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A handbook for teachers of learning disabled students in the field of science

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A HANDBOOK FOR TEACHERS OF LEARNING DISABLED STUDENTS IN THE FIELD OF SCIENCE

MASTER'S PROJECT

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CHAPTER I

INTRODUCTION

Because children learn at different levels, their needs must be met in different ways. The curriculum for the learning disabled should accommodate the needs and learning styles of the learning disabled adolescent. These students should be provided with opportunities to be actively involved in a process of all learning.

Other teachers sometimes avoid using various experiments or hands-on activities because of the time involved in organizing, making necessary activities, locating materials, and wondering if the activities would work.

The problem the researcher discovered was the infrequent use of experiments or hands-on activities used by teachers at the high school level.

Statement of the Problem

Thus, the researcher feels that classroom experiments or hands-on activities would provide these students the stimulation needed to be actively involved in the learning process.

The purpose of this study is to develop a handbook of science experiments and activities that can be used to supplement and enrich the curriculum for learning disabled students in grades nine through twelve.

Procedures

Subjects

This handbook was designed for use by teachers who teach science to the learning disabled in grades nine through twelve.

Setting

The study is intended for use by the researcher in the ninth through twelfth grade science classes at Walnut Ridge High School. The school is located in the Columbus Public School District, Franklin County, Columbus, Ohio. This school has approximately eighteen hundred students. The school seems to be evenly divided between Caucasians and Afro-Americans who come from low income families.

Data Collection

Information, activities, and research were collected from:

1. Subject related texts
2. Teacher's guides of texts
3. Instructional activities guides
4. Articles from educational journals
5. Published educational documents.

Definition of Terms

Critical Thinking — The process of reviewing any problem with a reasonable, open-minded approach while applying scientific problem solving skills.

Data — The process of gathering facts and figures.

Hands-On Activities — Learning by direct experiences rather than by textbook study.

Independent Thinking — Being able to think logically about everyday problems without any intervention.

Inquiry — Asking questions to aid in solution of problems.

Investigative Skills — Being able to observe, measure, identify, classify, experiment, generalize, and draw conclusions.

High School — An academic division which includes grades nine through twelve.

Development of Science — Incentive to inquire further.

Design

The writer has created a handbook of science activities to be used by the teachers of learning disabled students. These activities are intended to be easy to set up and to come from readable and available materials for both students and teachers. The emphasis is to aid the teachers in selecting activities to start, to enrich, and to enhance a science program for learning disabled students in grades nine through twelve.

Summary

Science, for the most part, has been directed by the contents of the particular science textbook adopted by the individual schools. The learning disabled student has been given little opportunity to be actively involved in the learning process. The use of experiments and hands-on activities will provide an

opportunity to be actively involved in the learning process of science. Thus, this handbook has been written to provide teachers of learning disabled students with a resource that provides numerous activities to supplement the textbook. This handbook should make the job of the learning disabilities teacher who uses science activities in the resource room much easier. The ideas should assist the teacher in motivating students' learning and enriching their experiences.

CHAPTER II

REVIEW OF THE RELATED LITERATURE

The Evolution of Science

When man was created and came to live on the planet Earth, he was surrounded by phenomena that he could neither understand nor explain. His sphere of operation was very limited. He had no language, no means of communication, and no knowledge of life beyond his own habitat. He accepted his way of life as it was. However, man's curiosity does not remain dormant forever. Ancient people discovered fire and its many useful purposes and how to raise crops. The Egyptians, Babylonians, and Chinese had made discoveries in the fields of medicine, mathematics, and astronomy as early as 3000 B.C. Fear and superstition kept people from sharing their thinking and findings.

The actual study of science really began with the Greeks. The human body, the stars, and the planets were their points of interest. By applying these scientific discoveries, the Romans were able to improve the construction of buildings and roads. This era produced such scientists as Hippocrates (medicine), Eratosthenes (geometry), and Archimedes (levers, pulleys, and density).

As time passed, the pace of scientific discoveries increased. The seventeenth century is often referred to as the Age of Genius. Sir Isaac Newton

(force and motion), Robert Boyle (chemistry), and Galileo (telescope) were products of this.

