

The Annenberg/CPB Channel
Professional Development Workshop Guide



An Eight-Part Workshop Series for K-12
Teachers of Mathematics and Science

produced by Harvard University



and Smithsonian Institution



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is produced by the Science Media Group
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About the Workshops

Series Overview

Ever since the first time teachers tried to influence students, there has been controversy surrounding the methods they used. In the years since Socrates first created and honed his famous method, hundreds of educators have developed theories about learning and teaching. Among these, there are many areas of convergence, as well as a few instances of contention, but all have in common a focus on how children learn and how best to create situations in which learning can take place. For today's teachers the challenge becomes "What are these theories really telling us? What do we do with these seemingly complicated and overlapping arguments?" And equally compelling is how the questions surrounding these ideas are viewed by professionals against the background of their own personal beliefs about teaching and learning.

To this end, **Looking at Learning . . . Again** invites seven leading educators to share the origin, structure, research base, and applicability of their arguments for creating the most efficient and productive learning environments for students in our elementary and secondary mathematics and science classes.

Teachers are the backbone of the educational system. Like educational theorists, they continually develop new ideas and insights, question current practices, and strive to keep education a living and changing organism. Both teachers and theorists bring to the table a wealth of experience that has shaped their ideas on what teaching and learning should be. But all too often, teachers and theorists work in isolation, and new educational theories do not always find their way into the classroom. This workshop series provides an opportunity for practitioners to explore, discuss, critique, and ultimately implement the ideas and strategies of seven leading educational theorists—an important step toward making the teaching of mathematics and science more effective.

About the Workshops

Workshop Descriptions

Workshop 1: The Many Faces of Learning

Reflect on your own personal beliefs about learning, and discover why it is important for teachers to examine and reexamine the learning process.

Workshop 2: Intellectual Development

Share ways to elicit, accept, and build on students' ideas, and discover the connection between student ideas and intellectual development.

Workshop 3: Conceptual Thinking

Consider how students learn by assimilating new concepts into their already existing frameworks.

Workshop 4: Inquiry

Explore why inquiry learning is essential in mathematics and science, and develop several strategies for inquiry-based teaching.

Workshop 5: Idea-Making

Investigate how facilitating the construction of students' own mathematical ideas has a positive effect on learning.

Workshop 6: The Mind's Intelligences

Review Gardner's theory of multiple intelligences and learn how to create learning environments that support the full spectrum of students' intelligences and abilities.

Workshop 7: Design, Construction, and Technology

Examine the effect of technology on learning when students design and develop tools to support their own inquiries.

Workshop 8: Intellectual Development

Analyze differences in curricula, textbooks, and teaching practices around the world, and discuss how these differences affect student learning in mathematics and science.

About the Workshops

Video Clip Descriptions

WORKSHOP 1

In the Dark

Richard and Karen, grade 8, discuss their ideas of light and vision.

Looking at Learning . . . Again

Guest educators explain why it is important to continually examine learning.

WORKSHOP 2

Batteries and Bulbs

Kris Newton's 9th grade class at the Cambridge Rindge & Latin School (Cambridge, MA) begins a unit on batteries and bulbs.

Tea for 40 (T-440)

A group of teachers who have worked with Eleanor Duckworth for more than 15 years meets once a month to share activities and discuss their own learning.

Mission Hill School (Boston, MA)

Eleanor Duckworth conducts a workshop in which teachers, parents, and staff examine their own understandings about a particular phenomenon.

WORKSHOP 3

Rocks and Minerals

Tom Vaughn's 9th grade earth science class at Arlington High School (Arlington, MA) makes concept maps on atomic structure as they begin a unit on rocks and minerals.

Plane Geometry

Colleen Schultz's 8th grade algebra class at the Vestal Middle School (Vestal, NY) makes concept maps to review a unit on plane geometry before a test.

WORKSHOP 4

Wetlands

Erien Gordon's 5th grade class in Methuen, MA, observes the wetlands behind their school in order to come up with questions for an investigation.

Pendulums

Margarita Manso-Rosa's students in a 5-8th grade bilingual (Spanish) class in Cambridge, MA, share their results of a pendulum investigation and ask each other questions about what they've learned.

