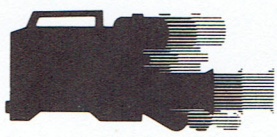
See What Science Is All About™

AN INSTRUCTIONAL PROGRAM FOR ELEMENTARY TEACHERS



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Published by
INSIGHTS Visual Productions, Inc.
P.O. Box 644
Encinitas, California 92024

Printed in the United States of America
Fourth Edition, 2nd Printing © 1990

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INTRODUCTION

Adequate in-service education is the first and most important component in building a successful science program. Most traditional in-service workshops have been hit-and-miss . . . a few tricks and activities a teacher could use, a little theory on specific topics but never any type of comprehensive training . . . until now!

With *See What Science Is All About*™ you will find an innovative solution to a national problem. Whether your needs are at the university level in a science methods course or on site at an elementary school, you can use this program to train your teachers in all areas of earth, life and physical science in the most economical, efficient manner possible.

The program consists of nine videotapes and comprehensive printed outline. It is presented at two levels, K-3 and 4-6, and can be utilized in a variety of applications. In structured workshops staff members meet twice a week and cover all topics in six weeks. Since there are nine separate stand-alone tapes in the program, in-service activities can be conducted concurrently at multiple sites. Another successful and economical approach is to introduce the program at a staff meeting and then make it available for prep period or overnight checkout. In this application one set of tapes can be shared by three elementary schools and the earth, life and physical science components rotated on a regular basis.

In pre-service applications a science methods instructor can either show segments in class or make the tapes available through the media center. Students may be assigned specific segments (there are 34) and present the material to the rest of the class. Customers of *See What Science Is All About*™ are given permission to photocopy the printed outline and students will find this outline an invaluable resource in their new teaching assignments.

The program utilizes close-up photography and computer graphics to clarify activities and concepts. Literally hundreds of classroom activities are demonstrated, all using basic scientific equipment and readily-available materials. Teachers will not only see what materials they'll need but they'll learn how to use them, too. Since many activities are unique and were chosen from a variety of resources, teachers will discover new applications for materials used in existing science programs. As a result, this video series will add substantial depth to any existing elementary science program.

The video workshops are always available for review or for use by new teachers or those changing grade level and, of course, the video medium is not intimidating to the participants. This program was designed around the *California State Science Framework Addendum* (1984) and correlates to many other state science frameworks and most major text series.

Jack Ross, the program instructor, has a Master of Arts degree in science instruction and has taught classroom science at junior high, adult education and university extension levels. Most recently he was a science resource specialist for the San Diego County Office of Education. During this time one of his responsibilities was to conduct science workshops for elementary teachers. *See What Science Is All About*™ developed from this experience. Jack takes an inquiry approach to problems, stresses the development of process skills and challenges his students to think critically and make logical progressions.

Our goal at Insights Visual Productions is to bring quality science instruction to the elementary classroom. By taking the first, most important step and supplying your teachers with the knowledge they'll need to teach science you'll make a quantum leap toward making this goal a reality.

Instructional Objectives and Goals:

The main objectives of this program are to (1) **motivate teachers** by getting them excited about science, (2) **demystify science** by explaining how and why things happen the way they do, and (3) **demonstrate the value of science instruction** as a vehicle for developing process skills. We meet these objectives by offering simple explanations of scientific theory and support this theory with a variety of classroom activities. It is designed to four main instructional goals:

1. To develop values, attitudes and aspirations which promote the individuals personal involvement with the environment and society.

2. To develop and apply rational thinking processes.

3. To develop skills in the use of equipment and manipulation of materials, in the care and handling of living organisms and in the collection, organization and communication of scientific information.

4. To develop knowledge of processes, facts, concepts and unifying principles and utilize this information to further understand natural phenomena.

Science instruction should be a blend of content and process. Students must learn scientific information but should also have the opportunity to develop the skills of observing, communicating, comparing, organizing, relating and inferring. Activities in *See What Science Is All About*™ are presented as interactive experiences designed to develop these process skills and stimulate convergent and divergent thinking. Convergent thinking includes observing objects, identifying properties of each and classifying them on the basis of common characteriestics. Divergent thinking may include formulating a creative solution to a problem or inventing a new use for a common object (such as using a balance to count a large number of similar items or using a drawer handle to pop off a bottle cap).

