

Workshop 2

Intellectual Development

In this workshop, you will explore the power of the mind and consider the notion that every child can learn everything. Eleanor Duckworth will discuss the importance of teaching for a deep and lasting understanding, and will explain why it is important to give students time to work through their own ideas and experience confusion in order to achieve such understanding.



ELEANOR DUCKWORTH

Professor of Education at the Harvard Graduate School of Education and a former student, colleague, and translator of Jean Piaget, Eleanor Duckworth grounds her work in Piaget's theories of the nature and development of intelligence. Her own interest, however, is in teaching and in the experience of teachers and learners of all ages, both in and out of schools. She has worked on curriculum development, teacher education, and program evaluation in the United States, Switzerland, Africa, and her native Canada. She is the author of *The Having of Wonderful Ideas* and *Teacher to Teacher: Learning from Each Other*.

Workshop 2 timeline

GETTING READY

30 minutes

30 minutes—Going to the Movies

How many different ways can four children sit in adjacent seats at a movie theater?

You may know a formula for solving the problem, but take a few moments to explore the different arrangements themselves. You might want to use four small objects to represent the children, or you could use a symbolic notation with pen and paper.

When you think you have identified all the arrangements, convince a partner that there are no more possibilities, and explain how you know for sure that you have found them all.

Your homework will be to ask two of your students to do this problem. Select two students that you think will approach the problem differently. Take a moment now to decide which students you will ask and to predict how they will solve the problem.



Remember to update the Moon and Learning Charts.

WATCH THE WORKSHOP VIDEO

60 minutes

GOING FURTHER

30 minutes

10 minutes—Moon Discussion

By now, you should have begun your Moon observations and Moon Journal. Discuss your progress. Is the process working for you? Have you had any problems? Remember to add new ideas and questions to the Moon Chart.

20 minutes—Finding a Balance

Letting students “take the lead” in the classroom and develop their own understandings may be great for their learning, but is it so great for the teacher? In most school districts, teachers are held accountable by mandatory local and state tests. How can you “let kids go” so they can learn from their own ideas, and at the same time make sure that they know the content—the facts—to succeed on the mandatory tests? How do you find the balance? What are some things you can do?



HOMework ASSIGNMENT

Recall the “Going to the Movies” problem that you did at the start of Workshop 2 (see Getting Ready, page 20). Select two students whom you think will approach the problem differently, and predict how they will solve the problem. Then present the problem to the students. You may need to ask some probing questions, such as:

How did you find your answer?

How do you know that there are no more possibilities?

Is there any other way you could have solved the problem?

After working with both students, compare their approaches to your original predictions. What impressed you most about their problem solving methods? What surprised you? What can you do in your teaching that will enable you to continue to learn these kinds of things about your students?

READING ASSIGNMENT

In preparation for Workshop 3, please read “How Do We Learn Our Lesson?” by Joseph Novak. (All readings are included in the Appendix.)



MOON JOURNAL

Here are some questions to consider as you continue to observe the Moon:

Does the appearance of the Moon change over time?

Does its size change?

Its shape?

Its color?

Suggested activity



Measuring the Moon's Diameter

When making your Moon observations, take a ruler with you. Hold the ruler at arm's length from your body and measure the diameter of the Moon in centimeters. Record your finding and try it again the following night. Does the diameter of the Moon change every night? Can the diameter of the Moon really be measured in centimeters with a ruler?

For more accuracy, you can measure the Moon's diameter using a Cross Staff. Here's how.

BUILDING A CROSS STAFF

MATERIALS:

- Cross Staff template (p. 23)
- Paste or glue
- Cardstock
- Meter stick
- Scissors

INSTRUCTIONS

1. Adhere the Cross Staff template to a piece of cardstock and cut along the solid lines. Be sure to cut out the notch at the top of the template and the rectangular slot in the center.
2. Push a meter stick through the rectangular slot and make sure that the card can move freely up and down the length of the meter stick.

USING A CROSS STAFF

1. On a night when the Moon is at or near full, hold the meter stick with the zero end touching your cheek and the meter stick pointing towards the Moon.
2. Slide the card along the meter stick until the Moon just fills the notch. (It may be helpful to close one eye while looking at the Moon through the notch.)
3. Note the distance along the meter stick between the card and the end closest to your eye.
4. You can now calculate the diameter of the Moon using the following ratio:

$$\frac{\text{width of notch}}{\text{distance from card to eye}} = \frac{\text{diameter of Moon}}{\text{distance to Moon}}$$

Use the distance 400,000 km as the distance from the Earth to the Moon. (The accepted value is 384,401 km.)

EXTENSIONS

Often the Moon looks “bigger” when it is near the horizon. How could you use a Cross Staff to check whether or not this is a true phenomenon?

A Cross Staff can be used to determine the dimensions of other objects once their distance from the observer is known.

Adapted from:

Hall, J. (1994). Calculating the Moon's diameter. In N.B. Ball, H.P. Coyle, & I.I. Shapiro (Eds.) *A teacher resource to enhance astronomy education: Project SPICA*. Kendall/Hunt Publishing Co.: Dubuque, Iowa.

Wong, O.K. (1987, October). “How wide is the Moon?” *The Science Teacher*.

CROSS STAFF TEMPLATE

