

Action and Reaction: An Elementary Exploration of Matter and Ethics

Mondrea D. Mitchell
Twain Elementary School

Man can learn nothing unless he proceeds from the known to the unknown.
- Claude Bernard

INTRODUCTION

Home

We inhabit a fascinating place that behaves in ways that astound and mystify. The same astonishment and mystification can be found in human actions. If we study history a bit, we see that our actions are every bit as remarkable as that of our home. Environments have been created from human action, just as they have from the actions of our Earth home. These actions have had the consequence of forming the path of human history. Societies have been determined by the actions and reactions within the environment-both social and physical. For this reason, it is important for children to understand that actions have reactions. Then they begin to see how their own actions have an impact within both the social and physical environments. They are then able to build empathy and consideration when interacting within their environment, and to see the relationship between human action and the quality of life. Developing a purpose and understanding of actions and reactions within our environment is the goal of teaching this unit.

The study of our physical environment is the perfect catalyst for action. We are able to observe phenomenon, and infer as to why our world acts the way it does. We are then able to test those inferences to see if we were correct. This is the way humans have gotten to know the environment since before historical accounts were taken. We have even advanced to the point that we use formulas for the growing mass of knowledge we have acquired to better understand our world. We have taken action with that knowledge so that we fly friendly skies, drive the best in Texas, and take huge steps for mankind. All of this has been done by human manipulation of the environment. Children must understand their environment so that they may take a pioneers attitude in inquiring into the environment for change.

Before children can inquire into the environment, this term must be defined. Our physical environment is comprised of matter. Related, though encompassed within more the realm of humanities is the social environment. As humans we act, and our actions produce consequences. Children should be succinctly aware of this relationship. With this awareness should come an empowerment to act in ways that develop them into social beings. To fully understand the idea that humans manipulate their environment, children must explore social action and reaction. This exploration should begin with the class environment, specifically teacher and student expectations. Students should be challenged to create a classroom community. Within an operative community, each

person is cognizant of how his or her actions produce a reaction; these reactions form the climate of every community. One of our jobs is to encourage children to develop certain attitudes concerning life.

At my school, we post certain attitudes that work for us. The attitudes are cooperation, confidence, appreciation, empathy, creativity, enthusiasm, independence, tolerance, respect, integrity, curiosity, and commitment. The list is fairly comprehensive. However, each attitude is distinct and necessary to form a successful self within an operative community. Seeds of antisocial behavior lay unfertilized in the presence of strong character training. The first few weeks of school, we are serious about creating effective social environments. Children also need to be serious concerning the social environment, while taking an active role in creating it. Realizing that through our actions we manipulate the social environment is the first step for children. They should be given opportunities to act—to know that they are human beings, capable of all the brilliant, destructive, and constructive acts of their forefathers and mothers—to question themselves about the kind of world they would like to live in, and know that they have a choice and voice in creating that world.

Interdisciplinary Teaching

I have discovered that there is an art to teaching. Though sharing knowledge is much of the art, the most fundamental quality is the encouragement of understanding and active participation. Units of well-planned and organized experiences which promote the acquisition and use of skills beyond passing tests guide the learning. What essentially happens in such a classroom is interdisciplinary teaching. Children are given time to manipulate concepts into their own tapestry of experiences while building skills. Creating such an effective environment involves using time wisely and interlocking concepts and subjects into a substantial masterpiece of learning. Interdisciplinary teaching works well for me. It allows me to be a creative, effective educator in a classroom of purposeful, creative, happy children. Fundamentally, interdisciplinary teaching mimics our world, where all knowledge is interrelated. When we conduct our daily lives, we do not separate our activities into disciplines. All disciplines are learned and practiced in unison. When creating an interdisciplinary environment, a teacher must be reflective, know the content that is expected to be taught, and be able to interlock those concepts within a central idea. A central idea should be “a broad statement, which is clear and concise, globally transportable” (International Baccalaureate Organisation 49-50).

