Action Research Project at

Salina Elementary School

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Seham Mohamed

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Abstract:

This Action Research Project was created to discover and address third grade students’ misconceptions about the structure and function of plants using the scientific “Big Idea” of models. After observing and pre-assessing the students in Saleh’s classroom, we found that students had misconceptions and a lack of knowledge about models, and the functions of plant stems. We taught two inquiry model-based lessons on the concept of physical models, and functions of the stem. We then altered some of our pre-assessment questions to be more specific for our post-assessment of the students, to see if our lessons improved the students’ understanding. Our analysis of the post-assessment data showed that, in a class of twenty-six students, the percentage of correct definitions of models rose from 11% to 54%. Also, the students progressed in being able to determine if an object was a model or was not a model from 15% to 69%. The students who knew functions of a plant stem increased from the pre-assessment, in which 25 could name one function, to the post-assessment, in which 21 could name two functions. In conclusion, we found that using models to show the functions of plant stems was beneficial for the third grade students, and should be further integrated in teaching science lessons.
Introduction:

The importance of models cannot be overstated as the scientific “Big Idea” because it crosses the boundaries of all scientific disciplines. A model is a representation of an object, idea, or illustration of the way something works. A model is not an exact copy of its target, but it demonstrates aspects of the target such as the physical, functional, or conceptual characteristics. Models need to be interpreted to make sense, otherwise misconceptions may occur. Through models we can learn, experiment, predict, and gain a better understanding of the world around us. From the time students’ kindergarten teachers show them an illustration of a plant, to the time they enter middle school and learn the chemical equation of photosynthesis, models are consistently a part of their curriculum. It is our desire to help children to see models are a “framework” which, as Gilbert (1999) states, will enable them to construct their own understanding of the target.

As part of the Capstone course in the University of Michigan-Dearborn, our team conducted an action research project in a third grade classroom that will discover student misconceptions about plants, with the use of the scientific “Big Idea” models in our instruction and assessment. In doing this research we wanted to answer the following questions: What do third graders know about structure and function of plants, and models? How does our instruction impact their knowledge?
There have been a variety of research studies done on the subject of plants, and the significance of models. One article we found that was relevant to our research was by Gatt, Tunnicliffe, Borg, & Lautier, (2007). They interviewed children from different cultural backgrounds to discover their prior knowledge about plants. The research indicated that elementary students had a restricted definition of what a plant was. Their “main mental model was that plants were something small, with a thin stalk, leaves and green in color” (p.119). Only some children identified roots as part of the plant’s structure. This relates to our research question in which we wanted to discover what students know about the structure of plants, and also to question two in our pre-assessment, “What three structures do most plants have?”

Another research study we found was an article by Gilbert (1999) concerning the model as a way for teachers to help students understand the processes of science as well as the nature of science. In his research paper, *The Model as a Vehicle for Understanding the Nature and Process of Science*, Gilbert (1999) affirms that scientific models are so critical to science that they may be considered “the heart of the scientific enterprise”(p.3). Yet, Gilbert cites VanDriel (1998) as finding only a few teachers in his study who see the importance of using models when teaching a lesson. Therefore, part of our action research project with these third grade students was framed around the premise that as we
presented our lessons, students and their teacher would be able to see the ways in which models enhance students’ learning, giving the students new ways to understand plant’s structure and function.

Our Action Research Project was conducted in an area of Dearborn with many new immigrants from the Middle East, mostly from Yemeni background and culture. Their knowledge base and ways of thinking, or looking at the world, are different from a “typical” Michigan family. Most students have a different home language than English. So these factors represented a new challenge, and some uncharted ground. We discovered what the students knew about plant structure and the function of a plant’s parts. We wanted to find out if their knowledge was complete, or if the students would have misconceptions such as Berthelsen (1999) noted in her article on students’ “naïve conceptions”. She claimed that students “believe plants feed by absorbing food through their roots” (p. 13). We also wanted to see if the third graders had adequate vocabulary in English to make their ideas known through our pre-assessment.

