together to make beautiful designs.

Susan wrote procedures for each pattern block piece. She included a left and right drawing procedure for each, to make moving the pieces on the computer easier.

Next, Susan drew each pattern block on paper, showing the turtle's heading and the procedure name for each. She taped these drawings on the table beside the computer for easy reference.

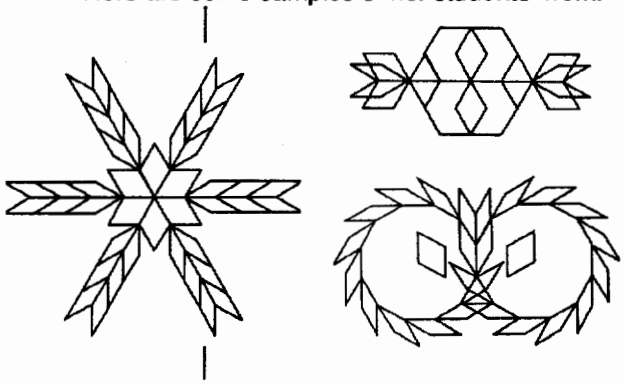
To help the children fit the pieces together easily, she decided to use the same size for each side of the blocks (FD 25 or BK 25) and to use multiples of 30 for turns. The long side of the trapezoid was 50, the only "non-25" side of any figure.



Only four turns were needed for fitting the pieces together: LT or RT 30, LT or RT 60, LT or RT 90, and LT or RT 120. The children could choose one of the turns from this list. If their choice was not the "right" one, they could undo it by typing its opposite turn, and then try one of the remaining angles. They not only learned to undo, but also to make excellent choices.

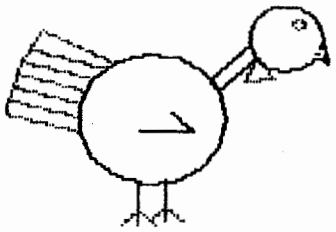
Susan had two children work together, so that, while one was making the design, the other was advising and recording in their journal. They used the journal as an aid in making the design into a procedure to be saved. From the journal, she could also help students discover how they could use REPEAT to shorten the procedure. Saving the procedures provided the basis for an on-going project in which they kept adding on to their designs.

Here are some samples of her students' work.



Procedure of the Month

Start your class early in November creating the first Thanksgiving. Have students design and draw figures to post on a Thanksgiving Dinner scene for a bulletin board. Use our turkey procedure to create Thanksgiving cards to be taken home, or have the students create their own "Turkey Cards," perhaps using the pattern block procedures.



If you are interested in a listing of the turkey procedure and / or Susan's pattern block procedures, please send us a self-addressed stamped envelope.

We invite any teachers or elementary students to send Logo procedures or ideas to be shared in this NLX column. Jane Toth and Donna Lanyi, Beall Avenue School, 716 Beall Avenue, Wooster, OH 44691.

Jane Toth and Donna Lanyi use Logo in their elementary classrooms in the Wooster (OH) City Schools.

LIFT's

Teacher to Teacher

A Review of New Logo Materials

By James Fry

This month's reviews are on some products that address an area of long time interest to Logo. People have been asking about "microworlds" and what they are, but publications have not addressed this issue until recently. Here are comments about two recent products which provide teachers with microworld-like activities for their students.

Logo Microworld: Picture Puzzles, by Ihor Charischak, 1985, published by K - 12 MicroMedia Publishing, Inc., 6 Arrow Road, Ramsey, NJ 07446, (201) 825-8888, $19.95.

Target Audience: Upper elementary children with Logo experience

Content: *Logo Microworld: Picture Puzzles* comes with a booklet and a disk. The booklet is divided into an introduction, a section on use in an instructional setting with directions for the accompanying disk with your Logo version, and five puzzle sheets to go along with the five lessons or microworlds.

The puzzle sheets contain goal statements, drawings, hints, and suggestions for further exploration. The materials are intended for students who are familiar with Logo procedure writing and editing. The puzzle sheets can be reproduced to be given to the students.

Strengths: *Logo Microworld: Picture Puzzles* is described as " a package of five programs designed as a learning environment using Apple Logo or MIT Logo". If you are looking for microworlds then this package is something you would like.

The strengths of *Logo Microworld* are many. Most importantly, it encourages students to write well organized and structured programs. The activities are set up to make the students think about and make use of a modular approach. This should also help teachers with little or no programming background to learn more about structured programming.