The successful implementation of interdisciplinary teaching is dependent upon the environment. Careful consideration must be given to arrangement, resources, and expectations. When one enters an interdisciplinary classroom, the arrangement is obvious. Some people will be working in groups while others are conferencing with the teacher. Still others will be working alone. It is a well-balanced cycle in which the teacher spends much time assessing. Vital to the art of teaching is the knowledge of each child's needs. Some may not need what others do, and all benefit from a variety of

arrangements. The special needs children, both gifted and deprived, are best served within an interdisciplinary classroom. Within such an environment, neither group sacrifices growth. The gifted child can extend and create unhampered, while the struggling learner receives support. Children which are part of neither group have the opportunity to work alone or within a group to refine their understanding. Private conferences are a large part of the classroom environment. Following group interaction, children should be set to extendable tasks while teacher conferences take place. Teachers are then free to circulate about the classroom observing, clarifying, and joining classroom discourse.

Literacy is another cornerstone of an interdisciplinary classroom. Literacy skills should be practiced each time a child expresses him or herself. Opportunities to read, write, listen, and speak should be abundant. Children must read daily. That is important. Even more important is the reading of personal works. Since they are most familiar with their own work, it is an easier road to fluency than impersonal reading.

Effective inquiry practices are also important to a successful classroom environment. How many teachers have encountered children who answer questions before they are out the teacher's mouth; they are so accustomed to literal questions that they have formed the erroneous habit of anticipating and responding prematurely. Surely no consideration accompanies such answers. That is why we must help children practice thoughtful responses that connect ideas, while forming a sound perspective. Many times when my children answer a question, I respond with "How do you know?" Children are then invited to think, connect, and express ideas. Inquiry tools are invaluable to an effective learning environment because they invite "children to access knowledge through a variety of problem-solving experiences that can be tied together" (Cecil 111).

Aside from being time and learning effective, a curricular unit of interdisciplinary teaching is an artistic masterpiece, for it allows educators to express both their knowledge and method while providing constructive learning environments. Such an environment build interest with provocative experiences, sustains interest with inquiry –based discourse, and finally guides it through research and application. Within such a unit, children learn all disciplines simultaneously. I've found that children are excited by this method of learning.

Preparation

In preparation for the unit, I would like to note the importance of literacy and materials. Language and literacy within the unit should be used to build the central idea, and the concepts taught within. A wide variety of subject-focused material should be available to the children; some of it will be actively used as a basis for classroom inquiry, while others are available for checkout in the library. Within my classroom, the children gravitate towards the library. It is inviting, full of beanbags, bookshelves, and a listening station. Though children have a choice of reading materials, those closely tied to the central idea are abundant and prominently displayed. I usually introduce the books

before I place them in the library. Tabbed margins and bookmarked pages help the children focus on the features of, and build knowledge of, the central idea. This knowledge is invaluable to classroom communication, particularly class discussions and writing. An abundance of writing materials including lined, plain, graph, and construction papers should be available. Various sizes of sticky notes and sentence strips should also be available to children. These materials are easily accessible to children.

Vocabulary can be taught without going through the boring rigors of rote. First, teachers should commit to using vocabulary words frequently and correctly. It was a challenge for me to do this initially. For example, if I were showing condensation, I might say “the water droplets.” What a disservice was done until I became conscious of my actions and their consequences. I was hampering not only the use of vocabulary, but comprehension as well. Our job is to transmit new vocabulary, particularly the more technical words. These words come without prior knowledge. Many children have not heard them, so building comprehension is vital. Children are better able to grasp concepts when the correct word for the concept appears coincidentally with experience. Each time children have an opportunity to experience the coincidental emergence of word and concept, understanding is reinforced. While speaking or conducting experiments, correct vocabulary must be used by the teacher. By the time children are ready to use the vocabulary concepts or skills independently, they should have enough prior knowledge to use vocabulary confidently.

A second note concerns preparation for science experiments. After conducting the experiment myself, I try now to allow at least one week slowly to prepare materials for the children. One very important part of creating an effective learning environment is gathering and organizing materials in advance. At one time, I gathered materials within forty-eight hours of a lesson. This often left me feeling rushed, and not properly able to enjoy watching the children learn. Nor did I have the freedom to make assessment observations as needed. When doing class experiments, all materials should be set up on a tray. In my classroom, experiments are usually done in groups of two or more. Supply Managers and Group Leaders are chosen to reduce the chaos sometimes encountered while collecting materials and conducting experiments. Supply Managers collect materials from a common area, while Group Leaders actually conduct the experiment. This arrangement leaves the teacher free to observe and take notes, both mental and anecdotal. These records allow me to observe the children’s understanding of the concept presented, and make necessary modifications. Modifications are so much easier to make when original and modification materials are not gathered simultaneously. Sometimes it will be necessary to search for another experiment to reinforce the concept.

