Hier and Hier: Logo and Ancient Egyptian Writing

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Logo LinX
by Judi Harris

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It's a very ancient saying,
But a true and honest thought,
That if you become a teacher
By your pupils you'll be taught.
--Rodgers and Hammerstein,
"The King and I"

Did you ever have to write a sentence 100 times as punishment for an infraction of a classroom rule? As a teacher, have you ever (gasp!) given that task to an uncooperative student? I recently felt as if I deserved such a chastisement from a group of sixth graders who were using Logo to investigate hieroglyphic writing. My sentence should have read:

"I will never again underestimate the cognitive abilities of my students, especially when they are working with Logo."

Hieroglyphics (in Greek: "sacred carvings") were originally devised by the ancient Egyptians as picture symbols to represent objects, ideas and actions. Later, words that had no signs to represent them were expressed by existing ideograms that had different meanings, but the same sound. For example, the verb "to go out," pronounced "prj," was drawn as a house, because the word that meant "house" sounded similar to the verb. So many phonetic substitutions of this type were made that the ideograms gradually lost their original meanings, in favor of their phonetic functions. Scribes further developed the symbol system by combining pairs of letters into more than 80 "bilateral hieroglyphs." or shorthand pictures that represented blends. (Does this sound reminiscent of superprocedure structures?)

My sixth graders were immersed in an interdisciplinary exploration of ancient Egypt, and were particularly intrigued with the notion of hieroglyphic writing. They had already noticed that the symbols were representations of everyday objects and creatures found near a river. (Hieroglyphics first developed as a means to record trading transactions, and most barter occurred in the vicinity of the Nile.) The students were impressed by the numbers of complex drawings that Egyptian scribes had to memorize, and "hieroglyphic doodling" often appeared on their papers. We decided to capitalize upon this interest, while encouraging use of single-function Logo sub-procedures, in a group programming project.

The idea was to use Logo to turn the computer into a "hieroglyphic typewriter." We wanted to help the children to plan, design, code, review, revise, and coalesce procedures that drew individual ideograms (developed by small groups of students) into a hierarchical succession of superprocedures. The resulting program would allow the user to phonetically encode any word(s) in hieroglyphics. The students decided to divide the 51 most frequently used single and blended sound-symbols by their "turtling difficulty," and groups chose whether they would rather work on a few difficult-to-draw, or many easy-to-draw hieroglyphs. They had pointed out, during the planning session, that it was important to agree upon a common size, final turtle heading, and avoidance of SETXY (SETPOS) and HOME commands, if the hieroglyphs were to be used at any location on the screen. We informed the sixth graders that these notions were called "state transparent procedures," and that we were impressed with their planning.

Hier Challenges

Interesting challenges presented themselves as the students began to write Logo procedures that drew the hieroglyphic symbols. The drawings were often larger than the agreed-upon 30 by 30 step size, and, when the students began to draw in a smaller space, most found it much harder to experiment graphically. They asked us for strategies that would help them to reduce their drawings to scale, and we were happy to oblige with several on- and off-computer math and art lessons and activities. Groups who finished their agreed-upon ideogram set quite naturally volunteered to assist other groups by drawing more signs, checking completed procedures for bugs, calculating scaled-down lengths, and compiling files of completed procedures. They happened upon quite a number of powerful ideas in the process, among them the notion of scale affecting FD and BK, not RT and LT, and the creation and use of tool procedures with variable inputs (namely, arc procedures that they wrote and shared with each other.)

After several weeks of work (usually twice weekly in the lab, plus many volunteer hours at home and during recess) we were ready to assemble the superprocedures. We hooked up a computer to the VCR monitor, loaded in all of the subprocedures, renamed them for greater clarity, and began to discuss the overall organization of the program. Since the kids had calculated the size of each hieroglyph to be 30 by 30 turtle steps, they already knew that the screen would hold 6 lines of 8 hieroglyphs each, including margins. We teachers had met prior to the group session, and had agreed that, though a recursive structure was the most economical and
powerful for the overall code format, the students weren't ready to really understand such a complicated idea." (They had been working with Logo for three years.) So, we reasoned, we should help them to create 6 superprocedures with similar structures for the 6 possible lines of hieroglyphs, or, perhaps, one procedure with variable inputs for X and Y coordinates used six times in a superprocedure.

That's when we should have gotten the 100-sentence punishment. No sooner had the students surmised the direction of my structure suggestions, that they began to murmur and protest.

"Isn't there an easier way, Miss Harris? That seems like a lot of typing the same idea with different numbers again and again."

"Well, there is an easier way, but Paula and I thought that you probably wouldn't like it. It's very hard to understand."

(Murmur, murmurmumur....)

"Could you just tell the computer to make copies of the procedure [that we just wrote] and use different X and Y numbers in each of the copies?"

"Yeah!" (some classmates chimed in.)

I wouldn't have believed that it really happened, but the two other teachers in the room looked as shocked as I felt.

"YES!!" we all said together, and began talking about recursion in a modern computer language in terms of ancient Egyptian writing....

As a teacher I've been learning:
You'll forgive me if I boast,
And I've now become an expert
On the subject I like most:
Getting to know you!
--Rodgers and Hammerstein,
"The King and I"

I'm having a hard time deciding who learned more during this excursion to ancient Egypt with Logo: the students or the teachers. Perhaps that is what being a facilitator is all about: the process more than the content; the questions more than the answers.

Judi Harris was an elementary school computer use facilitator, graduate education instructor, and computer consultant for a number of public and private schools in Pennsylvania. She is now a doctoral student in education at the University of Virginia. Her CompuServe number is 75116,1207.

MathWorlds

edited by
A. J. (Sandy) Dawson

This LX issue contains the first contributed article for the MathWorlds column. E. Paul Goldenberg's treatment of "thinking algebraically" fits well with the ideas suggested by Steve Tipps, Glen Bull, and Paula Cochran elsewhere in this issue.

If you are using Logo in mathematics teaching, or have some related ideas to share, please send them to the address at the end of the column.

Learning to Think Algebraically:
Word Problems and Data Flow

by E. Paul Goldenberg

I was invited to consult on a project to integrate computers into a newly-formed school in New York's Harlem neighborhood. My task was to help design the introduction, and to do so from a perspective that would maximize the chances that these teachers could later become successful and creative designers of their own curricula. Integration meant that the computer was not to be seen as a new subject matter in its own right, but rather as a complement to the intellectual and academic goals otherwise deemed most important to these students.

Word Problems

To my surprise, I became fascinated with what has usually been for me one of the dullest school exercises of all: the word problem. Judy presented her students with a word problem about a child who wanted to plan for a party of 48 friends.

Dana has invited 48 people to a party and wants to know how much punch to buy. If each person is served a single 6 oz. cup of punch, how many quarts will Dana need?

At first, this problem, like so many word problems, seemed rather lifeless to me: there is a single answer, not much room to explore, not even rich imagery that might stimulate problem posing.

After the students had had the opportunity to