Paper Trusses

Nancy Cianchetta's 8th grade students in Everett, MA move from disinterest to involvement when they are presented with a paper truss challenge.

WORKSHOP 5**Mental Addition**

Meredith Livings's 2nd grade class at the South Shades Crest School (Hoover, AL) engages in "mind mathematics" as the students solve double digit addition problems in their heads.

Mental Multiplication

Sherry Parrish's 4th grade students at the South Shades Crest School describe and defend their strategies for solving double digit multiplication problems in their heads.

WORKSHOP 6**Ross School (E. Hampton, NY)**

See a number of multiple intelligence strategies in practice:

Nichelle Wilson's 6th grade art class—"The Golden Mean"

Rick Faloon's 10th grade math class—Probability

Debra McCall's 7th grade history class—Roman architecture

David Purvis's 5th grade science class—Stars, Sun, and constellations

WORKSHOP 7**Girl Scouts Clubhouse**

At a computer clubhouse run by the Patriot Trail Girl Scouts (Boston, MA), girls ages 8 to 11 design projects on the computer, under the guidance of teenage mentors.

Robots

In Ronnie Ranere's K-1 class at the Bronx New School (Bronx, NY), students use robots to figure out distance on number lines.

Crickets

In Mark Hardy's 4th and 5th-grade class at the Bronx New School, students use "crickets" to collect temperature data before and after a walk.

WORKSHOP 8**Third International Mathematics and Science Study (TIMSS)**

A high school math class in Japan works on a challenging geometry problem.

Round Table

A group of teachers, administrators, and parents discuss how the TIMSS results reflect cultural and societal values and share their own ideas about what we, as a society, can do to improve our education system for our children.

About the Contributors

MICHAEL R. COHEN, Ph.D. (Content Advisor)

Dr. Michael Cohen is a Professor of Science and Environmental Education at Indiana University-Purdue University at Indianapolis. Dr. Cohen began his teaching career as a Junior High School science teacher, where he discovered that his students were his best teachers. For 30 years, he has used those early lessons as the basis of his research on children's science concepts. His studies have been used in science curricula, teacher education projects, and two textbook series he co-authored: *Scott-Foresman Science* and *Discover Science*.

REBECCA CORWIN, Ed.D. (Content Advisor)

Dr. Rebecca Corwin taught 5th grade for ten years. She is currently Professor of Education at Lesley College, and works with her graduate students in an elementary school in Boston in order to bring their practical and theoretical knowledge together as they learn to be teachers. Dr. Corwin has written a number of books for teachers, including the *Used Numbers* series about statistics and data analysis.

ANNA GOODSON (Interviewer)

Anna Goodson is the Director of Educational Services at Alabama Public Television where she works with teachers, administrators, and organizations to provide educational programming for school districts statewide. She teaches teachers how to use television as an instructional tool. Ms. Goodson has planned and facilitated educational programs at the Birmingham Zoo (Birmingham, AL), and has also taught gifted and talented students at both the elementary and middle school levels.

KALPANA GUTTMAN (Interviewer)

Kalpana Guttman holds a Master's of Education in both Elementary Education and Computers in Education. She has taught at the preschool and elementary levels for sixteen years. She has also worked at the Arnold Arboretum (Jamaica Plain, MA) where she worked with teachers on developing a constructivist approach to science teaching, and assisted them in incorporating technology into their classrooms. Ms. Guttman currently teaches 5th grade in Newton, MA.

RICHARD KONICEK, Ed.D. (Content Advisor)

Dr. Richard Konicek has been involved in science education for 38 years. He has conducted research, taught junior high school, and worked as a K-12 science curriculum coordinator. Dr. Konicek is now a Professor of Science Education at the University of Massachusetts in Amherst, where he teaches elementary science methods and research courses focused on the application of research to teaching.

SUSAN MATTSON, Ph.D. (Content Advisor, Interviewer)

Dr. Mattson received a B.A. in Biology from the University of California at Berkeley, followed by a Master's in Biology and Ph.D. in Science Education from Florida State University. In addition to teaching science methods courses for early childhood and elementary education majors, her experiences include curriculum development in the sciences and professional development for teachers. Dr. Mattson has recently returned to the classroom to teach high school biology.