Classroom learning is not a coincidence. It is the teacher’s responsibility to guide discoveries, adding knowledge, and new learning opportunities along the way by providing a constructive environment full of engaging experiences.

THE UNIT

The best thing about interdisciplinary teaching is that it does not bind the teacher to a bunch of tired facts. The children are also free to discover new avenues concerned with the same overall idea. Within this unit, the central idea that children will investigate is that our world is a place of actions and reactions. Given this broad idea, it is necessary to maintain focus. Specifically developed questions help guide inquiry and learning within the central idea. These guiding questions are:

- What is the environment?
- What is matter?
- How does matter behave?
- How do our actions effect the environment?
- What is our responsibility as humans on Earth?

Though short, this list of questions is inclusive of all objectives that will be studied within the unit.

What is the Environment?

Literature will play a large role in introducing the attitudes that the children will practice throughout the school year. Picture books are a great for this for two reasons. First, picture books are short with much content, including a large entertainment value when chosen carefully. Secondly, they are comfortable and familiar to children. Many are books that have been read and reread, so that children will not be focusing as much on plot as character attitudes. We will begin the unit by defining the social environment using literature. Identifying and comparing the attitudes using these books will be the goal. Each day we will read a book, and list individual attitudes. Discussions will follow, characterizing and identify the attitude(s) in the book attitudes by observing actions and their consequences. I will challenge the children to show and prove the attitude, both from the book and personal experience. To do this, they must be able to identify specific actions and their consequences. One book in particular, *Annabelle Swift, Kindergarten*, can be used to compare feelings and expectations of kindergartners and fourth graders at the beginning of the school year. This will be our first comparison writing of the year. Another book I will use is titled *Through the Cracks*. It is a narrative example of what happens when teachers fail in their responsibility to create an effective learning environment. Children need to see that I, their teacher, am responsible for my actions also.

After reviewing the children's compositions, a mini-lesson will be taught. Mini-lessons are dependent upon the children's needs at the time of assessment; they are semi-spontaneous and vary throughout the school year. Normally, sentence and paragraph structure are good places to start with any class. But again, this will be dependent on the group. Following the mini-lesson, children will go about editing their first drafts, while I conference individually. This cycle of writing, assessment, and refinement is used

throughout the school year in a variety of writing experiences. This cycle enables children to fully comprehend the process, purpose, and technicalities of writing.

Reading and familiarizing ourselves with the chosen attitudes will consume our first weeks of school. Current events from newspapers and the Internet will be included in the literature. Discussions and comparisons from current events will offer opportunities for children to persuade, inform, entertain, and analyze while writing. Carefully chosen articles not only incite thinking and discussion, but also reinforce the central idea, which challenges children to think of actions and reactions within their social environment.

Children need to have some idea of what kind of world they expect to live in. Before children are ready to choose three attitudes to represent the class rules, they must see how actions impact our Earth. To build awareness of social environments on Earth, I will use a book, *If the World Were a Village*, as springboard for discussion. It is important to allow as much autonomy to children as possible as they become more aware of social environments. Placing value on culture stifles children for two reasons. First, once a teacher has offered a value, children usually accept it. I do not want to give children answers; I want them to think for themselves and to witness the relationship between action and reaction. Secondly, children need to own their thoughts of how they feel their world should work. It should not be a forced realization that lacks emotional conviction.

At this time, children have enough information to vote on three attitudes they feel should represent our class rules. Whenever possible, I practice democracy. Not only is it respectful and appreciative of each within a community, it also offers wonderful opportunities to explore math. Data can be gathered, compared, organized, analyzed, and reorganized. Many of these data skills are the same used by those who practice the scientific design. Opportunities to practice these skills should be frequent. When the time comes to actually combine data-handing skills into scientific design, children are less concerned with skills and more with content and process. One of the first homework assignments will involve collecting data concerning the social environment. Given a list to the twelve attitudes, the children will survey five people. They will ask them which attitudes are most important to them. They should summarize the results in a paragraph. The following day, after we vote for class rules, we will tally our findings. We will then create charts to communicate the data. Some children will create the charts effortlessly, and be prepared to transfer the information to pie graphs. Pie graphs are a great introduction to the relationship between fractions, decimals, and percents. A mini-lesson for converting fractions, percentages, and decimals will benefit those children who are eager to make the transfer. So while some children will be creating pie graphs, others will continue working on charts and conversions.