As an example of how the lessons are organized, consider Lesson #1. The goal is to write a procedure to draw a "happy face." The students are given 3 Picture Piece procedures and 3 Move procedures to position and move the turtle. The challenge is to figure out the proper order of the 6 procedures to make the face.

As the students move through the lessons, the tasks become more complex. In Lesson # 5, they are given 4 Picture Pieces and must write their own MOVE procedures to produce a picture of a neighborhood.

Suggestions: I encourage the author to develop more microworlds of this nature.

KNOW LOGO, A Logo Exercise Program, by George Bredehorn and Learning Well, 1985, published by Learning Well, 200 South Service Road, Roslyn Heights, NY 11577, (800) 645-6564, $49.95.

Target Audience: Students in grade 1 and up

Content: *KNOW LOGO* comes with a guide book and disk. There are two separate versions, one for Terrapin and one for Apple Logo. *KNOW LOGO* consists of over 50 learning activities for exploring areas of Logo. The activities are organized by the types of skills that they reinforce, such as concepts of direction, distance, angles, and circles and arcs. The guide book consists of an introduction, how to work with the disk, and a brief description of the programs on the disk.

Strengths: For a teacher just beginning with Logo or a teacher with a group of inexperienced Logo students, *KNOW LOGO* offers a variety of activities to explore and expand upon. For example, the program called Artist1 consists of 8 different objects from space, including a rocketship, a star, and an astronaut. All the objects can be drawn in many different sizes by using an input number with each name. Students can then develop their own sets of procedures or pictures. This idea could be used in a classroom where students could put together a collection of all types of shapes to be shared by each other.

Suggestions: I would like to see the guide book expanded to give more ideas for extended activities and suggestions for teacher use in the classroom. I also suggest hat a price of $49.95 seems rather high for Logo activites with such limited documentation.

The Logo Information for Teachers (LIFT) group is interested in hearing from teachers who can identify new materials and books they have found useful in teaching Logo. Please send your suggestions and comments to: LIFT, PO Box 5396, Plymouth, MI 48170.

James Fry uses Logo with his Chapter 1 remedial mathematics students at Novi Community School, Novi, MI, and is a co-founder of the Logo Information for Teachers (LIFT) group.

Q and A

by Jim McCauley

Q. Logo is supposed to be easy to learn. My first lessons were easy enough, but now I'm finding that Logo is harder to learn than I imagined. Is this the usual case?

A. It certainly was for me! I began learning Logo when it first came out on the TI 99/4 computer, and I spent most of the first few months learning what my friend James Milojkovic calls "spinal cord Logo." That is, I mucked about doing clever things with the turtle and the TI's wonderful sprites. I did nothing with list processing until I picked up Apple Logo. Then I hit a brick wall.

I had done some fairly complicated things in other computer languages (BASIC, Pascal, PL/1, and Forth), but nearly all these projects had been based on the processing of indexed arrays (See last month's Q & A). I didn't know a linked list from a hole in the wall, and had never formally studied data structures.

The Simple Truth

Frankly, I felt intimidated by the structured data types of languages more complicated than BASIC, and that was one of the things that led me to Logo. In Logo, after all, the only objects to deal with are words and lists. That kind of apparent simplicity was right up my street.

I had, of course, completely misconceived the "simplicity" of Logo. The absence of indexed arrays in nearly all implementations of Logo essentially forces the use of recursion to decompose, traverse, and recompose data structures built from lists. I had done almost nothing with recursion in other languages, and there were no Logo books to explain it in the spring of 1982.

That "Help, Lisp!" Feeling

So, I turned with fear and trepidation to Lisp, Logo's predecessor. I had heard that Lisp was arcane, complex, and subtle, and was understandable only by freaky hackers at MIT. In the hope that these rumors were not entirely correct, I bought a Lisp interpreter and several Lisp books.

Most of the books were just awful (I refuse to read them even now, unless absolutely forced by circumstance), but I found two gems among the dross: *Artificial Intelligence*, by Patrick H. Winston and Berthold K. P. Horn (Addison-Wesley), and *The Little LISPer*, by D. P. Friedman (SRA Publications). Careful study of these books (and much hacking into the wee hours) gave me a Lisp perspective I could carry back to Logo.

Logo List Ladders

Today, though, learners of Logo who hit "the wall" are more fortunate. There are several Logo books that can help you get over, under, or around the conceptual blocks you face in understanding the list processing understructure of Logo. Here are two that I believe are especially useful.

• *The Second Logo Book: Advanced Techniques in Logo*, by Dan Weston (Scott, Foresman and Co.). This book contains an especially clear introduction to list processing concepts and a large part of what I brought back to Logo from my study of Lisp.