JAYNE OGATA (Host)

Jayne Ogata has worked for the past ten years as a performing artist and educator in the Boston area. She has also toured with Shakespeare & Company's education program, bringing theater performances and workshops to schools throughout New England and in New York City. Ms. Ogata recently earned her Master's of Education in Learning and Teaching from the Harvard Graduate School of Education. She continues to participate in creating quality educational programming for the classroom, workshops, stage, and broadcast media.

MAURICE PAGE (Interviewer)

Maurice Page has been teaching mathematics for 30 years. He has taught elementary, middle, and high school students, and currently teaches at the high school level at the Cambridge Rindge & Latin School (Cambridge, MA). Mr. Page also teaches mathematics methods courses to education majors at the Harvard Graduate School of Education and is a consultant for the science and mathematics teaching course at the MIT Teacher Education Program.

PHILIP SADLER, Ed.D. (Content Advisor)

Dr. Philip Sadler has a joint appointment as the Assistant Professor of Science Education at the Harvard Graduate School of Education, and the Director of the Science Education Department at the Harvard-Smithsonian Center for Astrophysics. Dr. Sadler is also the founder of Learning Technologies, Inc., a company creating science learning tools used each year by over 3 million students in 18 countries.

LISA SCHNEIER (Content Advisor, Interviewer)

Lisa Schneier has been a teacher and program developer at Boston English High School. She has also worked at the Massachusetts Corporation for Educational Telecommunications (MCET) as a curriculum developer. She has been a student and colleague of Eleanor Duckworth since 1983, and has used this work in her teaching and in research that documents 9th grade students learning poetry.

JAY SUGARMAN, Ed.D. (Host, Content Advisor)

Dr. Jay Sugarman holds a Master's of Science of Teaching in Elementary Education, and an Ed. D. in Curriculum and Instruction. He has been an elementary school teacher for 25 years, and currently teaches 4th grade at the Runkle School (Brookline, MA). Dr. Sugarman also teaches a number of education courses to undergraduate students at Simmons College.

TEREZ WALDOCH, Ph.D. (Interviewer)

Dr. Terez Waldoch is currently Assistant Principal at the Wildwood Elementary School in Amherst, MA. During her 25-year teaching career, she worked as a science curriculum coordinator, co-chaired a curriculum overview committee, and presented science workshops for teachers. In 1993, Dr. Waldoch was recognized with the Presidential Award for Excellence in Science Teaching in the Commonwealth of Massachusetts.

YVONNE WATSON (Host)

Yvonne Watson has been an elementary school teacher with the Boston School Department for 19 years. Actively involved in Boston's school change efforts, Ms. Watson serves as a member of the Instructional Leadership Team at the Manning School. She is also a lead teacher working as Boston Curriculum Standards Facilitator for the Office of Curriculum and Instruction. Ms. Watson has a passion for creating new ways to help children think critically and satisfy their natural curiosity about the world while developing basic skills.

JEFFREY WINOKUR (Host)

Jeffrey Winokur is an early childhood and elementary science specialist at Wheelock College (Boston, MA), where he teaches both undergraduate and graduate-level courses in science teaching. Mr. Winokur has worked with a number of Massachusetts school districts on the development of their elementary science programs, and has also consulted with early childhood programs throughout New England to provide teacher workshops on science for young children.

Workshop Components

Day of each workshop

Site Investigation: GETTING READY

30 minutes of discussion and activity to prepare you for the workshop video

Workshop Video

60 minutes of video with guest interviews, classroom footage, teacher panels, and more

Site Investigation: GOING FURTHER

30 minutes of discussion and activity to wrap up the workshop video

Between workshops

Homework Assignment

an exercise or activity that ties into the previous workshop or prepares you for the next one

Reading Assignment

an introduction to the ideas of the guest who will be featured in the upcoming workshop

Ongoing Activity

Moon Journal: an ongoing Moon observation activity to help you reflect on your own learning process

Web site

a place to go for additional activities, resources, and discussion

www.learner.org/channel/workshops/lala

Channel-Talk

an opportunity to communicate with other workshop participants via email

To subscribe to Channel-Talk (the workshop email discussion list)

Send an email message to: channel-talk-request@learner.org

The message should read: subscribe channel-talk <Your Name>

For example: subscribe channel-talk Amanda Cho

Be sure to remove any signature files before sending your message.