Having developed the class rules, children now have enough experience with the vocabulary and concept of environment to be able to define it. I will ask children to list ideas about environment. Environment should be defined as our surrounding, or something similar. I expect the children to respond with a focus on the social environment, since they will have been immersed in such discourse. It may be necessary

to goad them to recognize the physical environment as well. Once a complete list has been generated, we will create a Venn diagram to distinguish the features of both physical and social environments. I will ask children to place ideas from the list on the diagram, and explain their thinking. Assessment will be a written composition comparing the physical and social environments. This will be a time to reinforce class rules. As always, after the compositions have been graded, I will develop an appropriate writing mini-lesson, after which individual conferences will be held. Children are now ready to explore the physical environment.

What is Matter?

I would like children to know that matter is identified through its properties – both observable and unobservable. When we talk about unobservable properties, I am referring to those that actually cause matter to behave in certain ways that we can witness, classify, and identify. The physical environment will first be explored through classification. Students should understand that matter is anything that has mass and takes up space, and that it is classified into states: solids (definite shape and size), liquids (definite size and indefinite shape), and gases (indefinite size and shape). To assess the children's prior knowledge of the subject while reinforcing their text search skills, we will begin using the school-issued textbooks. First I will inform the children that they will be using a range of pages from their science textbooks. Once children have found the pages, I will tell them that we will be exploring their physical environment. Once children have searched for the definitions of matter and its states, I will record the responses. We will then list the properties that they can identify in all states.

Because children have a notion of matter, they have not yet realized that the lines of definition sometimes blur. Sometimes the properties of a material has the attributes of more than one state. When we reflect on this, we will begin to see a relationship that leads to an understanding of atomic theory. Because of the arrangements of atoms, matter takes its properties. We should be able to find a relationship between atomic weight and mass and the forming of the different states in matter. Substances containing a higher molecular weight and mass have more characteristics of a solid, while those with more gaseous properties contain a lower atomic weight. A relationship can also be found between atomic number and the observable properties of matter. Gas compositions are made easily, while heat energy is needed to bind more solid materials because it takes more energy than that of an electron to promote attraction. Liquids carry the attributes of both solids and liquids of both, so although they respond more quickly when heat energy is present, they are less reactive than gases.

When studying the Periodic Table, children are able to see the relationship of states of matter in relation to both atomic weight and number. I will make available to children a personal copy of the Periodic Table to be studied first as a group. Since the relationship between atomic weight and number can be seen on the Periodic Table, prior knowledge of patterns will guide this lesson. They can see that the numbers on the Periodic Table increase as materials become more identifiable according to the properties of a solid, and

vice versa. One particular kinesthetic activity allows children to behave like matter in its various states.

Of all the states of matter, air is probably the most elusive for children to understand because the properties are not normally easy to observe. Therefore, there are two experiences I would like to share with the children. They show that air indeed has mass and takes up space. I will blow up two balloons to approximately the same size, and attach them to each end of a wire hanger. The balloons should be balanced for the children to observe before the teacher pops one of the balloons. Like any balance, the weighted end will drop, showing the children that air has mass. To show that air takes up space, I will show the children a plastic bag that I will later seal. Once sealed, the air will have no release. The children will be able to witness how space is taken up by the air.

Another lesson allows children to see that some matter has properties of more than one state. A mixture of two parts cornstarch and one part water will produce a substance that has the properties of both a solid and a liquid. In pairs, the children will handle the material while taking notes. While the first child is handling the material, the second child will be observing and taking notes. He/she will also be listening and recording information from his/her partner. After five minutes, the first child will wash his/her hands. They will then switch roles, so that both have an opportunity to handle the material and scribe. It can be messy, so I recommend that a bucket of soapy water and paper towels be present for this experience. After a time for exploration, observations, and data collection children should address the matter of classifying this material. This is how children should begin to recognize the properties of matter.