In our description of process skills we identify seven major areas. At the primary (K-3) level these skills are mostly organizational in character:

1. **Observing:** By using the five senses we can identify the characteristics of objects and their interactions.

2. **Communicating:** Objects are identified and events are described so that information can be passed on. This skill allows us to learn information "secondhand" and at a much faster rate than would otherwise be possible.

3. **Comparing:** Objects and events are examined in terms of similarities and differences. By comparing the known to the unknown we gain knowledge about the unknown. All measurements (weight, capacity, quantity, relative position, temperature, voltage, etc.) are forms of comparing.

4. **Organizing:** By systematically compiling, classifying and ordering data we gain knowledge of principles and laws.

At the next level (4-6/junior high) the process skills are relational in character:

5. **Relating:** Includes experimenting and is a process by which we weave concrete and abstract ideas together to test or explain phenomena. Here skills of inductive, deductive and hypothetical reasoning are developed. As we attempt to answer a question or solve a problem we use the scientific method. It consists of the following five steps:

   a. **Identify the problem:** Specifically state what the investigator is attempting to find out.

   b. **Hypothesis:** The investigator considers what is previously known about the problem and proposes a solution.

   c. **Experiment:** An experiment is designed to solve the problem or answer the question. A "control" should be used whenever applicable. This is an unaffected sample that is compared to the experimental samples. Adequate sample sizes are also important. If there is more than one influence on the samples at the same time the student will be unable to determine the relative effect of each influence. This is why it is important to "control variables" or keep everything the same except the one variable which you wish to test. To illustrate this, an experiment may be designed to investigate the effect of fertilizer on bean growth. All samples are in the same size containers, have the same type of soil and get the same amount of water and sunlight. The "control" samples get no fertilizer while the experimental samples are fertilized. To reduce the variance caused by "strong" or "weak" seeds the average height of the fertilized plants is compared to the average height of the control plants.

   d. **Results:** Proper presentation of data allows one to easily see the relative effects of one or more variables. Results can be observable or measurable quantities and can be presented in tabular or graphical form.

   e. **Conclusion:** What was discovered by doing the experiment? Is there sufficient evidence from the results to answer the original question? Reevaluate the hypothesis. Was it correct?

By studying science and scientific methods students develop an attitude and method of inquiry as well as a body of scientific knowledge. In "guided inquiry" the teacher may identify the problem, suggest a hypothesis and a method of testing it. The students may then continue "unguided" and evaluate the results and formulate conclusions from the results. Eventually, with experience, students will be able to manage this entire process on their own.

The final process skills are developed at the secondary level and are theoretical and applicational in character:

6. **Inferring:** This higher-level skill involves realizing ideas that are not directly observable. Students go beyond the concrete to recognize patterns. They synthesize, analyze, theorize and offer predictive explanations to simple and complex phenomena.

7. **Applying:** Students bring acquired knowledge and experience together to create, invent or put information to use. This process of applying is necessary for technological advancement.

These processes are arranged sequentially and each includes the previous process (for example, one cannot organize objects without making comparisons and one cannot make comparisons without making observations). No attempt should be made to develop process skills that are beyond the developmental readiness of the student.

PROGRAM APPLICATION

Because of it's flexibility, there are a number of successful strategies used to implement this program.

Pre-service applications:

See What Science Is All About™ will greatly assist the science methods instructor by presenting scientific concepts and a number of science activities that would otherwise be logistically impossible to cover in the brief period of a science methods course. The goal in this application is to familiarize each student with science concepts, methods and activities and prepare students to teach all major areas of earth, life and physical science (from kindergarten through the sixth grade). With a copy of this printed outline, students will have additional valuable material that they can use in their new assignment.

The program can be presented in the classroom using a six-week format similar to the one presented below or stretched out over the entire semester. Segments range from 22 to 55 minutes with an average of 37 minutes. Selected activities or group discussions can be pursued following each segment (refer to "in-service applications" for more information).

