Puzzle Corner/Maximizing Math
Zoo-Knowlogy

by Michelle Pauls

The *Maximizing Math* and *Puzzle Corner* activities this month are two parts of the same activity—my own variation of a mind reading puzzle. In the *Puzzle Corner* portion, students will experience the puzzle. In the *Maximizing Math* portion, they will analyze the puzzle and try to develop their own. This type of mind reading puzzle is likely familiar to you. Many versions exist, but they all follow the same basic format. You are directed to make a secret selection and then follow a series of directions given to you by the "mind reader." For example, picking any two-digit number and then performing a series of operations on that number. With an ease and confidence that is astonishing, the mind reader is able to tell you the result of the steps you took—which number you came up with, what animal you are thinking of, which country you ended up in, etc.

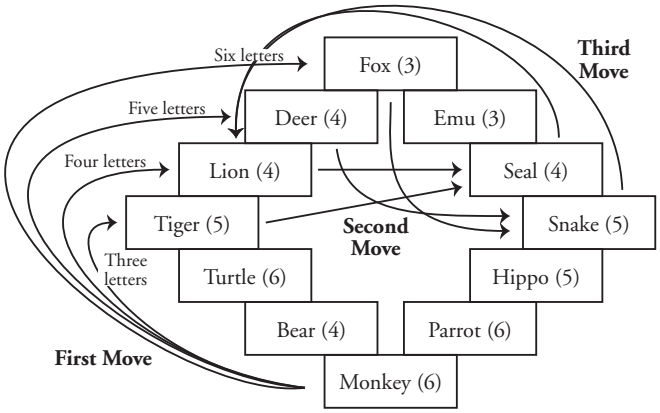
In the *Puzzle Corner* portion of *Zoo-Knowlogy*, students will move markers, representing themselves, around a map of the zoo following specific directions. They will each make a decision unknown to you, yet at the end of three moves, you will be able to tell every student the exhibit at which he/she ended. (This assumes, of course, that all directions were followed properly.) Once students have experienced the trick, they will move on to the *Maximizing Math* section, where the challenge is for them to explain how it works, and then develop a similar puzzle based on the same principles. There are two versions of the *Maximizing Math* page, with *Version Two* being more open-ended than the other. Determine which page is best, based on the ages and abilities of your students.

For the *Puzzle Corner* portion, each student will need a copy of the map of the zoo and a small marking chip of some kind to move around on the map. It is helpful if you make an overhead of the map so that you can give examples of how to move and clarify any questions. It will also make it more dramatic when you place your marker on the spot that all of the students (should) end on. A page of *Teacher Directions* is provided that gives the step-by-step instructions to be read to the class. There are two versions of this puzzle, each using the same map, but different directions.

Once students have tried both versions of this activity, have them get together in small groups and hand out the appropriate *Maximizing Math* student sheet. Allow students ample time to explore the problem and develop their explanations for how it works. Conduct a class discussion in which groups share their explanations, making sure that all students come to an accurate understanding of the principles behind this puzzle.

The reason this puzzle works is illustrated here. (This explanation assumes that you are familiar with the procedure for the game, found in *Teacher Directions*.) All players begin at the monkey exhibit and pick an animal in the zoo (this is the only point at which the players have a choice). The animals in the zoo have names ranging from three to six letters in length. This means that players can end at any one of four exhibits after the first move—the tiger, the lion, the deer, or the fox. (If they pick an animal with a three-letter name, they move to the tiger exhibit; if they pick an animal with a four-letter name, they move to the lion exhibit; and so on.) For the second move, players no longer have a choice; their movements are dictated by the names of the animals at the exhibits where they are now located. Those four animals have names that are three, four, or five letters long. This results in two possible locations after the second move—the seal exhibit and the snake exhibit. Because *SNAKE* has one more letter than *SEAL*, and the snake exhibit is one exhibit past the seal exhibit, a counterclockwise move from either location will end in the same

place—the lion exhibit. The same principles are true for the second version of the game in which students begin in a counterclockwise direction. This version results in all players ending at the seal exhibit.



By using these principles and modifying the number of moves, direction of the moves, number of locations, etc., students should be able to come up with their own mind-reading games. Encourage students to be creative and come up with different settings for their games. The format can be very different from the one presented here as long as the end is known each time. Provide time for groups to develop their games and then share them with the entire class, and perhaps even other classes.

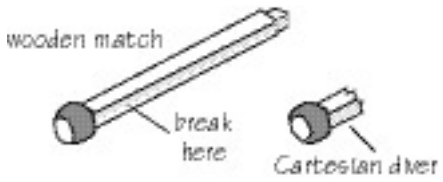
If you have student work you would like to share with us here at AIMS, we'd love to see it. Please send it to my attention care of AIMS: PO Box 8120, Fresno, CA 93747. I hope you and your students find these experiences challenging and fun. We'll be back next month with another *Maximizing Math* and *Puzzle Corner*.