We will then begin a study of material properties. A property is a characteristic of something that can be observed and described such as size, shape, color, hardness, mass, volume, etc. Children should begin to recognize the fact that matter can be classified by its properties. Some of the most prominent features of matter can be measured, particularly mass and volume, and the amount of matter and the amount of space taken up, respectively.

When measuring, children should be able to differentiate between one, two, and three-dimensional figures. We will begin by measuring just one dimension – length. We will begin this activity by having them draw a portrait of themselves using a full piece of 8” by 11” manila paper. They will be instructed to use geometric shapes to do so – squares, circles, ovals, diamonds, and rectangles. Once pictures are completed, they will practice measuring parts of their bodies using tape measures. First they will estimate, and record their estimations. Then they will find the actual measurement. They will then record the data in both centimeters and inches. Once children have had an opportunity to become familiar with the units of measure, we will begin a practical study of conversions. I will introduce both the foot and the meter stick for them to compare the inch and centimeter. We will then correlate the idea of counting within our base ten systems with measurement within the metric and standard systems. Counting to one thousands is much easier when done by one hundreds than ones. The same is true with measurement. It is

much easier to measure a large dimension using kilometers, feet, meters, and yards than inches or centimeters. We will also explore measuring parts of a unit. This will continue our study of fractions, decimals, and percentages, and hone the children's ability to operate within this part/whole system using addition, subtraction, multiplication, and division. Using the overhead projector and rulers, the children will identify and convert part of a whole unit.

Next two-dimensions, area, will be explored. We will be working with two-dimensional figures, as well as their properties and measurements, through a variety of activities. The first will introduce the formula for finding area. I will then tell the children that I would like them to test the formula using plastic square inch flats. The children will be instructed to choose two numbers between one and twenty, and write them down. These will be the dimensions of their rectangle. After drawing and cutting out the rectangles, children will measure both the length and width, multiplying them to find the area. They can test the answer using the squares to cover the surface area of their figure. Once this activity is complete, the practicality of formulas will become evident to children. I feel children should have all the formulas to tackle a problem successfully, but they should also know why they use the formula, and what they are representative of. I have encountered children who are able to use formulas to excellent end; many were A students the children will use the given formula to find the area, then the squares to test. However, they were to take the formula out of a particular context, and reapply it practically. Children should appreciate formulas for what they are—shortcuts. They should also be aware of a full path of knowledge that can be readily diverged.

Following an exploration of area, we will graduate, no pun intended, to three-dimensional figures. I would like children to fully appreciate the fact that volume is space taken up, and that a liquid can be measured and compared to a three-dimensional solid object. We will work to compare the volumes of both solids and liquids using the metric system. Once children have become familiar with that system, we will compare Metric and customary systems. We will then estimate and convert between the two systems. At this point, children are comfortable with centimeters, and should be made aware of the relationship between one cubic centimeter and one mL. While the main goal is that they know that one cubic centimeter equals one mL, after working in measurement stations with various containers, cylinders, and beakers for exploration. Children are then able to see the many ways we measure how much space is taken up by a particular material. After children have had time to explore the systems a bit, I would like to have a cooking day. I will give them recipes in customary units, and measuring utensils in metric units. Given their knowledge of the two systems, they will prepare batches of cookies. Once the cookies have been baked, children will see firsthand the importance of accuracy and conversion. Following this exercise, a quiz to check understanding of measurement concepts will be given.

One of the first activities involving mass, weight, and density will be weighing ourselves. As the children enter the classroom, I will send them to a weight station set up

in the room. The weigh station will contain a scale, pencil, chart, and sticky notes. After finding their weight, the number of pounds should be written on a sticky note and placed on a number line ranging from 50 to 100 pounds. Later, this information can be used to find the average, mean, mode, and median weights. As a class, we can create a bar graph of the information, converting it later to a pie graph.

We will explore the difference between mass and weight. From my experience, children tend to confuse the two. While weight is the gravitational pull of an object, mass is the measure of matter that an object contains. Children should have opportunities to work in stations with balances to mass various objects. Not only will this help them to see the differences between mass and weight, but also help them to recognize how mass is related to density.

