

FOSS® SOLIDS AND LIQUIDS TEACHER PREPARATION VIDEO TRANSCRIPT

<Larry Lowery Introduction to FOSS Program>

Lowery: Hello. Welcome to the Full Option Science System. This program was funded by the National Science Foundation. Its goal was to develop materials that would involve youngsters with both the processes and the content of science.

The program is developed with the Lawrence Hall of Science, with scientists, science educators and teachers working together as a team to develop the materials. The materials are tested in the hands of teachers and children in classrooms. It takes about two years to turn out a module.

Each module begins with firsthand experiences. This is done because it has been found that firsthand experiences are the best way for youngsters to learn about the concepts of science. As the module progresses, children are introduced to abstractions and reading materials. The sequence from firsthand experiences through reading materials is deliberate because it has been found that youngsters, when they have some experience before they read, learn and understand more from the reading. Authors of reading materials can then take youngsters to greater abstractions.

Trust the materials that you are getting acquainted with. They have been well tested. We found that they work extremely well in the hands of all teachers and are effective for youngsters in learning about science.

<Linda De Lucchi Introduction to Module>

Narrator/Linda De Lucchi: Hello. I'm Linda De Lucchi. I'll be introducing you to the FOSS Solids and Liquids module designed for students in Grades 1 and 2.

Everything that we know of in the universe is either matter or energy. Matter is the stuff from which tangible objects are made. Energy is the drive and the glue that holds things together and moves them around. In this module, students will gain some fundamental ideas about one of those two things, matter.

The matter that we encounter in a typical day is usually in one of three states: Solids, liquids or gas. We'll save gas for students to explore in the air and weather module and in this module look at solids and liquids.

FOSS activities guides students through a number of simple experiences, any one of which taken alone may appear trivial. Some materials are mundane and familiar to students. But the way the students interact with the materials and the precise way they describe them makes the endeavor science.

The power of FOSS comes from the accumulation of experiences over time. One of the keys to successful science experiences for early childhood students is providing them with opportunities for free exploration.

Materials are provided and the teacher might say to the students "See what you can do with

them" or "See if you can separate them." Much of this module will involve the students working individually or in pairs in free exploration followed by group discussions. Through the individual experiences, students develop a better understanding of the properties of matter as solids and liquids as they observe, as they describe, as they compare and as they begin to organize their observations.

Let's take a look at the components of the module. The student equipment comes in these two big boxes. Along with that, you'll find a separate shipper box containing these five large bus trays. In the kit there will be the teacher guide. The teacher guide is just that, your guide through the module. Read it carefully and refer to it often.

Be sure to read the overview folio before you begin teaching the module. It contains many helpful suggestions for getting started. In it are the national standards that are addressed in this module, background information on solids and liquids, ideas for organizing your classroom for the investigations and suggestions for scheduling the activities.

This chart lists the parts of each investigation, the number of sessions for each part and the class organization, whether it's done as a whole class or in learning centers. Investigation 2 and 3 do involve learning centers. We'll talk more about this later.

The overview matrix will help you plan the entire module and integrate it into other areas of the curriculum. In the materials folio you'll find an inventory list for the kit, lists of any materials you need to provide for the investigations, directions for preparing the materials and information on ordering any replacements.

The next four folios are the investigation folios. These are the heart of the program. The first page gives overview information. The At A Glance Chart summarizes the investigation and helps you plan for assessments and extension activities.

Next you'll find background information specific to the investigation. And there's a section called Teaching Children About which gives you some insight into the research on how children think and learn.

Each investigation has several parts. For each part you'll find a materials list, Getting Ready section and step-by-step directions for guiding the investigation.

The interdisciplinary section in the back of the folio has many ideas for extending the investigation into other areas of your curriculum. In the next section are the duplication masters. Here you'll find all of the student sheets used in the investigations. There are also masters for math extensions and home/school connections for each investigation.

There are many ways to assess your students' learning as they progress through the investigations. Read through the module assessment folio at the back of the guide for more information about the formative assessments suggested for each session, end-of-the-module sessions and portfolio sessions. After the assessment folio, you'll find duplication masters to help you with assessments. On the anecdotal notes sheet you can record your students' insights or the difficulties they run into. The assessment checklist is used when assessing specific skills or concepts the students have learned.