**Methods and Procedures:**

We conducted our action research project in a third grade classroom at Salina Elementary in Dearborn, MI. Salina Elementary School’s students come with little or no prior knowledge mainly due to their low SES (socio-economical status) or recent immigration to the United States, as their classroom teacher, Ms. Saleh, explained. She also stated that approximately 97% of the students are eligible for free breakfast and lunch. Ms. Saleh has been teaching with Dearborn Public Schools for ten years. When we began the project the classroom consisted of 27 students, almost all of whom are Yemenis. By the end of the project the number dropped to 26 students. The students’
achievement levels range from those who are highly intelligent to those who are struggling to attain average achievement levels. The teacher had many posters hung on the walls to motivate her students. The classroom desks were arranged in groups of three, making it easy for us when we conducted our lessons and divided the students for group activities.

When we started this project the teacher, Ms. Saleh, began giving her class life science lessons. The textbook, *Macmillan McGraw-Hill Science* (2005), was provided by the district along with a science kit. She taught straight from the book, and had the students read along with her. She also reviewed the concepts, such as all plants have the same basic needs – sunlight, air, water, and minerals. Ms. Saleh did try to give her students “connections” as she called them, “so the children can have an idea to hang onto.” For example, in reading about the stem of a plant she told them, “The stem is like a messenger, taking water and minerals from the roots up to the leaves.” Some of the examples she used could be considered similes, or verbal models, because they help the students relate one aspect of the target (the stem takes water and minerals from the roots to the leaves) to something they already know (a messenger takes a letter from one person to another). So, in these analogies, she is comparing a known object to an unknown object, based on similarities, to enhance the students learning ideas. This is cited by Rule and Rust (2001), quoting Goswami (1992), who says this type of analogous reasoning “is a central component of human cognition. It is involved in classification and learning, it provides a tool for thought and explanation…” (p. 26).

From our first and second observations, we were able to focus on the action research question formerly mentioned, and locate similar research studies done in the
past. Reading through the studies, and using the science textbook Ms. Saleh provided for us, we were able to come up with five pre-assessment questions that revealed what ideas and misconceptions the students had about plant structure and function. We planned to administer the pre-assessment to the class as a whole, in written form, asking each student to write short answers, explanations, and to draw a plant with its structures labeled. We also circulated through the classroom as students were doing the pre-assessment, asking a random sample of students (ten students) to explain their ideas to us, and we wrote their answers on 3 X 5 cards. These helped us clarify their ideas.

The first question (see Appendix B) assessed the students’ understanding of models by showing a picture of a plant, a plastic plant, and a real plant. Children should see models as a “familiar framework,” according to Gilbert (1999), which will enable them to construct their own understanding of the target (p.3), which in this case was a plant. The idea that Gilbert wanted to convey, and which we wanted to impart to these students, was that models are extremely beneficial to students’ learning. Since by nature models do not perfectly represent the target, students must construct the way in which a model corresponds to the target, building a mental framework (p.7). If the students did not have a clear concept of models, then it was our task to help them understand about models through our subsequent lessons.
Questions two and three asked the students to name three structures of a plant, and to draw and label their own concept of a plant. A research study done by C. R. Barman, Stein, N. S. Barman, and McNair (2003) related to our questions where, using a set of pictures, their investigators asked the students to classify them “as plants or not plants,” and “to explain what all plants have in common” (p.47). Our question three had the students draw a picture of a plant (we wanted to find out what a typical plant looked like to them) instead of providing pictures for them. Several of the pictures C. R. Barman, Stein, N. S. Barman, and McNair (2003) used (such as mushroom, Venus’ flytrap, and walking stick) would have been confusing to immigrant children from Yemen. Drawing their own picture of a plant gave us a better idea of their mental model. Our question two related to the second part of the previously cited investigation. The researchers asked their students “to explain what all plants have in common” (p.47), while we asked our students to name three structures most plants have. The question was asking for the same type of information, but our question was more specific, asking students to name three structures of plants, rather than write an explanation.
Questions four and five dealt with functions of plant parts, asking students about the function of the stem and how the roots help plants. We wanted to compare the students’ answers for question five (provided in Appendix B) to the study done by Barman and Stein (2003). When the students in this research study were asked about the roots, they answered by stating that roots kept the plant in the ground (p. 50). We wanted to see if the third grade students we would be pre-assessing would have the same ideas as those students in the research study, that roots are only anchors to the plant. Our questions four and five were taken directly from the lesson topics taught by Ms. Saleh during our second observation. We wanted to see if the students would understand the concepts being conveyed by their teacher’s verbal models, “the stem is like a messenger” or “the stem is like an elevator” for the function of the stem. We also wanted to find out whether students would have a good mental model of how roots function to help plants stay alive.