I would like to give children plenty of time to become familiar mass and density, and the relationship between the two. They should know that density is the amount of mass per cubic centimeter, or how much mass/volume. One activity to help children understand the concept of density is the use of a density column. To create a density column, it is best to select at least four liquids of different density and color. Water, vegetable oil, milk, and maple syrup work well. Once children have identified the materials, I would like them to predict the final arrangement of the liquids once they are poured individually into the jar. They should be able to make an inference to defend their predictions.

Once children have basic knowledge of the properties of materials, we will watch a movie titled *Matter*. Since the children have already inquired into the concepts taught within the movie, the goal will be note taking. Both listening and note-taking skills will be practiced. As children watch and listen to the movie, they will be instructed to jot at least ten notes from the movie. Each note should be one to five words, depending on the child's needs. Those who recall easily may be more comfortable jotting one word, while others may jot up to five words. These notes should represent a whole thought, which should be catalysts for further thoughts and questions. It is important that after the movie, we share our notes. This sharing will allow children to see how notes are actually used as a catalyst for further thought. This activity can be extended to a writing exercise, since each note can represent the main idea of a paragraph, while the extended thoughts are the details. This can help clarify existing ideas concerning matter.

Another literacy experience that will reinforce the classification and properties of matter is the examinations of an Eyewitness book titled *The Earth*. The pages from this book are easily copied and supply a wealth of information and communication for the children. This book explores Earth through its main states of matter. It also effectively teaches children to appreciate and read margins, pictures, and graphs contained in text. Children are accustomed to reading narrative text, but sometimes flounder when asked to gather information from expository text. Text searches are quick games where teacher asks a question, and students must search the text, including illustrations, margins, and graphs for answers. This game can be played children against teacher, boys versus girls,

whole class, etc. I usually play this game in such a way that children have an opportunity to earn points. This game will serve as an informal assessment.

How Does Matter Act and React?

I would like children to understand that matter acts and reacts within its environment. To do this, children have first explored matter by its stages, and their properties. To understand matter's reaction, the children must know the difference between a chemical and a physical change. They must know that a physical change is reversible, and that not permanent molecular bond has taken place. With a chemical change, the material has change into a whole different substance, and that an irreversible molecular bonding has occurred.

Matter classifications are based on observable, measurable properties. The children should have an understanding about how the atoms and molecules of a material determine its action. Within this strand of study, the children will study both physical and chemical changes, and form predictions and conclusions as to why materials react to their environment in certain ways. Next, we begin to see how some environmental elements cause matter to react, particularly heat. Knowing this, children are able to appreciate the fact that matter acts and reacts. Children should know what matter is and how it behaves in order to understand how their world works.

How Do Our Actions Effect Our Environment?

Science is defined in Webster's Dictionary as "knowledge as of facts, phenomena, laws, and proximate causes, gained and verified by exact observation, organized experiment, and analysis." Humans have been using science to understand and manipulate their environments since the beginning of history – building upon each other's experiences until critical mass occurs. Critical mass in this sense is a grand manipulation which results in life-altering consequences. Such occurrences were fire, the wheel, social and political systems, religion, and computers to name a few. These occurrences were not spontaneous: experience, observation, and examination spawned inquiry. I would like to create an environment for children to practice science: to observe inquire, examine, and test our world. They must act in ways that produce an understanding of how our world works.

Effective scientists are able to observe, identify, classify, measure, predict, and reflect. They must also make and test inferences. However, all these skills are meaningless if one cannot record the process of these skills and conduct a fair test. Of course, when given examples, children are able to recognize an unfair situation (just try giving candy out in random proportion!). A fair scientific test should include controlled, manipulated, and responding variables. The controlled variables are conditions which remain equal, so that we can determine what is causing a change to the manipulated variable – the only condition that is changed in an experiment. The responding variable responds to the change. For instance, if we were conducting a simple experiment to

determine if water affects plant growth, the amount of water would be the condition that we manipulate. All other variables (seeds, sunlight, soil, human contact, temperature, etc.) would remain equal, or controlled. The plant's actual growth would be the responding variable. Using this scientific design enables children to practice the process of scientific integrity while observing how our environment acts and reacts.