In the kit you'll find a class big book and eight matching student books, the FOSS Science Stories for Solids and Liquids. These are designed to be read periodically throughout the module, after students have had the hands-on experience of the activities. The Science Stories folio found in the teacher guide provides background information and follow-up activities.

Check out the resources folio located near the back of the guide. This annotated list includes both fiction and non-fiction books for student reading, videos, software and teacher resources.

There are a few things to get ready that you'll use throughout the module. Make copies of the anecdotal notes and assessment checklist sheets for assessing student understanding during the investigations. Many teachers write in student names before making copies.

Word Bank and content charts are used to help students remember the new vocabulary and concepts they learned as the module progresses. Students will add to these charts at the end of each session.

<Investigation 1, Part 1>

Narrator: In this activity students are given solid objects to observe, to describe and to sort. There are three parts to the activity. Let's take a look at what you'll need for Part 1. The equipment from the kit for each student is the following: Plastic triangle, cloth square, wood cylinder, clear plastic tube, insulated wire, popsicle stick and a metal screw. You'll also need a zip bag so each student can contain their objects. For the class you'll need 11 half liter containers and four zip bags.

These are the materials that you'll need to provide: A rock about this size will be fine, some water and a brown bag or a small cardboard box. You'll also need to make copies of two duplication masters, the letter home to parents and the student sheet called Properties of Solid Objects.

Just before class, get those four Ziploc bags. In the first one, put in the rock. Put water in the second one. And take the third one and blow into it so it's all puffed up filled with air. The fourth one should remain flat but zipped closed. And then put the four bags inside the box away from the students so they don't know what's inside.

Call them to the rug and tell the students that you have something to show them. Reach into the box and pull out the bag with the rock and ask the students what's inside. They'll identify it. And then you can tell them that the rock is an example of a solid. Reach into the box again. This time pull out the water. And the kids will probably tell you it's water. You can identify it as a liquid.

Back into the box. This time pull out the bag that's puffed up. The students will probably say there's nothing inside. That's when you reach in for the fourth bag and show them this one. Then they'll get the idea that yes, there is something in this bag. It's filled with air. You can identify air as an example of a gas.

Three states of material: Solid, liquid and gas. Students are going to be investigating solids today. Show them the solids they will be investigating.

Each student will get these four solid materials. Divide the kids up into groups and have one member from each group come up and get the materials for their entire group. They can store the materials in the containers and carry them back to the group.

Once the students are back at the group, challenge them to investigate the materials, look at their properties and to share their observations with their neighbor. As the students' work, cruise the groups and observe what they do. Here are some of the things you might see in your classroom.

As you talk with students, highlight some of the properties of the objects they have. Distribute more objects: Wire, stick and screw. And allow the students more time for free exploration.

After about five minutes, call for the students' attention. Ask a student to select one object and describe a property of that object. Or instead, you may want to hold up an object and ask the students for a description. Write the words on the board for all the students to see. Continue this process to develop more vocabulary about the properties of solid objects.

Teacher: Okay, does anyone else want to tell me something about one of the items that they have? Fawn? Okay.

Student: You can make springs out of it.

Teacher: Why do you think you can make springs out of it? What does it do?

Student: Um, it bends.

Teacher: It bends? So go back to bendable.

Narrator: At the end of the session, conduct an inventory with the class. Call out the name of one object at a time. Have the students find that object and put it in their bags. This is the time that you could use the student sheet called Properties of Solid Objects, if you choose to do so.

Teacher: Do you have an object that has points? Hold up your object . . .

<Investigation 1, Part 2>

Narrator: Part 2 is called Sort Solid Objects. In this part, students use the same seven solid materials that they used in Part 1. At the end of Activity 1, they inventoried them and bagged them up so they should be all ready to go for each student. In addition, you'll need to make a copy of the sorting circle on paper for each student and one copy of the sorting circle on an overhead transparency for class.

Call the students to the rug and review some of the properties of the solid materials. Then demonstrate how to use the sorting circle. Two students work together with one sorting circle. One of the students selects two objects that share a property and puts them in the circle. The partner tries to figure out what property the person was thinking about when they put them in the circle. In this case, I was thinking that both of these objects are flexible or bendable. They share that property. Then the students take turns putting objects in and trying to guess the property they share.

Student: They both have round edges.

Student: That has two. That has two. That one has one. That's not right.

Student: Hmm . . . that one -- wait. They are both hard.