(TINKERING, cont. from page 31)

The wood fibers at the broken end of the match trap small air bubbles. When the two-liter bottle is squeezed, the pressure decreases the volume of these bubbles and the match head sinks. When the pressure is released, the volume of the bubbles returns to normal and the match head floats. Eventually the air bubbles escape from the fibers and the diver no longer works.

Because the Cartesian diver is so popular with students, I've been collecting the science concepts that can be connected to the diver. The more science concepts teachers and students explore when playing with a Cartesian diver, the richer the diver becomes as an object for thinking. If you would like a graphic representation of the seven science concepts that can be taught and learned by playing with a Cartesian diver, email your request to jawilson@fresno.edu.

I will continue to tinker with the Cartesian diver. Every time I think I've learned all there is to know about the diver, I'm surprised to learn something new.



In the next column I will start a continuing series of electrical circuit projects. Each project will be built on a special board called a "breadboard." I will begin by constructing the important early twentieth-century electrical circuits and eventually complete the series by constructing a few simple twenty-first century circuits.

(REACHING, cont. from page 47)

6. How long did it take for the first leaves to appear on the plant? What do the leaves do for the new plant?
7. Why do you think some seeds grew faster (or slower) than others?

Extensions

1. Suggest to the students that they continue to record in a journal the growth and flowering of their sunflowers. Encourage them to especially watch the heads of the plants as they tend to follow the direction of the sun.
2. Other activities that deal with seeds can be found in the AIMS publications *Winter Wonders, Primarily Plants,* and *Budding Botanist.*

Home Link

Copy the sheet showing the growth cycle of a plant. Send it home with the students. Encourage the students to cut the picture cards apart, put them in the correct order, and explain to their parents how their sunflower seed grew.

Evidence of Learning

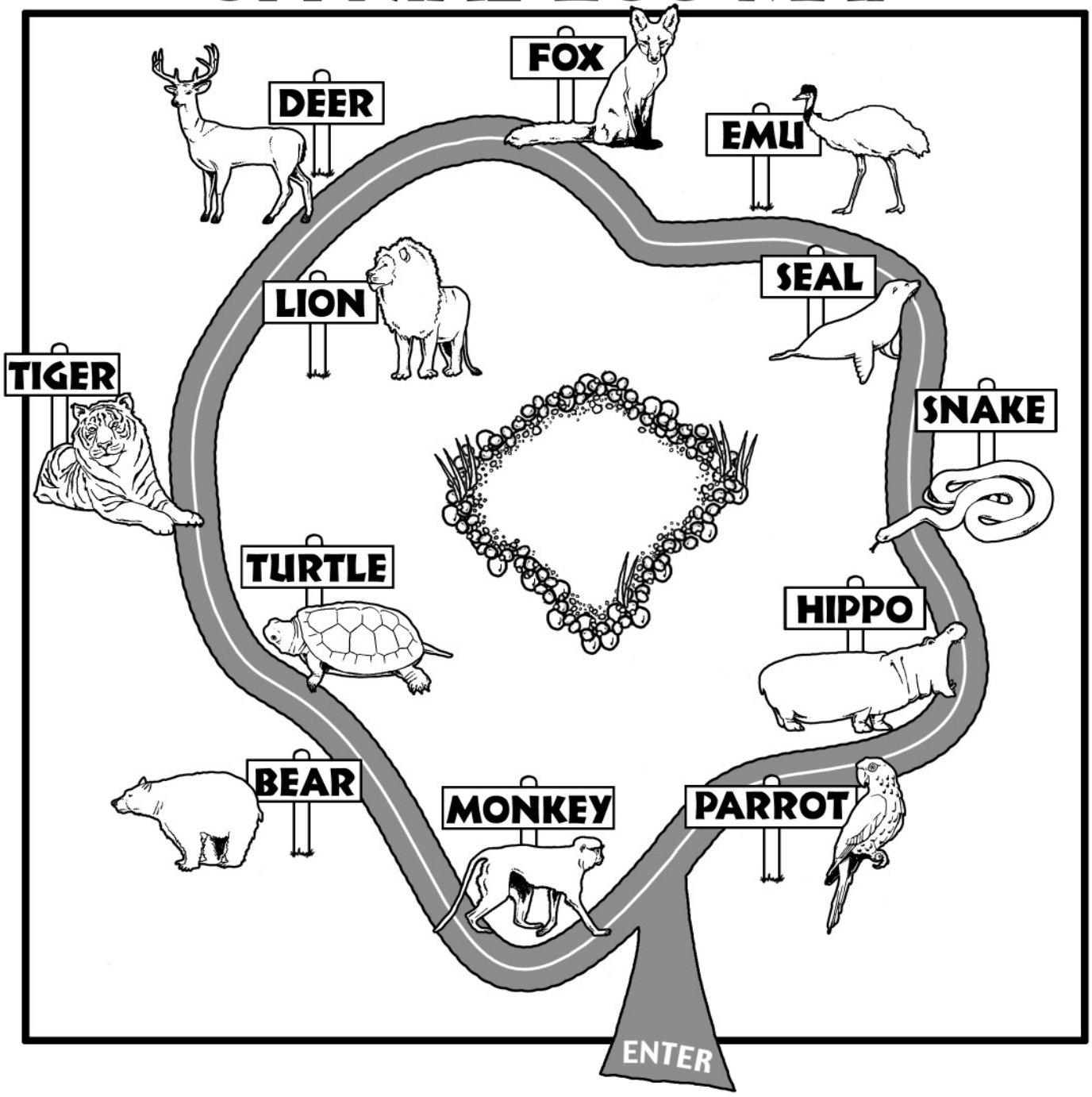
Students should be able to explain how their seeds germinated. They should explain after the seed absorbed water, the root emerged first, then the stem and leaves.