The Age of Electricity emerged in the 1800's. Many discoveries were about electricity and magnetism. Also discoveries were made by Gregory Mendel (basic laws of heredity), Michael Faraday and Joseph Henry (electricity and magnetism), Dimitri Mendeleev (chemistry), and Charles Darwin (theory of evolution).

The last seventy-five years have seen a greater increase in scientific knowledge than in any other time period. Automobiles, jet airplanes, and modern electronics are just a part of that knowledge. New discoveries have necessitated a change in ideas about time and space (Harcourt, Brace, Jovanovich, 1989, p. 5).

The launching of Sputnik by Russia in 1957 was the beginning of the Space Age. Just twelve years later, the United States sent into space two astronauts who walked on the moon (Armstrong, Aldrin). Since that time, space probes have landed on Mars and a space shuttle has begun to carry teams of astronauts into space.

The Computer Age is now upon us. Computers have become a way of life for many people. Practically all business is geared to the use of computers.

The advancement of technology has been so rapid that most of us cannot keep up with it. Whoever would have thought of seeing a war, such as we saw so recently in the Persian Gulf, on our television?

How can teachers relate all these advances to our students? Prior to 1960, when curricular reforms were made, teachers were content with understanding

basic laws and principles and by testing facts through laboratory exercises. Teachers keep adding goals such as understanding the establishment of how the basic laws and principles came to be. Now we need to concentrate on the relationship between science and society.

Science is suddenly unlocking the deepest secrets of human health.

Gene therapy is the latest advance in a revolutionary branch of medicine called molecular genetics. This science is now unlocking the most closely guarded secrets of human biology, yielding almost daily insights into the prevention, diagnosis, treatment, and cure of the most devastating diseases.

Such diseases as cancer, muscular dystrophy, AIDS, heart problems, cystic fibrosis, diabetes, and many others may be controlled or eliminated altogether (Reader's Digest, September 1991, pp. 23-32).

Science Education Today

Rather than considering science as a body of knowledge, today it is being viewed as a process — a method of finding new and better knowledge about our surroundings.

Too often the teaching of science is confined to the science room — no correlation with other subjects or with everyday life. Usually, the learning was confined to the textbook facts rather than to hands-on activities. Students like to think they are a part of and not a part from classroom involvement.

Very little science is taught in the lower and middle grades. Most of it is left for the high school level which gives little or no background and not too much

time to achieve. The subject of science should be introduced no later than the middle grades.

Many teachers in the elementary level are not prepared to teach science. They are often uncomfortable with hands-on activities and may do more harm than good. Students may sense this inadequateness and lose interest in the subject (Holt, Rinehart and Winston, 1981, p. 10).

Students should be encouraged to put to use the findings of the scientists they study. If this attitude is present, students are inclined to use critical thinking, inquiry, and investigative skills. These investigative skills can solve projects involving scientific processes.

Using something important and of interest in the student's life should encourage students to do investigative critical thinking which in turn will improve their interest in the scientific process.

Observing interesting items brought into the resource center, or by a group going outside to observe a student's project, can kindle interest for the students and cause them to ask questions. This activity can create a desire to use the information to create a project of their own using their investigative skills.

Students can gain knowledge and increase a desire to use investigative skills by reading from scientific literature.

Science education must be carefully planned so that the needs of all students are served. A few will want to make the study of science a priority, while others will be satisfied to meet just the basic requirements for graduation.

The study of science is more than an area of experiments and discovering scientific data. Students must be able to disseminate and acquire data from reading printed materials. Competence in reading — study skills, such as skimming and scanning, library usage, finding main ideas, summarizing, and using visual aids such as graphs, pictures, tables, and charts effectively.

Taking notes is a very important part of the scientific study. Science writing can be precise, specific, and jammed with facts. "The body of knowledge that exists about the world and the method used to obtain that knowledge are called science" (Harcourt, Brace, Jovanovich, 1989, p. 3). Students must learn how to access that knowledge.

Science should be taught as an activity through which problems and questions dealing with the natural world can be identified and defined and from which solutions are proposed and tested. Science is a priority for students if they are to develop skills necessary to meet the challenge of the future.