Helpful Hints

Successful Site Investigations

Included in the materials for each workshop you will find detailed instructions for the content of your Getting Ready and your Going Further Site Investigations. The following hints are intended to help you and your colleagues get the most out of these pre- and post-video discussions.

Designate a facilitator.

Each week, one person should be responsible for facilitating the Site Investigations (or you might select two people—one to facilitate Getting Ready, the other to facilitate Going Further). The facilitator does not need to be the Site Leader, nor does it need to be the same person(s) each week. In fact, we recommend that participants rotate the role of facilitator on a weekly basis.

Review the Site Investigations.

Be sure to read over the Getting Ready and Going Further sections of your materials before arriving at each workshop. The Site Investigations will be the most productive if you and your colleagues come to the workshops prepared for the discussions.

Bring the necessary materials.

A few of the Site Investigations require group brainstorming or list making. In these instances, it will be useful to have markers and chart paper or newsprint. The facilitator should be responsible for bringing these materials, when necessary. **You will need these materials for Workshop 1.**

Keep an eye on the time.

Thirty minutes go by very quickly, and it is easy to lose track of the time. We have suggested the amount of time that you should spend on each question or activity. While these times are merely a guideline, you should keep an eye on the clock so that you are able to get through everything before the workshop video begins. In fact, you may want to set a small alarm clock or kitchen timer before you begin the Getting Ready Site Investigation to ensure that you won't miss the beginning of the video. (Sites that are watching the workshops on videotape will have more flexibility if their Site Investigations run longer than expected.)

Record your discussions.

We recommend that someone take notes during each Site Investigation, or even better, that you make an audiotape recording of the discussions each week. These notes and/or audiotape can serve as "make-up" materials in case anyone misses a workshop.

Share your discussions on the Internet.

The Site Investigations are merely a starting point. We encourage you to continue your discussions with participants from other sites on the discussion area of the Web site and on Channel-Talk, the workshop email discussion list.

Ongoing Activity—Moon Journal

Overview

The behavior of the Moon is a phenomenon that we have all experienced during the entirety of our lives, but very few of us have spent time thoughtfully observing its behavior. Think about it for a moment . . . when was the last time you saw the Moon? What did it look like? If you went outside right now, would you be able to see the Moon? Where in the sky would you look to find it? What would it look like? No matter how much you already know about the Moon's behavior, there is always something new to learn!

Throughout this workshop series, you are encouraged to learn about the Moon by keeping a Moon Journal. This means simply going outside several nights a week to observe the Moon, recording your observations on a drawing, and reflecting on your observations in a journal. Your recordings or data will become a path for you to follow as you look for patterns in the Moon's behavior and build your knowledge both about the Moon, and also about your own learning process.

In Workshop 1, you and your colleagues will be asked to develop a Moon Chart to display the group's collective knowledge about the Moon. The chart will grow and change over time as you gather new knowledge through your observations of the Moon. Several times throughout the series you will have an opportunity to discuss your findings with your colleagues, but you are encouraged to update the Moon Chart weekly, even when no specific Moon discussions are planned.

Experiencing the process of learning new content is a useful way to reflect on your own personal beliefs about learning. As you progress through the Moon Journal activity, think not only about what you are learning, but how you are learning. Whether you teach first graders or high school seniors, math or science, keeping a Moon Journal will provide a shared experience that will enable you and your colleagues to examine your own learning processes, and will lend insight into your beliefs about how your students, and others, learn.