ZOO-KNOWLOGY

Puzzle Corner

You are going to take a trip around the zoo using the map below. Carefully follow the directions your teacher gives you and move your marker around the zoo. You must stay on the path.

OFFICIAL ZOO MAP



ZOO-KNOWLOGY

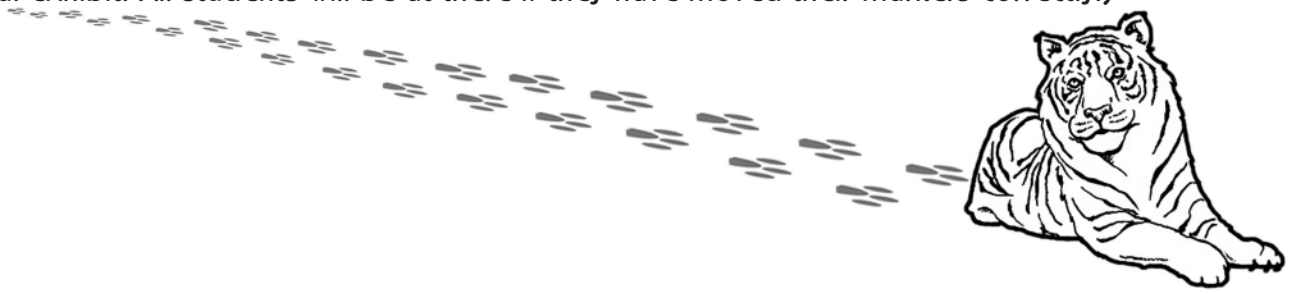
Puzzle Corner—Teacher Directions

Version One

1. We're going to take a trip around the zoo beginning at the monkey exhibit. Place your marker there.
2. Choose any animal in the zoo, but don't tell anyone which animal you picked. Spell out the name of that animal, moving around the zoo one exhibit for every letter in the name. Move in a **clockwise** direction. Do not count the space where you are starting. For example, if you picked "Emu," you would end up at the tiger exhibit. (Show how to move the marker around the zoo, spelling out the name of an animal. Emphasize the clockwise direction and the accurate spelling of the name.)
3. Spell the name of the animal at the exhibit where your marker ended, again moving around the zoo in a **clockwise** direction. If you were starting from the tiger exhibit, you would now be at the seal exhibit.
4. Spell the name of the animal at the exhibit where your marker ended once more, this time moving in a **counterclockwise** direction. (Be sure that all students pay attention to this change in direction.)
5. I will now go to the exhibit where you are and meet you there. (Place your marker on the lion exhibit. All students will be there if they have moved their markers correctly.)