Science Education in the Future

If students are to leave school with an awareness of what the scientific process is and how it relates to their culture and to their lives, the curriculum will need to be changed. Instead of using textbooks as the only means of teaching, there is need to create and implement more hands-on activities.

Teachers need to encourage curiosity and creativity among their students. They need to have adequate supplies, work space, and maintenance which will require a budget to meet these needs. There is a definite difference between

watching an experiment being performed, and in having a part in that performance.

Students need to be encouraged to ask questions. They need to know who, when, where, and/or why something is important. Help students to develop skills that will enable them to do well.

Funding for special education would allow for more activities to be planned.

If all this is to be realized, more cooperation will have to be established among business, industry, and education. An exchange of personnel should be a great help to all concerned. We must not forget the parents who must surely be involved.

The coordinated effort of all groups should produce a comprehensive science program for all students, and especially for those in the special education classes.

CHAPTER III

A HANDBOOK FOR HIGH SCHOOL SCIENCE TEACHERS OF LEARNING DISABLED STUDENTS

by

Jon M. Culbertson

HANDBOOK

TABLE OF CONTENTS

I. INTRODUCTION TO THE HANDBOOK

II. PHYSICAL SCIENCE ACTIVITIES

III. LIFE SCIENCE ACTIVITIES

IV. EARTH SCIENCE ACTIVITIES

INTRODUCTION

The contents of this handbook will emphasize hands-on cooperative learning activities formulated for learning disabled students in grades nine through twelve. The activities will prepare students to be more aware and to better help them to respond to everyday situations. Students will learn to develop scientific techniques which can be applied to a better understanding of science. Students will use scientific equipment and materials for the purpose of making observations and gathering data.

When science ideas are presented to learning disabled students, the experiences need to be real, tangible experiences with real materials. The experiences need to be presented in a way that will allow learning disabled students to feel a connection to them. The information gained from these must be presented in such a way that it ties it to the learning disabled students' life which will give them a desire to learn more. Sometimes teachers become overly concerned with content and facts. It is more important for learning disabled students to be actively involved in all experiences so that they learn all the facts that aid them in everyday living.

This handbook will provide teaching strategies, activities, and lessons that can be implemented for use in a learning disability resource room. Learning

disabled students will think creatively, will generalize, and will be able to initiate ideas for solving problems.

Title: Building an Electromagnet

Objective: To demonstrate the power of electricity through the use of a magnet.

Materials Required:

(1) 39" piece of 22 gauge copper wire stripped on both ends

(2) 1½ volt dry cell battery

(3) Large iron nail no longer than 10"

(4) Paper clips

Procedure:

(1) Coil the wire ten times around the nail. Be sure to bring it near some paper clips.

(2) Attach one end of the wire to a terminal of the battery. Bring the nail near some paper clips. Touch the other end of the wire to the other terminal of the battery.

(3) Disconnect the wire from one terminal of the battery. Hold the nail above the table and observe what happens.

(4) Have a class discussion to talk about the project and what is happening.

Title: Magnetic Field of a Compass

Objective: To demonstrate the power of the earth's gravity on objects.

Materials Required:

(1) Plastic, aluminum, or glass bowl

(2) Non-magnetized needle

(3) Small piece of styrofoam

(4) Compass

(5) Water

(6) Bar magnet

(7) Paper clip

Procedure:

(1) Rub the needle 30 times with the bar magnet.

(2) Fill the bowl partly full of water.

(3) Stick the needle through the styrofoam and float it in the bowl of water.

(4) Point the needle in different directions, then allow it to settle.

(5) Take the magnet and go underneath the bowl and watch how the magnet affects the compass even through water.

Title: Stationary Pulley

Objective: To show one way by which work can be made easier.

Materials Required:

(1) Single wheel pulley

(2) Crossbar

(3) Spring balance

(4) Meter stick

(5) Cord or heavy string

(6) Pencil

(7) Bundle of books or other heavy objects

Procedure:

(1) Find a good, solid piece to mount the crossbar so that when weight is added, it will not come down.

(2) Attach the fixed pulley to the crossbar so that you will have something to help lift the objects.