Student: Uh-huh.

Narrator: As a class you can play this same sorting game using the overhead projector.

Student: That's skinny.

Teacher: Who can tell me what I was thinking when I put this down and this down? What is it about those two, what property -- what similar property was I thinking about when I thought about those two? What do you think?
Jewel?

Student: They are both round.

Teacher: They are both round. That's something that's similar. Uh-huh. The ends -- if you looked at the ends, they are both -- the ends are both round.
Johnny?

Student: They can both bend.

Teacher: They both bend.

Narrator: At the end of the session have the students bag up the items once again.

<Investigation 1, Part 3>

Narrator: Part 3 is called Construct With Solids. And that's what the students do. They build with solid materials.

You'll need these materials from the kit: The same bag of solid objects used in Parts 1 and 2, an additional popsicle stick, a piece of cardboard, rubber band, a paper cup, soda straw and a sheet of aluminum foil. For distributing the items, you'll need for the class four basins and ten half liter containers.

Begin the part by inviting the students to build something out of solid materials. Construct something only using the materials at hand. A good challenge to give them is to build a tower as tall as they can.

A word of warning is important here: No inappropriate use of materials such as shooting rubber bands. And tell the students that if they need to, they can poke holes in the cardboard, the aluminum foil and the paper cup. Send the groups back to their tables and then have the getters get the materials needed for the entire group.

Cruise the groups and discuss their constructions. If two students want to work together, that's great. But don't force it. Don't provide any other materials such as glue or tape but rather, let the students discover the properties of these objects that make them useful for building a tall tower. This will only be the first opportunity for the students to construct. During the second activity, you'll bring the materials out again and they'll have a second chance.

Here are the concepts that students have been introduced to in Investigation 1: Solids are one state of matter. Solid materials have properties that separate them from other states of matter. Solids can be sorted by their properties. Solid materials have distinct uses based on their properties.

Now that the students have had experience with these concepts, you can introduce the FOSS Science Stories. Students get a lot more out of reading material when the subject matter is familiar.

<Investigation 2, Part 1>

Narrator: In Activity 2, students explore liquids and describe their properties. There are three parts to this activity. Parts 1 and 3 are conducted in centers. Before Part 1 there is a section called Working At Learning Centers. There you will find a chart that shows the parts of the investigation, what is conducted at the FOSS center and then some suggestions for what to do with the rest of the class.

You will need these materials from the kit for Part 1, Liquids and Bottles: Each pair of students at a station will need a basin and a bag of seven bottles. You'll need food coloring from the kit for the class. You'll need to provide these materials: Corn syrup, liquid hand soap, fabric softener, liquid detergent, cooking oil and water.

If you are the first person to use this kit, you'll need to prepare five sets of bottles with seven bottles in each set like this one that I have here. I've taken those liquids and I've put one liquid in each bottle. This is the corn syrup, hand soap, fabric softener, detergent, cooking oil and plain water.

The color of the fabric softener is not important. The color of the detergent is not important, except that the seventh bottle is colored water. And I made this by adding just food coloring to plain water. Whatever color detergent you have, you want to mix up the colored water so that it's the same color.

The level is important. You want to fill them about half full. And you want to make sure that all of the bottles are at about the same level. Keep that constant.

This is a good time to look ahead to Investigation 4, Part 2, Liquids In Water, where you will need to prepare bottles of liquids in a similar way. It will save you time if you prepare all of the bottles now.

Your preparation for Part 1 is complete when you have five sets of seven bottles in bags. If you will have an assistant, duplicate the center instruction card Liquids and Bottles.

Call ten students over to the center and show them the bottles. Caution them that they are not to

open the lids for any reason. The lids stay on all the time. Tell them they will work in pairs to explore the liquids and find out as much as they can about them.

As the students work, you can offer these focus questions: How are all of the liquids the same? How are they different? Compare how the liquids move. What happens to the liquids when you slowly tip the bottles on their sides? When you turn the bottles upside down? What happens when you spin the bottles? When you roll them? When you shake them?

Allow the students to explore the liquids. After about 15 to 20 minutes, invite another group to come to the center and work with the bottles.

<Investigation 2, Part 2>

Narrator: In Part 2, students develop their vocabulary to describe some of the properties of liquids. From the kit you'll need to get these materials: Five envelopes of liquid property cards. If you are the first person to use the kit, the cards will still be intact on their die cut sheets like this. There are six cards in each of the envelopes and all of the cards are alike. All of the sheets are alike. The only difference in the sheets is the back.