Ongoing Activity—Moon Journal

Instructions

Materials: drawing paper and pencil, directional compass, notebook


1. Choose a location convenient to your home or work with as clear a view as possible of the southern sky. (Use a compass to locate south. If you do not have a compass, call the direction of the setting Sun west, and then approximate south.) When facing south, you should be able to look east (to your left) and west (to your right) without any major obstacles blocking your view.
2. You should make all of your Moon observations from the same location. To help you find this location each time you make an observation, identify the location by pushing a stick or stone into the ground or making a scratch or chalk mark on a paved surface.
3. Make an **Observation Sheet**. On a plain sheet of paper, draw the horizon you see while standing in your location and looking south. Place south in the center of your drawing, and include anything that falls into your field of view (buildings, trees, hills, etc.) These landmarks will provide you with reference points when you draw the Moon's position.
4. Choose a specific time to make your observations and make all your Moon observations within the same 30-minute period every evening. If you're not sure when to make your observations, refer to an almanac to find the time of moonrise and moonset. You also may be able to find this information on a calendar. Moon observations can be started any time during the sequence of the Moon's phases. If you cannot observe every evening, we recommend that you observe at least four times per week.
5. For each observation, draw the Moon on your Observation Sheet, recording both its position in the sky as well as its apparent shape. Write the date next to each drawing of the Moon.
6. After you have observed the Moon, make an entry in a notebook, or **Moon Journal**. Record the date, time, apparent shape of the Moon, and anything interesting or unusual you observe about the Moon or the sky. You should also take some time to write a few reflections, such as what you saw, what you think about what you saw, what questions you have, or what you've learned. We will suggest some Moon Journal questions in each workshop, but you should not feel obliged to answer the questions we provide. Write about what moves you, and remember to consider your own learning process.
7. Bring your Observation Sheet and Moon Journal with you to each workshop and discuss your findings with your colleagues, when time allows. Also, record your new ideas and questions on the Moon Chart at each workshop (see Going Further, page 17).

Ongoing Activity—Moon Journal

Sample Moon Journal Entry

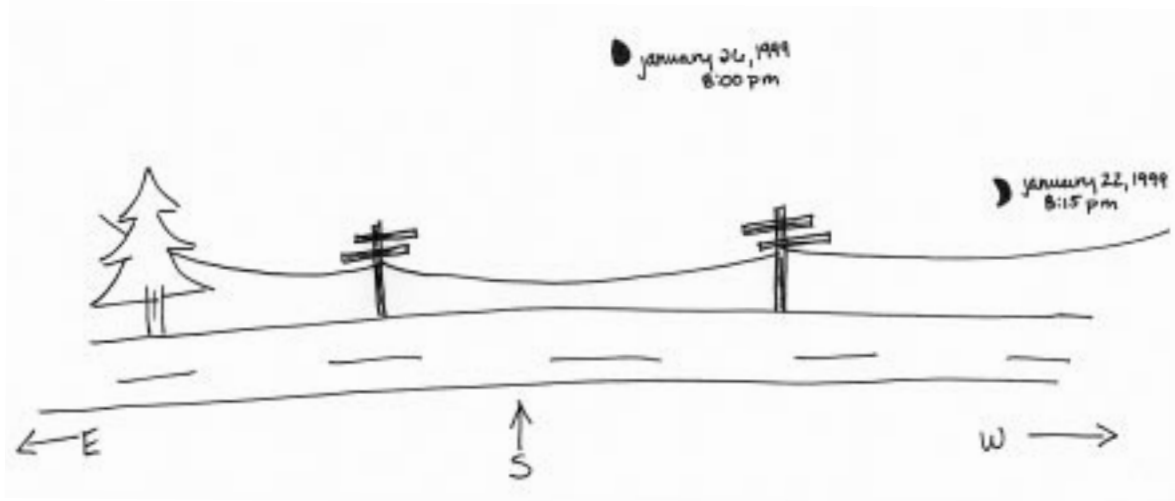
January 22, 1999, 8:15 pm

Tonight when I went outside during my observation time I noticed the Moon in the western portion of the sky. This was the shape of the Moon at this time:



Sometimes when I go outside at lunchtime I notice the Moon. I wonder if there is a time when the Moon is only visible during the day and not at night???

Sample Moon Observation Sheet



Adapted from:

Coyle, H.P., Gregory, B., Luzader, W.M., Sadler, P.M., & Shapiro, I.I. (1993). *Project STAR: The universe in your hands*. Kendall/Hunt Publishing Co.: Dubuque, Iowa.

Brandou, B. (1997). Backyard astronomy: Observing Moon phases. *Science and Children*, 34(8), 18-21, 48.

Education Development Center, Inc. (1968). *Where is the Moon? Teacher's Guide*. McGraw-Hill Book Company: St. Louis, MO.