(3) Place the cord or heavy string through the wheel of the pulley. Be sure you have enough to attach to the objects and to the spring scale.

(4) Tie one end to the spring scale.

(5) Stack the bundle of books one on top of the other and tie them together.

(6) Tie the other end of the rope or cord to the bundle of books.

(7) Pull on the free hook of the spring scale, and lift the bundle of books. Be sure to record the amount of effort that was required to lift the spring scale.

Title: Advantages of a Lever

Objective: To show how the lever can go about showing how heavy objects can be moved.

Materials Required:

(1) Board 4" wide and 36" long, or other suitable lever

(2) Fulcrum

(3) Book

Procedure:

(1) Place the fulcrum underneath the board.

(2) Place the book at one end of the lever.

(3) Have a student push down on the other end of the board and observe what happens.

(4) Keep moving the fulcrum and observe what type of results occur.

Title: How Decreased Molecules Affect Sound

Objective: To show how sound can be removed with the decrease of molecules.

Materials Required:

(1) One 4 to 8 ounce glass jar with a tightly sealing lid.

(2) Thread or string

(3) Hot (not boiling) water

(4) Small bell

(5) Tape

Procedure:

(1) Tape the bell to the inside of the lid and suspend it in the jar. Make sure the bell does not touch the sides or bottom of the jar.

(2) Gently shake the jar and listen to the bell.

(3) Remove the lid with the bell attached and carefully pour about 1" of hot water into the jar.

(4) Allow the jar to stand for about 30 seconds and replace the lid. Again be sure the bell does not touch the sides of the jar or the water.

(5) Gently shake the jar again and listen to the bell.

Title: Mixtures vs. Solutions

Objective: To demonstrate the difference between a mixture and a solution.

Materials Required:

(1) Two glass jars

(2) Spoons

(3) Sugars

(4) Water

(5) Marbles or small rocks

(6) Paper clips

(7) Toothpicks

(8) Bits of paper

(9) Paper and pencil

Procedure:

(1) Fill each jar about half full of water.

(2) Put the marbles, paper clips, toothpicks, and bits of paper in one jar and a spoonful of sugar into the other jar.

(3) Stir both jars and observe what happens to materials in the water of each jar.

(4) Compare the results in the two jars. One is a mixture and the other is a solution.

(5) Try other substances in water such as sand, powdered milk, or powdered chocolate.

Title: Light Through the Use of Concave and Convex Lens

Objective: To show how light can be bent through different shaped lens.

Materials Required:

(1) Convex lens

(2) Concave lens

(3) Piece of plain glass

(4) Flashlight or projector

(5) Sheet of paper

(6) Tape

(7) White surface

Procedure:

(1) Roll the paper into a tube around the end of the flashlight and tape it into place.

(2) Shine the light on a white surface.

(3) Hold each lens and the glass, one at a time, in the path of the light. Explain what you see.

Title: The Effects of Gravity on Light and Heavy Objects

Objective: To demonstrate how gravity affects light and heavy objects.

Materials Required:

(1) Large book

(2) Small book

(3) Wadded paper

(4) Pencil

(5) Eraser

(6) Paper clip

(7) Paper

Procedure:

(1) Take the large book in one hand and the small book in the other. Hold the two books at exactly the same height.

(2) Drop both books at the same time. Have someone watch to see which book hits the floor first.

(3) Repeat the book drop three times to be sure of the results.

(4) Compare the pencil and the paper in the same way. Predict which you think will fall faster.

(5) Explain how the force of gravity compares with objects that are large, small, heavy, and light according to your findings.

(6) Compare the falling speed of the wadded paper with the flat sheet of paper dropped horizontally.

(7) Compare the falling speed of two flat sheets of paper, one dropped vertically, and the other horizontally.

(8) Compare the falling speed of the wadded paper with that of a flat sheet of paper dropped vertically.

Title: Color Affects Energy Absorbed from Light

Objective: To show how various colors affect light.

Materials Required:

(1) Two equally calibrated thermometers

(2) Heat lamp

(3) One sheet of white paper and one sheet of black paper of the same thickness

(4) Paper and pencil

Procedure:

(1) Drop the thermometers in an upright position about 8" apart, facing in the same direction.