Another successful application is to assign a particular segment to each student and make the tapes available for checkout at the media center. Since there are nine tapes in the program, each student should find an opportunity to view their subject within a week. Students can then design lesson plans around their topic. They can set up activities or demonstrations and present their topic to the rest of the class.

Utilizing *See What Science Is All About*™, the methods instructor can establish realistic requirements for students and issue certificates of completion which can be added to the students' personnel files and give them an edge in the job market.

Week	Monday	Running Time	Tuesday	Running Time	Wednesday	Running Time	Thursday	Running Time
1	K-3 Astronomy*	23 min.	4-6 Astronomy	34 min.	K-3 Geology/ Oceanography	22 min.	4-6 Geology/ Oceanography	45 min.
2	K-3 Meteorology*	34 min.	4-6 Meteorology	29 min.	K-3 Matter*	34 min.	4-6 Matter, sec. 1	36 min.
3	no meeting	-	4-6 Matter, sec. 2	31 min.	K-3 Mechanics	30 min.	4-6 Mechanics	24 min.
4	K-3 Heat/Light	25 min.	4-6 Heat/Light	47 min.	K-3 Sound/Electricity Magnetism	38 min.	4-6 Sound/Electricity Magnetism	46 min.
5	K-3 Cells/Genetics*	24 min.	4-6 Cells/Genetics	42 min.	K-3 Protists/Plants	50 min.	4-6 Plants, sec. 1 & 2	55 min.
6	K-3 Animals/ Humans/Ecosystems	44 min.	4-6 Classification/ Protists	24 min.	4-6 Animals	43 min.	4-6 Humans/Ecosystems	36 min.

In-service applications:

At the school site or district level, the program can be made available for check-out by individual teachers or presented in a series of workshops.

Chapter-by-chapter correlations are available for all major science text series. They are free to customers and may be obtained by contacting INSIGHTS Visual Productions, Inc. These correlations will show teachers (by grade level) which video segments to concentrate on.

For an economical approach, the program and textbook correlation can be introduced at a staff meeting and the tapes can be made available for individual teachers to check out and view at home. It's not uncommon for teachers to check out and view all the tapes in the interest of developing a broad base of science knowledge.

In a structured application, workshops may be set up according to the program outlined on page 4. Teachers need only attend workshops pertinent to their course of study. Intermediate teachers should be encouraged to attend some of the primary workshops to familiarize themselves with the basic science concepts. The more important primary sessions are delineated with an asterisk in the presentation chart. If this workshop crossover is not feasible, you can supply the intermediate teachers with sections of the primary outline for information. This presentation plan is only one of many possibilities. You may wish to redesign this plan for your specific needs. Workshops can be conducted by a science/math coordinator, junior high or high school science teacher or an elementary "mentor" teacher. Larger districts have been successful by training two teachers from each elementary school (one primary and one intermediate). These teachers then return with their set of the program and conduct science workshops "on-site" at their schools.

If you follow the plan on page 4, do not attempt to double up workshops as this information is already highly condensed. You may wish to break up the longer presentations with a discussion or activity (i.e., during 4-6 Matter, section 2, turn off the TV after "paper chromatography," try the activity and, while the paper is developing, watch the remainder of the segment).

Following each video presentation, the facilitator can pursue many options. Here are some possibilities:

1. Discuss which process skills are being developed for a particular activity (NOTE: for a comprehensive explanation of process skills refer to pages 2-3).

2. Discuss ways to best present a particular activity in a fashion that will encourage each student to think of a solution or offer a logical explanation (we regularly take this approach in the outline).

3. Discuss ways to incorporate English or mathematics instruction into particular science activities (cross-content approach).

4. Discuss ways to present an activity or demonstration that will actively involve as many students as possible (using assistants, for example).

5. Solicit additional activities, ideas or suggestions that can be used to help support these concepts.

6. Set up activity stations. Have participants perform one or more activities shown. To prepare for this, the facilitator must preview the tape in advance, gather the necessary materials and make a simple instruction sheet to go along with each activity. For ease and simplicity, the following activities from each section are recommended:

K-3 Astronomy: Make a star map of Orion and the Big Dipper. Look for them that evening.

