

Tim Dowd  
Hui Tang  
EDSC 5543  
12/606

## All Shook Up

### Grade Three Physical Science (or grade Seven)

“Mixtures can be separated if the parts have different properties”

PASS Standard 1, Objective 1:

“Objects can be described in terms of the materials of which they are made. Mixtures and solutions can be separated (i.e. sand and marbles; or salt and water) (Oklahoma State Department of Education, 2002 Page 186. Accessed at [http://www.sde.state.ok.us/home/home01\\_test.html?http://www.sde.state.ok.us/publ/pass.html](http://www.sde.state.ok.us/home/home01_test.html?http://www.sde.state.ok.us/publ/pass.html)! On 12/6/2006)

It also meets one objective (the first bulleted one) of the national science education physical science standard B for K-4 students:

“As a result of the activities in grades K-4, all students should develop an understanding of: (objective number one is properties of objects and materials) (National Research Council, 1996, <http://www.nap.edu/readingroom/books/nses/6c.html#ps> Accessed 12/6/06)

This was clarified by the following quote in the same document. This is the second of three bullet points in the “Properties of Objects and Materials” heading:

“Objects are made of one or more materials, such as paper, wood, and metal. Objects can be described by the properties of the materials from which they are made, and those properties can be used to separate or sort a group of objects or materials.”

(National Research Council, 1996, <http://www.nap.edu/readingroom/books/nses/6c.html#ps> Accessed 12/6/06)

This learning cycle was written for 3<sup>rd</sup> graders. However, the concept statement gave our students a lot of trouble when we tested it. It is not a 3<sup>rd</sup> grade concept; it is actually more along the lines of the grade 7 PASS Standard 1 Objective 2:

“A mixture of substances can often be separated into the original substance using one or more physical properties” (Oklahoma State Department of Education, 2002 Page 202. Accessed at [http://www.sde.state.ok.us/home/home01\\_test.html?http://www.sde.state.ok.us/publ/pass.html](http://www.sde.state.ok.us/home/home01_test.html?http://www.sde.state.ok.us/publ/pass.html)! On 12/6/2006)

There is a corresponding NSES Standard for grades 5-8. This time the first bullet point is called “Properties and Changes of Properties in Matter.” The clarification of this reads as follows:

“A substance has characteristic properties, such as density, a boiling point, and solubility, all of which are independent of the amount of the sample. A mixture of substances often can be separated into the original substances using one or more of the characteristic properties.” (National Research Council, 1996,

<http://www.nap.edu/readingroom/books/nse/6c.html#ps> Accessed 12/6/06)

We still think that the learning cycle is valuable for 3<sup>rd</sup> graders to do as it has students separating mixtures and generalizing about them. The teacher should be aware, however, that third graders will have trouble making the generalization that is the concept statement. They will understand it in terms of each experiment that they do, though.

### Exploration

The students will be lead through obtaining some sand and some gravel, describing these, and then mixing them together and describing the mixture. They will then be asked if they can think of any way of separating the two. Once the students make predictions about how they can separate things they will be given a dish strainer and will use this to make the separation. A separate experiment will be done using Styrofoam and water. The goal is to realize that things can be separated if they have different properties

### Safety:

This activity appears to be safe.

The student guide starts here:

Today we’re going to do a new investigation! You will do this in groups of four

To start you need these things

1 cup of dry sand

1 cup of gravel from a fish tank

1 cardboard work tray

1.) Pick up a pinch of the sand, and let it fall back into the cup through your fingers. Look very carefully at the pieces of sand while you are doing this.

What does the sand look like?

*There are brown, grainy crystals*

What does the sand feel like?

*It is cold, wet, and grainy.*

Is there anything else you notice about the sand?

*This depends on the student*

2.) Pick up some gravel, and let this fall back into your cup through your fingers

What does the gravel look like?

*If you use fish tank gravel it will be colorful, hard, bigger, and funny shaped*

What does the gravel feel like?

*It is cold, hard, and not as grainy*

Is there anything else you notice about the gravel?

*This depends on the student*

Is there any difference between the sand and the gravel? Record any differences:

	Similarity	Difference
Sand	<i>hard</i>	<i>Big</i>
Gravel		<i>small</i>

3.) Carefully pour one cup into the other cup. Using your pencil, stir the two cups together.