These six sheets all have Letter A on them. The sheets in this envelope have Letter B, C, D, and E. This is to help you and the students keep track of these cards when they are sorted out into different decks.

If you're the first person to use the kit, you'll also need to get ten Ziploc bags. These are going to become the storage bags for the card decks.

The third item that you'll need from the kit is the envelope containing the laminated liquid property posters. There are six of them. Here is one as an example.

You'll need to make copies of two duplication masters, the memory tally sheet and the card deck labels. If you choose to use optional sheet Properties of Liquids, make copies now.

You'll need to prepare all of the card decks. Let me show you how to do that from one of the envelopes. This is the one with the Letter A. And there are six sheets here. These are die cut. But you're going to still have to snip them to get them loose. I'm going to snip these loose. Now I have six identical cards. Put them right over here.

Alright, now I've got all of the cards loose and they are in their stacks. I'm going to take two from each of these decks to put them together as a memory card deck. Here are the two viscous, two foamy, two bubbly, two translucent, two colored, two transparent. These 12 cards go together to make up a memory deck. I've labeled the bag using the duplication master and now we're all set.

I have four of each of the cards left. I'm just going to pick those up. And these 24 cards go together to make a Go Fish deck.

When you've prepared all five envelopes, you end up with five Go Fish decks and five memory decks.

Teacher: There's the bottle and the word is transparent. You can see straight through it.

Narrator: The part begins with the teacher working with the whole class to develop the vocabulary describing the properties of liquids. Have a set of the seven bottles on hand for this discussion.

Teacher: You can see the line through it. So it is--it's clearly transparent.

Student: Let me see.

Teacher: Good job. Good thinking, Bryce.

Now, I've got another bottle. This is something that we saw before. I'm going to ask you to watch it. Do you remember how this bottle was? Now, can you describe -- oh, good. I like all of those hands.

Nicole, what do you think about this bottle? Could you describe it?

Student: It's slow.

Teacher: It's slow. Watch this. Is it slow? Yes, it is.

So we know that it's slow and sticky. Kind of slips down the side. And another word that we can call that is viscous. Let me show you that word. Big word.

Student: It's hard to see through.

Teacher: Here it is: Viscous. Would you say it with me?

Students: Viscous.

Teacher: And you can see that it's slowly slipping down the sides, sticking to the sides.

Narrator: The vocabulary is reinforced as the students play the card games.

Student: Yea! Where does this go? Colored, oh, yeah. I got one right. Yea! Where does this go? Right here?

Student: Do you have colored?

Student: No, I don't. Go Fish.

Narrator: The posters are put up for the students to refer to.

Student: Colored.

Student: Sure.

<Investigation 2, Part 3>

Narrator: Part 3 is called Liquid Level. This is a center activity with five pairs of students each working at a station. This is the equipment that you'll need from the kit for these stations: Each

station will have a bus tray, a bottle, quarter liter container, a large vial and a plastic cup. In addition, each station needs a liter container of water and a seven gram vial. You'll need to provide paper towels, white glue, colored pencils and if you want, food coloring. For each student make a copy of Liquids In Containers, Liquid Level in a Bottle and the Falling-Bottle Puzzle. If you'll have an assistant, duplicate the center instruction card, Liquids In Containers.

Begin the part with all of the students at the rug. Ask them to close their eyes and to imagine a glass half filled with water. Someone is taking that glass and starting to tip it so the water is about to spill. What does the water level look like now? Now, that person is turning the glass all the way over on its side. What does it look like now?

Show the students the Liquid Level in a Bottle sheet. Tell them that their challenge is to draw what the water level looks like in each picture as the bottle is turned upside down. Distribute the sheets and have them work.

Introduce the Falling-Bottle Puzzle. Tell the students that their task is to order the pictures from a bottle standing up to a bottle on its side. The black line on the sheet may help the students to sequence the bottles.

Break into groups. While two groups are working on the representational materials, one group will be at the water level in container center. There they work with a partner to line up the containers and put one small vial of water in each of the four containers. They record the water level on the record sheet.

After everyone has done all three activities, hold a summary discussion with the students. Here are the concepts that students have been introduced to through Investigation 2: Liquids are one state of matter. Liquids have many properties. Liquids pour and flow. Liquids take the shape of their container. The surface of liquid is level with respect to the ground.