4-6 Astronomy: Make a quadrant (with soda straw, cardboard and string). Measure the angle of the sun at a particular time and Polaris at night (report findings at next meeting). Also, look for new constellations (i.e., Dogs, Gemini, Taurus).

K-3 Geology/Oceanography: Soda straw hydrometer activity -or- sea floor box activity.

4-6 Geology/Oceanography: Identify some rock samples as igneous, sedimentary or metamorphic -or- obsertainer activity.

K-3 Meteorology: Make a simple wind-direction indicator -or- make cloud types with cotton -or- "Bugscopter" activity (have a contest).

4-6 Meteorology: Air pressure experiments -or- find relative humidity using two thermometers and a data table.

K-3 Matter: Braille activity -or- identify odors in Dixie Cups -or- drops of water on a penny -or- pennies in a full glass of water.

4-6 Matter, section 1: Filtering starch and/or sugar from water and using indicators to identify the presence of each.

4-6 Matter, section 2: Paper chromatography (use rectangular strips to identify three different black inks) -or- exothermic/endothermic experiment.

K-3 Mechanics: Reading coordinates activity -or- identify various tools as first-, second- or third-class levers.

4-6 Mechanics: Wood ramp and block experiment (try sandpaper, too) -or- rolling marble with milk carton experiment.

K-3 Heat: Reading room temperature (need thermometers) -or- heat transfer through liquids activity (two containers).

K-3 Light: Color wheel and food coloring activity.

4-6 Heat: Test materials next to a light bulb for transmission, reflection or absorption.

4-6 Light: Water drop magnifiers -or- backward writing -or- measure angle of incidence vs. angle of reflection.

K-3 Sound: Party-line telephones.

K-3 Electricity/Magnetism: Test metallic items (i.e., needles) in baking cups with a compass. Determine if they are magnets or not.

4-6 Sound: Tissue tube sound amplifier.

4-6 Electricity/Magnetism: Battery and bulb experiments.

K-3 Cells/Genetics: Egg activities (observe a chicken egg).

4-6 Cells/Genetics: Observe and record genetic traits (earlobes, tongue rollers, etc.) -or- "Square of fortune" activity.

K-3 Protists/Plants: Make plaster "fossils" -or- segments and seeds in an orange.

4-6 Plants: Dissect a flower -or- observe photocopies of tree rings (make inferences) -or- root observations.

K-3 Animals/Humans/Ecosystems: Earthworm observation -or- fingerprints -or- reaction timer (squares) -or- food chain boards (can draw lines instead of using boards).

4-6 Classification/Protists: "Name the person" -or- cut out paper shapes (classify each).

4-6 Animals: Natural selection activity -or- earthworm response.

4-6 Humans/Ecosystems: Reaction timer (yardstick) -or- measure blind spot distance -or- breathe into BTB (titrate with Ammonium Hydroxide 1:3) -or- thickness of an egg shell.

After trying a series of activities, each teacher may be required to pick one and prepare a lesson plan around it. All teachers can then switch lesson plans and add to their resource materials.

Because of the highly condensed nature of each video presentation, note taking should be limited, especially during the theory presentations. Included with each purchase is this comprehensive outline. Permission to photocopy this material is granted to our customers and copies of each segment should be distributed to all workshop participants at the beginning of each session. Advise teachers not to cover specific topics that are assigned to another teacher (unless it is an upper grade teacher reviewing the primary concepts with their class).

After viewing these tapes it should become apparent that expertise in science is not necessary to facilitate this program. It is presently being utilized by curriculum directors, science coordinators, principals, secondary science teachers and elementary-level mentor teachers.

As an incentive to get teachers involved you may wish to set course requirements and award certificates. A typical requirement may be to watch all pertinent segments for one grade level and perform three activities, demonstrations or theory presentations in a classroom situation. You may even offer the certificate as credit toward acquiring mini-grants of science equipment for each school or perhaps toward horizontal movement on the salary schedule. If each teacher specializes in their particular topics and all teachers work together to develop the program, the students will receive a very comprehensive science education. *See What Science Is All About*™ is an ideal resource to assist each school in building this valuable team of science specialists.