Version Two

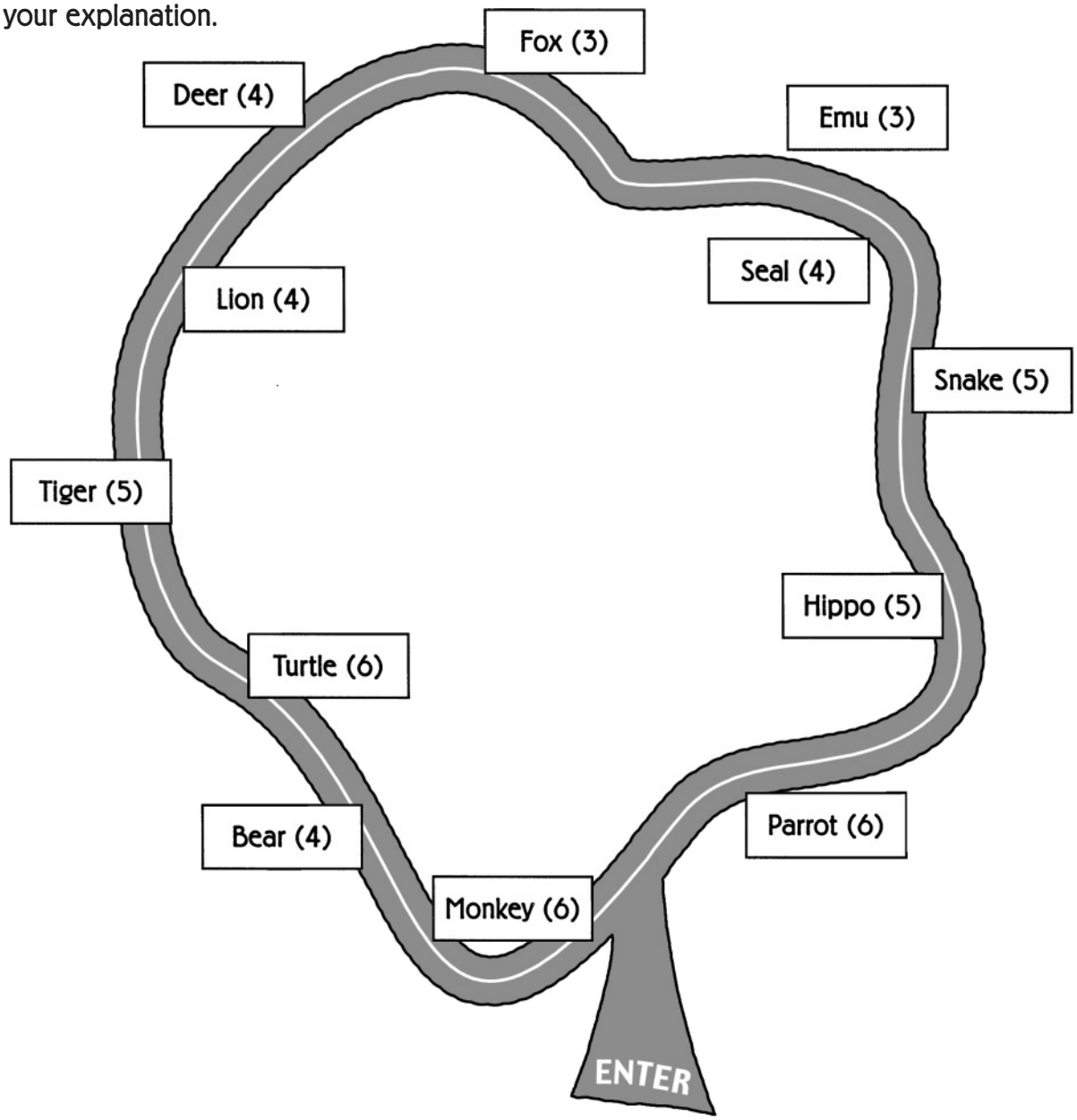
1. Let's take another trip around the zoo, once again beginning at the monkey exhibit. (Have students place their markers at the monkey exhibit once again.)
2. We're going to follow the same rules as before, but this time, when you pick your animal, move your marker around the zoo in a **counterclockwise** direction, spelling out that animal's name. (Be sure all students begin moving their markers in the correct direction.)
3. When you get to the second animal, continue to move in a **counterclockwise** direction, spelling out this second animal's name.
4. For the final move, spell the third animal's name while moving **clockwise**.
5. I will once again join you at the exhibit where you have finished. (Place your marking chip on the seal exhibit. All students will be at there if they have moved their markers correctly.)



ZOO-KNOWLOGY

Maximizing Math—Version One

1. How did your teacher know what exhibit you were at by the end of each trip? Study the diagram below to help you develop an explanation for why it works. Notice that the number of letters in each animal's name has been included. Use the back of this paper to record your explanation.



2. As a group, come up with a similar puzzle in which you will always know the answer or the final result. Your new puzzle can have a very different format as long as you always know how it will end. Be prepared to share your puzzle with your classmates.

ZOO-KNOWLOGY

Maximizing Math—Version Two

1. How did your teacher know what exhibit you were at by the end of each trip? Study this problem and develop an explanation for why it works. You can use words and/or diagrams to describe you answer.

2. As a group, come up with a similar puzzle in which you will always know the answer or the final result. Your new puzzle can have a very different format as long as you always know how it will end. Be prepared to share your puzzle with your classmates.