<Investigation 3>

Narrator: In Activity 3 students experience solids as pieces, grains and particles and observe their properties and their interactions. The activity has four parts. The first three parts are conducted in a learning center format where ten students or five pairs of students work at a time while the rest of the class is involved in extension activities such as constructing with solids or making a solids book. After 20 minutes, another group of ten students rotates into the center activity.

In the folio you will find this chart outlining what is done at the FOSS Center and suggestions for what the rest of the class might do. You can use these suggestions or others that fit in with your overall curriculum.

If it's possible to have another adult in the classroom to assist during science, arrange it. The center instruction card has been developed for each of the center activities to help a parent or other assistants guide the students.

<Investigation 3, Part 1>

Narrator: In Part 1, students work with Solids In Containers. These are the materials that you'll need from the kit: Each station will have a bus tray and these plastic containers, two cups, two

large vials, two small vials, two bottles, a scoop, a funnel, and a beaker. Each station will also need a screw and a wood cylinder. A pair of students will work at a station with these materials.

Each station will also need a container of solid materials. This station will use cornmeal. The second station will use mung beans. The third, rice. The fourth, lima beans, and the last station will use pinto beans. Each pair of students will have a chance to use all five of the solid materials as they rotate through the stations.

Call the students to the rug and introduce them to the new small solid materials. Find out what they know about them and then tell them they'll have a chance to investigate them. They'll work in a center. Pairs of students will work together. And they'll work in the bus tray. Emphasize that all of the work done at the center will be in the tray.

Tell them that their challenge is to find out as much as they can about the solid materials by transferring them from one container to another. Identify ten students to go off and work at the center and then get the rest of the students engaged in other activities.

As the students work, visit them and pose some questions. Ask them to put one level scoop of material in each container and to look at the level. Does the highest level mean the most material? Can they get the material to pile up? Have them describe how small particles pour. These and other focus questions are listed on the center instruction card.

When all the students have gone through the center, you will hold a summary discussion and let them tell you what they found out.

While some students were at the center, others were creating some solids books. Here are examples of two books created by students. Making this book is described in the Interdisciplinary Extensions section of the folio.

<Investigation 3, Part 2>

Narrator: Part 2 is called Separating Soup Mix. And you will need these materials from the kit: For each station you'll need a bus tray, five half liter containers, a scoop and a set of three screens. For the class you'll need these materials: Five plastic bottles, the funnel and the same five solid materials used in Part 1.

You'll need to prepare a container of soup mix for each station. To do that, take the scoop and a half liter container and put one level scoop of each of the solid materials in there for the soup mix. Mix it up. And that goes in the bus tray along with the scoop, the liter containers and the screens. This is what a pair of students would work with at a station. Create five identical stations to this.

In addition, I'll use the funnel to fill each of these plastic bottles with one of the solid materials for use in the class introduction. This is what I'll end up with.

If you will have an assistant, duplicate the center instruction card Separating Soup Mix. Think about what you're going to have the rest of the class do while ten students are working at the center. In the activity folio we suggest that you get a bag of 15 bean soup mix, some construction paper and glue and invite the kids to create an art project out of bits and pieces.

Start at the rug with the whole class. Use the bottles to review the properties of the solid materials. Then show the students the soup mix you've created made up of many different kinds of materials. Tell them that their challenge at the center is to work in the bus tray to separate the soup mix and find out how many different kinds of materials are in there. Identify five pairs of students to go and work at the center. And then get the rest of the class working on their project.

Don't be dismayed if the students don't use the screens to separate the pieces at first. Let them work at their own speed and in their own way. After a while, if the students still haven't discovered the screens, you might ask them if the screens would be helpful with the separating. And then don't expect them to be systematic in their screening. Allow them time to work and play.

There are focus questions in the teacher guide to help the students think about what they are doing. Some of these questions include: Were you able to separate the mix? How did you do it? How many different materials were in the soup mix? If you use the screens to sift the mixture, what is the best way to use them? Which screen should you use first?

<Investigation 3, Part 3>

Narrator: Part 3 is called Solids In Bottles. For this part you'll need this equipment from the kit: For each station you'll need a bus tray, four half liter containers, four bottles, a scoop and a funnel. For the class you'll need four solid materials. These are the ones we are using. And the one that's left out is the pinto beans. We'll only use four in this activity.