• *Computer Science Logo Style: Intermediate Programming*, by Brian Harvey (MIT Press). This is an excellent source for a solid foundation in list processing and advanced ideas in program design.

Finally, I would encourage serious Logo students to get acquainted with Lisp. A very good introuctory text is *LISP: A Gentle Introduction to the Art of Symbolic Computation*, by David S. Touretzky (Harper and Row).

This monthly column features questions about Logo programming techniques and the thinking which leads to programming. If you have a question, send it to me at 876 East 12th Street, #4, Eugene, OR 97401. Please enclose a self addressed stamped envelope.

Jim McCauley is a graduate student at the University of Oregon, studying wtih David Moursund, and has written Logo articles for many national publications.

NLXual Challenges

by Robs Muir

Ella and the n-gon

If the Lord Almighty had consulted me before embarking on the Creation, I should have recommended something simpler.
-Alfonso X, King of Castile (1226 - 1284)

There is a rumbling in the school hallways that is growing to a crescendo. Depending on the region, this song is called, alternately, problem-solving, critical thinking, or critical reasoning. Now, every "Educational Consultant" smart enough to hang a shingle is jumping on the bandwagon to sell the best package to improve your students' thinking skills; reproducible worksheets and diskettes optional. However, like all good music, this tune can be played on the commonest of instruments.

Sorry to harp on about all this, but this whole fascination with problem-solving sounds like a round which repeats itself in Education every 20 years or so.

NLXual Challenges continued

You don't need any special software or hardware to create a healthy problem-solving environment in your school or classroom. What you really need is a terminal case of over-enthusiastic curiosity about the world and a desire to "find out." This is bound to be infectious.

Circle and the Square

You may remember an interesting problem in this column last year about circles and boxes (See NLXual Challenges, January 1984 NLX). The challenge was to write a Logo program that would draw a circle within a square of any given size such that the circle is tangent to the sides of the square. Stop here a moment! Can you do this?

We have gotten a lot of life out of this challenge, spurred, by the fact that several of my colleagues unwittingly derived the value for pi in the course of their explorations. You learn something old every day!

I happened to give this challenge to some of my graduate students two summers ago and one student came back with a challenge of her own, a challenge that still baffles me. Ella Pfeiffer gave this CIRCLE.BOX challenge a new twist that may give some problem-solver devotees food for thought. Can you solve this one?

Circle and the n-gon

Try this: Get the turtle to draw any n-sided regular polygon. Next, get the turtle to draw a circle such that it lies inside the polygon. Yes, of course, it must be tangent to the polygon! Next, generalize this algorithm to work with *any* regular polygon. If you have some difficulty with the math as I did, dig out those old 8th grade geometry texts.

After several weeks, Ella solved this problem that she had imposed on herself and she proudly demonstrated her handiwork to the class. We watched in silent awe as the turtle appeared to do her bidding. Ella also proceeded to explain, in great analytical specificity, her arrival at the "truth."

Since you've solved this problem (right?), here is Ella's solution.

```
TO POLYCIRC :S :L
;[ INSCRIBES A CIRCLE WITHIN A POLYGON ]
;[ WRITTEN BY ELLA PFEIFFER ]
;[ FIRST DRAW THE POLYGON, THEN THE CIRCLE ]
REPEAT :S [ FD :L RT 360 / :S ]
FD 0.5 * :L
REPEAT 360 [ FD ( :L * 11 * COS (180 / :S ) ) / ( 1260 *
      SIN (180 / :S ) ) RT 1 ]
END
```

Now, if you appreciate Nature's simplicity, you might have reason to question this solution. Where did the 11 come from? Why the number 1260? This is a far cry from the simple elegance of the Total Turtle Trip Theorem! Yet, Ella Pfeiffer claims that this is mathematically correct and can be analytically derived.

This month's challenge then: Can you prove or disprove Ella's claims?

I'm afraid that, like Ptolemy before me, I'll spend years vainly seeking to prove that the Universe is simpler than evidence might suggest. And that 11's and 1260's aren't a part of the Turtle's Trip.

Send your analysis and conclusions, along with a self-addressed stamped envelope to:

NLXual Challenges
Attn: Robs Muir
1688 Denver Avenue
Claremont, CA 91711

We will redistribute to all contributors a representative cross-section of responses.

Do you have a favorite Logo challenge to share with other NLX readers? If so, then send it to the above address.

Robs Muir is a teacher in the Claremont CA Unified School District and Claremont Graduate School.