To begin to understand a fair test, I will begin with an exercise that will surely test the children's sensibilities and provoke immediate response. I will tell the children that I'd like to know who jumps farther, boys or girls. One very large child and one very small child will be chosen by me to represent the two groups. Two data collectors will be needed. They will measure the jumps using a tape measure. Marking the start line with a meter stick, I will instruct each child to jump. Already, I can hear the groans of disapproval. Somewhere within the groans, the word 'fair' should emerge. This is an opportunity to introduce manipulated and controlled variables. The children will be allowed to choose fair representatives after they have named some of the variables that should be controlled, since we are already manipulating the sex of the children. Using a scale and tape measure, we will control for the variables of height and weight, and conduct several more trials. Following this exercise, we will brainstorm more controlled variables we could include.

We will begin this strand of study with measurement. All scientists must be definite in measurement to process ideas accurately. This is a time for us to practice our measurement skills as well as begin to see the significance of proper measurement. These include length, width, height, volume, density, mass, and temperature.

What is Our Responsibility as Humans on Earth?

This exploration of human action and reaction will develop through the use of newspaper, magazine articles, trade books, and literature. They offer examples of how scientific behavior has worked in the real world, allowing children to witness the impact human action has on our environment in a larger sense. Provocative text and real issues are tools for reflective journaling. In this way, we will begin to explore our responsibility as humans on Earth. First, what is this responsibility? The answer to this question is not to be taught, but reflected upon. The teacher's job is to ask this question, and then allow children to answer based on what they have learned. In this way, children are able to build a meaningful knowledge base: there is no right or wrong answer-just the evidence of action.

SUMMARY

To summarize the unit, I will give both an essay and a comprehensive multiple choice test, coupled with an opportunity for the children to design their own experiment. The essay will be an open-ended question that will allow children to use what they know about both their social and physical environments to prove that actions have reactions within their environments. They will also be challenged to prove or disprove human

responsibility within the environment. I usually develop a comprehensive multiple choice test from observing how children have interacted with the lessons. The adopted textbook for fourth grade offers chapter tests which assess the state objectives; however, it will not be encompassing of all the objectives covered in this unit.

One important part of the summative assessment is each child's development of their own scientific experiment using all the guided information they have received throughout the unit. It should include the observation that led them to make inferences, and a hypothetical statement which includes the manipulated and controlled variables. From this hypothesis, they should be able to make a prediction, and test it using numbered, concise, detailed procedures. An equally important part of designing an experiment is identifying all variables – controlled, manipulated, and controlled. Children should be able to do this, and arrive at a conclusion which can be retested with the same results.

In concluding this unit, children should be aware of how their world acts and reacts, and their power to manipulate their environment.

LESSON PLANS

Lesson One: Mix and Un-Mix

Objectives

1. Students will use the physical properties of a mixture to separate the part.
2. Students will identify which physical properties should be used to separate a mixture.
3. Students will gain a foundational understanding of physical changes.

Materials

Sandwich bags
Rice
Metal Shavings
Salt
Water
Magnets
Coffee filters
Metal mesh
Cotton
Various containers
Plastic trays

Preparation

Rice, salt, and metal shavings should be combined, and then equal amount should be placed in enough sandwich bags so that children can work in pairs.

Procedure

Before children have an opportunity to interact with materials, we will review the safety rules. Once the rules have been reviewed, children will prepare their science journals to

record observations and procedures of the experience. Once children have taken out their science journals, I'll show them one of the bags full of the mixture, and tell them it is metal shavings, rice and salt. I will then ask them if they think the three materials can be separated and to record their answers in their science journals as a prediction. I will then pour the mixture into a graduated measuring cup, and add an eight ounce bottle of water. And then ask the children the same question, "Can these materials be separated?" I will tell the children that if they feel it can be separated, they feel that the materials are a mixture; and if they feel that the materials cannot be separated, then it forms a compound. The children will be challenged to defend their position, using inferential knowledge of the properties of matter, in their science journals before they actually test it. The children will then be put in pairs.

Once the children are in pairs, the supply manager will be instructed to retrieve a sandwich bag, two pairs of goggles, a graduated measuring cup, and a container of water on a plastic tray. They will also be told that there are a variety of tools available to help them determine if the contents mixed with water is a mixture or a compound. Those tools include cotton, wire mesh, coffee filters, a funnel, two graduated cylinders, and a magnet.