Prepare for each station four half liter containers, each with a different solid material. Put two scoops of one solid material in one container, a different one in the second and so forth.

When you have the four containers ready, put those into the bus tray along with the bottles, the funnel and the scoop. Prepare five stations just like this one. If you will have an assistant, duplicate the center instruction card Solids In Bottles.

Start the part with all of the students at the rug. Suggest to the students that they could put the solid materials in bottles and more easily observe how the particles move. Tell them that at the center there will be a bus tray with four containers of solid materials. They will also have four bottles in the tray. Their job is to put one of each kind of material in a separate bottle. They should put the entire materials from the container into a bottle and screw the lid on tightly.

They should do that for all four bottles so they end up with a different material in each bottle. No mixing of materials at this point. Once the materials are in the bottle, then they can tip the bottle. They can turn the bottle. They can roll the bottle. They can shake the bottle. And they can observe how the particles move.

Caution them to be careful not to bang the bottles on the table or drop them on the floor because they can break. Identify ten students to go and work at the center and then get the rest of the class doing another activity waiting for their turn to rotate into the center.

Check the activity folio for our suggestions on what to do with the rest of the class.

<Investigation 3, Part 4>

Narrator: In Part 4, Separating Beads with a Screen, students simulate separating solids using representational materials. You don't need much for this activity. And this is a whole class activity. Everybody can do it at one time.

In the kit you will find one of these sheets for every pair of students. You'll want to take some scissors and cut it in half so that each student has three screens.

Here are the two student sheets that you'll need to make copies of. One sheet for each student. Bead Mix A and Bead Mix B. These sheets differ in the number of beads in each cup. There's just one size of bead in this cup. But over here, Bead Mix B, we have two different sizes of bead in each cup.

Students will use the screens to answer these questions: Which screen can these beads go through? Can these beads go through the large screen, No. 1, Screen No. 2, Screen No. 3? And they'll answer that question for all four containers.

The question on Bead Mix B is: Which screen can separate the mixture? So the students have to look and see if one of the beads will go through the screen and the other one is too large to go through. Here is Screen No. 1, Screen No. 2 and Screen No. 3.

Here are the concepts that students have been introduced to through Investigation 3: Solid materials come in all sizes and shapes. Particles of solid materials can pour like liquids but maintain their shape. Solid materials can support denser materials on their surface. Mixtures of solid particles can be separated with a screen.

<Investigation 4, Part 1>

Narrator: Now that the students have worked with solids and liquids separately, they are ready to mix them and look for changes and interactions. The three parts of this activity are all whole class activities.

Part 1, Solids In Water, will take several days to complete. This is the equipment you'll need from the kit: A zip bag for every student and solid materials: Pinto beans, rice, rock salt, aluminum foil, cloth, popsicle sticks, cardboard and candy, beakers to measure water, liter containers as a water source, bus trays and basins for the students to store their investigation over night. You'll need to provide three solid materials for the students to mix with water: Cookies, chalk and raisins.

You'll need scissors and tape to prepare the Ziploc bags with their labels for each student. And have some paper towels on hand to clean up spills. Make a copy of the Solid Materials In Water sheet for each student. Make four copies of the Solid Materials labels sheet.

Students work as individuals with one zip bag in this activity so prepare a bag for each student. Cut three sheets of the labels apart and tape one label onto each of the bags. Then put inside the bag whatever is on the label. If it's a discrete object like the popsicle sticks or chalk, put two pieces in each bag. If the item is particulate like beans or rice or rock salt, put two spoonfuls of the material in the bag.

Cut apart the fourth sheet of labels and put one label on each of 11 quarter liter containers. I've labeled one here but you'll have to label all 11.

Introduce the part by holding up one of the bags and telling the students everyone will get one of these and they'll add water to the bag to see what happens to the solid material.

The first thing they should do when they get the bag is to write their name on the label. Then they should remove some of the solid material and put it in a half liter container so they can remember what it looks like when it was dry. In addition, they should record what it looks like on their record sheet. Then they can add the water and observe what happens.

Teacher: What's happened to yours, Jessie?

Narrator: The next day the students look at the bags and describe and record the changes. They will find that some materials fell apart, some materials got bigger, some disappeared and some didn't change at all. In the folio you will find a method for creating a class bar graph of the changes in the solid materials.