Describe what you see now and compare it with the sand and the gravel by themselves.

*The two are now there together. The individual pieces have not changed [Emphasize this point, students have trouble with it]*

Can you think of any way get the sand by itself again, and the gravel by itself again?

*This depends on the student*

Once you have answered this question, raise your hand so that the teacher knows that you have finished.

*At this point, once everyone gets here, ask the class how they thought they could separate things. Hopefully someone says that we can use a screen so the small stuff falls down through it.*

*Even if they don't say this, hand out the dish strainers and ask if there's any way they think that they can use this.*

Your teacher will pass out a tool that you can use to separate the sand from the gravel.

4.) How can you use this tool?

*It will let the sand through but not the gravel*

Separate the sand and the gravel.

What about the sand (or the gravel) let you get it apart from the other stuff in the cup?

*The size of the gravel keeps it from falling*

Put all of your sand back in your cup, and raise your hand. Your teacher will come take your sand away and give you some pieces of Styrofoam, the thing that coffee cups are made out of.

5.) What does the Styrofoam look like?

*White and broken looking*

How is it similar to the gravel?

*It is the same size*

How is it different from the gravel? Record the similarities and differences in the table below:

	Similarity	Difference
gravel	<i>size</i>	<i>Hard, colorful</i>
Styrofoam		<i>Soft, white</i>

6.) Using the back end of a marker, swirl the Styrofoam and the gravel together

Describe what you see now and compare it with the sand and the gravel by themselves.

*The pieces are the same, but they are now together*

Can you think of any way to separate the gravel from the sand now? HINT: Sometimes Styrofoam is used to make toys that float in a pool.

*Put the two into some water*

Raise your hand when you are done with this part

*Once the students are done, ask them the answer to this last question. Hopefully someone says something like "floating." Lead them to this by asking questions about rocks and coffee cups and what they do with water.*

Your teacher will now give you a bowl of water. Can you use this to separate the sand and the iron?

If you can, please do this.

One student should bring the bowl up to the front of the room. The teacher will clean it up later.

11/21/06

### All Shook Up (TG)

- 1.) What did we do with the sand and the gravel?  
*We put the sand and the gravel together*
  
- 2.) Did the sand or the gravel change when we mixed them? Why or why not?  
*No, they are still the same thing. In our experience, some kids did see them as if they had changed*  
*Try to focus the students on each piece of sand and each piece of gravel, rather than the bulk materials in order to clear this up.*
  
- 3.) How were you able to separate these two?  
*The students generated a list:*  
*fingers; screen; pencils; The issue that gravel are big and sand is small was discussed here too*
  
- 4.) What did we do with the gravel and the Styrofoam?  
*We put them together or mixed them*
  
- 5.) Did the sand and the Styrofoam change when we mixed them? Why or why not?  
*No, they did not.*
  
- 6.) How were we able to separate the two?  
*Using a magnet, pencils (to push individual grains) or scissors [Once the filings are magnetized by a magnet, all sorts of metal things stick to them]*  
  
*One thing that students said throughout this learning cycle was that “you could separate them with a pencil.” That is an ok thing to say, but they need to be reminded that you can only do this because the substances look different.*
  
- 7.) To be able to separate two things, what must be true?  
*They must have a difference. You can use size, color, shape, the way they were made, their weight (these are the ideas students had.) [This is the concept statement. We don't have any specific notes on how this part worked, but later on when we revisited this discussion in a similar way we really had to lead the kids to say this, to the point where we didn't think they had made the generalization for themselves. It might be very difficult to get the kids to this point, depending on when this concept is taught and what other preparation they had. Our cooperating teacher plans on revisiting mixtures later and suspects this will have been good preparation.*

8.) Define the word mixture

*This is when different substances are scattered together. You can still separate them if they have a difference in some property.*

## All Shook Up

### Application

#### Materials:

Wax paper (one sheet per group of four)

Dixie cups (two per group of four)

Salt to fill the bottom part of one Dixie cup per group

Water

#### Safety:

Avoid getting salt in the eyes. Depending on the school, goggles may be required.

Procedure: Start the learning cycle on a Friday. They do not initially need any worksheets. Give each group the materials listed above, with one of the Dixie cups partially filled with salt and the other filled with water. Ask them to observe the two materials and write a detailed description

After this, tell them to add just enough water to dissolve all of the salt. They will probably end up with a lot of undissolved salt suspended in the water, but that is ok.