(2) Record the temperature of both thermometers.

(3) Place the sheet of white paper in front of one thermometer, and the black sheet of paper in front of the other.

(4) Shine the heat lamp at the sheets of paper in such a way that it faces both equally. The lamp should be about 16"-20" away from the papers.

(5) After the heat lamp has shone on the papers for about 2 minutes, check and record the temperatures of the two thermometers again.

(6) Repeat for two more minutes and again record temperatures.

(7) What changes do you see in the first and second temperature readings and how do they differ with the two thermometers?

(8) How does color affect the activity?

Title: The Color is White

Objective: To show how light affects the color white.

Materials Required:

(1) White posterboard

(2) Compass

(3) String 36" long

(4) Crayons

(5) Scissors

Procedure:

(1) With the compass draw a circle 6" in diameter on the posterboard.

(2) Cut out the circle with the scissors.

(3) Draw three equal pie-shaped sections on the posterboard and color them red, green, and blue.

(4) Make two small holes near the center of the circle.

(5) Thread the string through the holes and tie the ends of the string together forming a loop which passes through the two holes of the disk.

(6) Center the disk on the string loop and make the disk spin by alternately stretching and relaxing the string.

(7) As the disk spins, watch the colored side.

Title: Solids, Liquids, and Gases

Objective: To demonstrate the difference among solids, liquids, and gases.

Materials Required:

(1) Charcoal briquette or piece of coal

(2) Hammer

(3) Block of wood

(4) Ice cube

(5) Dish

(6) Paper towel

(7) Paper and pencil

Procedure:

(1) Put the ice cube in the dish and place the block of wood and the dish on a table.

(2) Place the paper towel over the block of wood and the charcoal on the paper towel. The wood block will be used for a pounding surface.

(3) Examine and describe the charcoal and the ice cube. You need to tell whether each one is solid, liquid, or gas.

(4) Crush the piece of charcoal with the hammer. Be sure it is on the paper towel and the wood block when this is done. Pound lightly with the hammer so that the pieces do not scatter.

(5) Examine the charcoal again. Is it liquid, solid, or gas?

(6) Let the ice cube remain in the dish. Examine and describe it after a few minutes, after an hour, and after a day. Tell whether it is a liquid, solid, or gas.

Title: Chemical Changes of Acids and Bases

Objective: To show the difference between acids and bases, and to show what a chemical change is.

Materials Required:

(1) Household ammonia

(2) Vinegar

(3) Red litmus paper

(4) Blue litmus paper

(5) Medicine dropper

Procedure:

(1) Use the medicine dropper to place several drops of vinegar on blue litmus paper. Look for a color change. Record your observations.

(2) Place several drops of vinegar on red litmus paper. Look for a color change. Record your observations.

(3) Use a clean dropper to place a drop of household ammonia on both red and blue litmus paper. Look for some sort of color change, and record your observations.

Title: Structure of Stems

Objective: To show the structure of stems and to demonstrate how materials are transported through flowers and other vegetation.

Materials Required:

(1) White carnation

(2) 100 mL graduated cylinder

(3) Water

(4) 3-100 mL beakers

(5) Medicine dropper

(6) Red vegetable coloring

(7) Stirring rod

(8) Blue vegetable coloring

(9) Scalpel

(10) Dissecting tray

(11) Hard lens

Procedure:

(1) Obtain from your teacher a carnation whose stem has been cut in half lengthwise.

(2) Using the graduated cylinder, measure out 100 mL of water. Pour 50 mL of the water into one of the beakers. Pour the remaining 50 mL of water into the other beaker. Using the medicine dropper, add 5 drops of red vegetable coloring to the water in one of the

beakers. Add 5 drops of blue vegetable coloring to the water in the other beaker. Stir the water in each beaker.

(3) Place the beakers side by side. Carefully place one-half of the carnation in each beaker.

(4) Set the carnation and beakers in a place where they will remain undisturbed for 24 hours. What do you think the color of the carnation will be at the end of the experiment?

Title: Observing Organisms in the Soil

Objective: To demonstrate how many different kinds of small invertebrates can be found in various types of soil.