Teacher: Where has it gone? What's happened to it?

Narrator: Suggest to the students that they take the solid materials out of the water and see if the materials will return to their original condition. All the students that work with one kind of material will put that solid material in a quarter liter container that you provide for them. So you need 11 quarter liter containers for the entire class.

The students who work with rock salt and with the candy won't be able to find the solid material in the bag so they'll need to carefully pour some of the liquid into the quarter liter container and let it evaporate. Here is what the students might see after several days.

Some of the solid materials look very much like they did before. The popsicle sticks and the chalk and even the beans don't look too different. But the cardboard has fallen apart and is in several pieces. The most interesting of the solid materials are the candy and the rock salt. The candy has returned as a very thick syrup. And the rock salt has returned as crystals.

<Investigation 4, Part 2>

Narrator: Part 2 is called Liquids With Water. Now, I've prepared these bottles in Activity 2 when I made the 35 permanent bottles. These I prepared in addition at that time planning ahead for this part. Three cooking oil, three syrup, three hand soap, three fabric softener, three detergent and one colored water for demonstration.

Each pair of students will need one of these bottles and they will open it up and add water to it. In addition, each group will need a beaker and a container for water, the liter container.

Make a copy of the Liquids With Water sheet for each student. Begin this part by calling the students to the rug and have a set of the bottles there for the students to see. Identify for them what is in each of the bottles so they know what the liquids are.

Then suggest that they might add water to the liquids and ask them what they think might

happen. You can demonstrate the process. Use the colored water. That way you won't give anything away about what will happen in any of the other bottles. Show the students how you unscrew the lid, dip up a beaker of water, carefully pour it in and then screw the lid back on being very careful not to shake the bottle yet.

Distribute the bottles to the students when they are at the tables and let them begin. After they add the water, you can encourage them to gently tip the bottle and observe what happens.

Teacher: Maybe, Stacy, would you like to tip it? Why don't you put the top on.

Narrator: After the students have observed the bottle on the table and have recorded their observations, then they can gently lift the bottle and tip it to see what happens. When you give the signal, then the students can shake the bottles and see if the liquids mix.

Student: Ours is changing.

Teacher: That's what happens when you wait a bit.

Narrator: Put the bottles in a safe place to settle for the students' final observations.

<Investigation 4, Part 3>

Narrator: The third and final part of this activity is called the toothpaste investigation. It was designed by a second grade class and came about as a result of a question from one student. The question was: What is toothpaste? At first we weren't sure what the question was about. But the student persisted. What is toothpaste, is it a solid or is it a liquid?

Well, we didn't know. So we turned it back to the class and asked them to help us find out. They knew a lot about solids. They knew a lot about liquids. They knew what happened when you mixed solids with water and liquids with water. So we thought they would be the perfect people to investigate this question.

You and your students can design an investigation around toothpaste. Each pair of students can get a bottle like this one. And they'll get some water and some toothpaste. They can add the water to the bottle like this. And they can be ready for you as you come around with the toothpaste tube and give them some toothpaste.

Now, you need to tell the students that they should observe the toothpaste in the water without shaking it. See what happens. They might want to tip it a little bit. See what the toothpaste does. But what they really want to do is to shake it. You can swirl it gently and finally shake it. And there's a record sheet that the students can use to record their observations. The students are going to have to let these sit overnight and see what happens the next day.

You want to set one up like this, too. But you don't want to shake yours so the students will have a control to compare. Here is a control. This one has been sitting for some time now. I didn't shake it. And there's the toothpaste still down at the bottom.

When the students come back the next day, they may see something like this. Let me tip this up so you can see material down on the bottom. And it's at this point that the students get to make a

decision. What do they think toothpaste is?

Some students may think it's a solid. Some may say it's a liquid. Some may say it's both a solid and a liquid. And others may say they need to do some more investigating. Some students may want to evaporate the liquid to see what remains of the solid material. That's a good investigation.

Some other students might want to put some toothpaste out on a piece of paper and observe what happens. That's a good investigation. The toothpaste investigations may be the end of the module or they may just be the beginning of many new investigations of solids and liquids for your students.

Here are the concepts that students have been introduced to through Investigation 4: Some solids change when mixed with water; others do not. Some solids dissolve in water; evaporation leaves the solid behind. Some liquids mix with water; other liquids form a layer above or below water.