The children will then work in pairs with the tools given to determine if the materials are a mixture or a compound. While the children are working, I will make observations, and prompt them to record their procedures. The children will then be given thirty minutes on two consecutive days to attempt to separate the materials. At the end of each day, we will discuss our findings to see if they support our predictions.

I will ask the children to record their conclusions in their science journals, as to whether the materials formed a mixture or a compound. To assess the children's understanding of mixtures and compounds for this lesson, I will use their science journals, and observations taken from both discussion and procedures.

Lesson Two: Choosing Our World

Objectives

1. Students will choose three attitudes to represent our class rules using the democratic process.
2. Students will help me choose three teacher expectations.
3. Students will choose what they feel is the most important attitude based on previous information and discussions.
4. Students will prove that their chosen attitude is valid by offering examples.

Materials

Paper
Pencils
Sticky notes

Through the Cracks book
Poster board

Preparation

The preparation for this lesson is the identification and exploration of the attitudes through previous literature experiences

Procedure

I will gather the children on the rug area, where teacher read-alouds and discussions are often held in my classrooms. I will tell the students that I have an important book to share with them.

I will read the book, *Through the Cracks*. I will then ask how the book connects to what we know about expectations. After children respond, I will ask them to identify attitudes, or the absence of a necessary attitude, found in the book. I will ask them to comment specifically on the attitude of the teacher. I will record the children's responses on chart paper. Once we have generated a list, I will ask the children which attitudes are the most important attitudes for a teacher to have and to defend their responses. These responses will be recorded on an adjacent list. Once all responses have been recorded, we will make a connection between the students in the book and the teacher's attitude. I will tell them that I will choose three attitudes that represent my teacher expectations, and they will do the same to choose their class rules.

Next, the children will return to their desks to prepare their ballots, while I prepare mine. These "ballots" will actually be written compositions in which the children choose an attitude that they feel is always present in an effective community. The paper should be a position paper, in which the children choose a position and defend it with examples. While the children are writing, I will work on a similar composition which will outline my own attitudinal expectations.

Over the next two days, we will take time to share our compositions at the podium – each speech a ballot for a particular attitude. Once the "ballots" have been counted, we will work to create a poster for our class rules. This poster will include the three attitudes along with handwritten sticky notes. Children will be instructed to write an example of how one of the attitudes looks, sounds, or feels. These will be placed on the poster, on which I will have already placed the chosen attitudes in large letters. It will then be laminated, and hung in the room as a reminder.

Lesson Three: Rock-it

Objectives

1. Students will understand the concept of displacement.
2. Students will find the volume of an irregular solid object.

3. Students will operate mathematically to find the volume of an irregular solid object given the specific volume of a liquid.

Materials

Rocks
10 graduated measuring cups
50 mL of water in each cup
Additional pitcher of water
Science Journals
Pencils

Preparation

The only preparation for this lesson is to fill each of the measuring cups with 50mL of water.

Procedure

First I will introduce the word “displacement” to the children, and ask them if they recognize a root word. Once they have identified the root word as “place,” I will ask them to find both the prefixes and suffixes of the word, using a dictionary to clarify any unknowns. After we have a working definition of displacement, I will ask them to write the definition in their Science Journals. I will tell them that the word is important for what we will do next, and that they should remember the word and its meaning.

By now, the children have studied finding the volume of both solids and liquids, but have no experience in finding the volume of an irregular solid. I will tell them that we will go outside for five minutes to search for a rock that is no wider than three inches. After they have selected their rocks they will be instructed to return to the room, and find a partner. They will also be told that Science Journals will be needed for recording any strategies they will be using.

Once children are in pairs, I will instruct the supply managers to pass out the cups containing 50 mL of water. I will tell them that they will be using the water to find the volume of the rock. They will be instructed to record all strategies they use to find the volume. After fifteen minutes, I will call the group to attention to share progress and strategies. I will then model for them how to find the volume of an irregular object. By recording the volume of the water before and after putting the rock in, then finding the difference, they are finding the volume of an irregular solid. They will then be instructed to exchange rocks with another pair, and to practice finding the volume of their new rocks. They are to record their calculations in their Science Journal, along with the importance of the word displacement, and the material that was displaced. The Science Journals will be used as an assessment tool.

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