Materials Required:

(1) 2 jars

(2) 2 funnels

(3) Some coarse wool or wire screen

(4) Some top and deep soil from the woods, an old field, or the banks of a pond

(5) 2 petri dishes or other small containers

(6) Hard lens

(7) Masking tape

(8) Light source

Procedure:

(1) Set up the jars, funnels, and steel wool on wire screen as shown in the diagram. Label one jar "A. Surface Soil" and the other jar "B. Deep Soil."

(2) Obtain a surface and a deep soil sample from your teacher.

(3) On top of the wire mesh or steel wool of jar A, place some of the surface soil. Place some of the deep soil on the wire mesh or the steel wool of jar B.

(4) Place a light source 10 cm above the jars. Turn on the light and leave it on all night.

(5) Observe the jars the next day. You should be able to see several organisms in the jars.

(6) Compare the different types of organisms that you find in both jars "A" and "B."

Title: Human Reflexes

Objective: To discuss what a reflex is and how it works.

Materials Required:

(1) Black construction paper 12 cm by 17 cm

(2) 1 sheet of notebook paper

(3) Pencil

(4) Watch or clock with sweep secondhand

(5) Small flashlight

Procedure: Part A

(1) Have your partner face a light source, such as a window or a bright light in the classroom.

(2) Instruct your partner to close both eyes and to cover them with his/her hands for 45 seconds.

(3) Have your partner uncover and open both eyes while you closely observe the pupils of his/her eyes.

(4) Have your partner look out the window or at a bright light. Then shade your partner's eye with a sheet of black construction paper and observe any changes in the pupils. Remove the sheet of paper and continue to observe any changes in the pupils.

(5) Have your partner hold an edge of the black construction paper vertically to his/her face. The edge of the paper should run along a line from the middle of the forehead along the bridge of the nose to

the center of the chin. Using the small flashlight, shine a light into your partner's left eye. Observe any changes in both eyes. Then shine a light into your partner's right eye. Observe any changes in both eyes.

Procedure: Part B — The knee-jerk reflex

(1) Have your partner sit on a chair and cross his or her legs at the knees.

(2) Using the side of your hand, tap your partner sharply but not painfully just below the knee cap of the top leg. Observe the response of the top leg.

Title: Food Pyramid

Objective: To be able to see the relationship among producers and consumers at different levels.

Materials Required:

(1) Glass fish tank

(2) Soil

(3) Clumps of moss and grass

(4) Rocks

(5) Beetles

(6) Earthworms

(7) Small frog

(8) Pieces of tree bark covered with fungi and algae

(9) Plastic wrap

(10) Water

Procedure:

(1) Place 2½ to 5 cm of soil in the bottom of the tank.

(2) Create an environment for your animals, using the grass, tree bark, algae, and mosses. Water the terrarium until the soil is damp.

(3) Release your living animals into the terrarium one at a time.

(4) Cover the terrarium with the plastic wrap.

(5) Keep it out of direct sunlight.

Title: Digesting Food

Objective: To demonstrate the workings of the digestive system as food goes through the mouth, esophagus, and stomach.

Materials Required:

(1) Starch solution

(2) Saliva

(3) Water

(4) Test tubes

(5) Iodine solution

(6) Dropper

(7) Teaspoon

(8) Sugar test tablets

Procedure:

(1) Collect some saliva in a teaspoon.

(2) Place one drop of starch solution in each of two test tubes one-fourth filled with water.

(3) Add a drop of iodine solution to each tube. The starch should turn blue.

(4) Add the saliva to one tube. Add an equal amount of water to this tube. Shake the tubes.

(5) Add a sugar-test tablet to each tube.

Title: Lung Capacity

Objective: To demonstrate the exchange of gases that occurs in the human body as a person inhales and exhales.

Materials Required:

(1) Piece of rubber tubing

(2) Tank

(3) Water

(4) Saucer

(5) Measuring cup

Procedure:

(1) Set up the bottle of water and the rubber tube as shown.

(2) Inhale and fill your lungs with air. Exhale, blowing slowly through the rubber tube.

(3) Slide the saucer under the mouth of the jar. Take the jar from the tank. Using the measuring cup, fill the jar with water. Record how much water was needed to fill the jar. This is the amount of air you exhaled.