Ask them if they can think of any way to separate the salt and the water. Ask them to write any ideas they have down in their science notebooks.

Tell them to write their names on the wax paper and then to pour a little of the water onto it. Leave this over the weekend so that the water can evaporate, leaving the salt.

Before the end of class Friday, ask them to predict what will happen

On Monday, have the students get their wax paper and record their observations. Then give them the following questions

- 1.) What did the salt look like before we mixed it into the water?  
*It looked like small, white crystals*
- 2.) What did the water look like before we mixed the water in?  
*It was clear and wet*
- 3.) What did the mixture look like?  
*It was a liquid, it looked somewhat white and could have had salt crystals in it*
- 4.) How did we separate the salt and the water?  
*We let it sit for a while*
- 5.) Why did this work?  
*Water can dry up and salt cannot*
- 6.) How is this like when we separated sand and gravel? How is it different?

*It is similar because we used a difference between the two to separate them. It was different because salt and water are different.* [In our experience, students could not make this generalization. The best answers that we got for it were that we used different tools in each case... they did not identify that we were using a property of one substance to remove it from the other.]

[During this phase we felt the need to go through a discussion similar to the second phase again with the students, and we found that by asking the right questions, we could get them to explain our strategy for each separation. But they had trouble generalizing. We could draw out the answers, but it was pretty clear that our concept had not been accommodated. It might be better to save this learning cycle for a later time.]

name: \_\_\_\_\_

### All Shook Up

#### Puzzle

##### Procedure

Tell your students to take out a sheet of paper

Hold up a small piece of metal

Ask “Do you all know what this is?” This is a piece of iron, which magnets stick to.

Say “Pretend this was in really small pieces, exactly the same size as this sand.” Hold up a cup of sand

Say “You mixed the two of these together, and now you want to separate them. Can you write a paragraph or draw a picture showing how you would do this? This is a by yourself assignment.

Grade students on the following rubric, which should be drawn on the board:

	Yes	No
The student identifies a difference between iron and sand	1 point	No points
They have a way of separating them	1 point	No points

Name: \_\_\_\_\_

### **All shook up**

#### Exploration

Today we're going to do a new investigation! You will do this in groups of four

To start you need these things

1 cup of dry sand

1 cup of gravel from a fish tank

1 cardboard work tray

1.) Pick up a pinch of the sand, and let it fall back into the cup through your fingers. Look very carefully at the pieces of sand while you are doing this.

What does the sand look like?

What does the sand feel like?

Is there anything else you notice about the sand?

2.) Pick up some gravel, and let this fall back into your cup through your fingers

What does the gravel look like?

What does the gravel feel like?

Is there anything else you notice about the gravel?

Is there any difference between the sand and the gravel? Record any differences:

	Similarity	Difference
Sand		
Gravel		

3.) Carefully pour one cup into the other cup. Using your pencil, stir the two cups together.

Describe what you see now and compare it with the sand and the gravel by themselves.

Can you think of any way get the sand by itself again, and the gravel by itself again?

Once you have answered this question, raise your hand so that the teacher knows that you have finished.

Your teacher will pass out a tool that you can use to separate the sand from the gravel.

4.) How can you use this tool?

Separate the sand and the gravel.

What about the sand (or the gravel) let you get it apart from the other stuff in the cup?

Put all of your sand back in your cup, and raise your hand. Your teacher will come take your sand away and give you some pieces of Styrofoam, the thing that coffee cups are made out of.

5.) What does the Styrofoam look like?

How is it similar to the gravel?

How is it different from the gravel? Record the similarities and differences in the table below:

	Similarity	Difference
gravel		
Styrofoam		

6.) Using the back end of a marker, swirl the Styrofoam and the gravel together

Describe what you see now and compare it with the sand and the gravel by themselves.

Can you think of any way to separate the gravel from the sand now? HINT: Sometimes Styrofoam is used to make toys that float in a pool.

Raise your hand when you are done with this part

Your teacher will now give you a bowl of water. Can you use this to separate the sand and the iron?

If you can, please do this.

One student should bring the bowl up to the front of the room. The teacher will clean it up later.