(4) Make three more trials and take an average.

Title: Bones

Objective: To describe the various parts of the human body and its framework, such as bones, cartilage, and ligaments.

Materials Required:

(1) Chicken bones

(2) Large beef bone sawed in half

(3) Hand lens

Procedure:

(1) Scrape the outside of the bones and describe what you find.

(2) Look for cartilage at the ends of the chicken bones.

(3) Use a hand lens to examine the inside of the beef bone. Draw and label the parts you can identify.

Title: Learning Animals

Objective: To demonstrate how a response can become conditional with certain animals.

Materials Required:

(1) Fish tank

(2) Goldfish

(3) Fish food

(4) Pencil

Procedure:

(1) Set up a simple fish tank with several fish of one kind in it.

(2) Before the fish are fed, tap the side of the tank several times with the pencil. Do this each time the fish are fed. Feed the fish at the same time each day. Also feed them at the same place in the tank.

(3) After a week or so, tap the side of the aquarium, but do not feed the fish.

Title: Cell Reproduction

Objective: To demonstrate through the use of yeast the process of cell reproduction.

Materials Required:

(1) Sugar

(2) Package of dry yeast

(3) Glass jars

(4) Medicine dropper

(5) Warm water

(6) Cold water

rocedure:

(1) In one jar place one-half cup warm water, one-third package dry yeast, and one-half spoonful sugar. Label.

(2) Set up the second jar in the same way but use cold water. Label.

(3) Set up the third jar in the same way as the first but omit the sugar. Label.

(4) Stir each jar and allow to stand.

(5) After 5 to 10 minutes, examine the jars. When yeast reproduces, alcohol and carbon dioxide are present. Carefully smell each jar and determine the one or ones in which yeast reproduced.

Title: Classroom Rainbow

Objective: To show how light along with water can create a prism effect to show us the colors of the rainbow.

Materials Required:

(1) Glass container

(2) Water

(3) Mirror and sunshine

Procedure:

(1) Fill the glass bowl with water and place in a sunny spot.

(2) With the mirror in your hand, place the mirror in the water and hold it at various angles until the brightest reflection of the colorful reflection can be seen on the classroom wall or ceiling.

(3) After the water becomes calm, identify the order of colors in the reflection.

Title: Rain Shower

Objective: To show how the merging of cold air and warm air creates some form of precipitation.

Materials Required:

(1) Portable burner

(2) Pan of water

(3) 12x12 clear glass tray

(4) Ice cubes

Procedure:

(1) Bring the pan of water to a boil.

(2) Cover half of the tray with ice.

(3) Take the tray with the ice and hold it over the steaming hot water.

(4) Discuss the stages of precipitation.

Title: Air Pollution

Objective: To show the unseen pollution that is in our air.

Materials Required:

(1) 2 glass slides

(2) Vaseline

(3) Light

(4) Classroom window

(5) Microscope or magnifying glass

Procedure:

(1) Using a glass slide, coat one side with a think layer of vaseline.

(2) Leave the slide on a window ledge overnight.

(3) Examine the slide with a magnifying lens or a microscope.

CHAPTER IV

CONCLUSIONS AND RECOMMENDATIONS

Restatement of Problem

This study was made for the purpose of developing a handbook which lists lessons and activities that can be used in a L.D. resource room to help teach science to students who have learning disabilities.

Conclusions

The author of this handbook believes that to achieve success in a science program for students who have learning disabilities, the teacher must provide hands-on activities for these students. By so doing, students will develop skills that will enable them to think scientifically, logically, and perhaps creatively in order to solve problems.

The contents of this handbook provide the teacher with a variety of suggestions that will enrich the science program. These activities are not only stimulating but also flexible enough to meet the needs of the learning disabled students. Instruction in these activities may be given on an individual basis, in small groups, or to an entire class.

Recommendations

This handbook is intended for teachers who teach students with learning disabilities. The hands-on experiments in this book are divided into three categories: physical science, life science, and earth science.

For this handbook to be used effectively in an L.D. resource room, the teacher needs to know the personality of each student and to know the modalities from which they learn best.

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