Once we gave the students the pre-assessment, we took the raw data and tabulated the students’ answers according to agreed upon categories. For question one, we
separated students’ responses into three different parts: 1. Do students think a picture of a plant is a model, yes or no; then we separated their reasoning into categories based on the most repeated student answers. 2. Do students think a plastic plant is a model, yes or no; their reasoning was separated into categories with the most student responses. 3. Do students think a real plant is a model, yes or no; their reasoning was separated into categories as well.
Question #1

A. Picture Model of a Plant

<table>
<thead>
<tr>
<th>Types of students’ responses</th>
<th># of students’ responses</th>
<th># of students’ responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>It’s Fake</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>It’s Real</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>It Has Plant Parts</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>I Don’t Know</td>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>

Is This a Model of a Plant? (Picture Model)

<table>
<thead>
<tr>
<th>Students’ Responses</th>
<th># of Students' Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>It’s Fake</td>
<td>2</td>
</tr>
<tr>
<td>It’s Real</td>
<td>8</td>
</tr>
<tr>
<td>Has Plant Parts</td>
<td>7</td>
</tr>
<tr>
<td>I Don’t Know</td>
<td>2</td>
</tr>
</tbody>
</table>
B. Plastic Model of a Plant

<table>
<thead>
<tr>
<th>Types of students’ responses</th>
<th># of students’ responses</th>
<th># of students’ responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>It's Fake</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Plant Parts</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>I Don't Know</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Is This a Model of a Plant? (Plastic Plant)

Students’ Responses
C. Real Plant

<table>
<thead>
<tr>
<th>Types of students’ responses</th>
<th># of students’ responses</th>
<th># of students’ responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>It's Alive</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>It's Fake</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>I Don't Know</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

Is This a Model of a Plant? (Real Plant)

![Bar chart showing responses to Is This a Model of a Plant? (Real Plant)](chart.png)
For question two, we asked the students, “What three structures do most plants have?” We divided the answers into two categories, Know or Do not know, but all the students knew the three structures most plants have. There was no need to have a “Do not know” category.

Question #2

What three structures do most plants have?

<table>
<thead>
<tr>
<th>Types of students’ responses</th>
<th># of students’ responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roots</td>
<td>26</td>
</tr>
<tr>
<td>Stem</td>
<td>26</td>
</tr>
<tr>
<td>Leaves</td>
<td>26</td>
</tr>
</tbody>
</table>

We analyzed question three, the pictures of a plant which the students drew, first to see if they drew a flower or some other type of plant; then we considered how the students labeled their pictures, dividing them up into categories based on their answers.
Question #3

**Draw a picture of plant and label the parts.**

<table>
<thead>
<tr>
<th>Types of students’ responses</th>
<th># of students’ responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flower, leaves, stem, roots, seed</td>
<td>3</td>
</tr>
<tr>
<td>Flower, leaves, stem, roots</td>
<td>10</td>
</tr>
<tr>
<td>Leaves, stem, roots, seed</td>
<td>4</td>
</tr>
<tr>
<td>Leaves, stem, roots</td>
<td>9</td>
</tr>
</tbody>
</table>

For question four, we analyzed the students’ responses and divided them up into the following four categories: The function of the stem is 1. To have the plant stay straight, 2. To carry water, 3. To stand up straight and move food and water through the plant, 4. Don’t Know.
Question #4

What function does the stem of a plant perform?

<table>
<thead>
<tr>
<th>Types of students’ responses</th>
<th># of students’ responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>To stay straight</td>
<td>8</td>
</tr>
<tr>
<td>Stand up straight + move food through plant</td>
<td>4</td>
</tr>
<tr>
<td>Carries water</td>
<td>12</td>
</tr>
<tr>
<td>I don’t know</td>
<td>2</td>
</tr>
</tbody>
</table>

We examined the answers for question five, “How do roots help plants stay alive?”, and separated them into four categories: 1. Collect food and minerals, 2. Carry water, 3. Keep plant in place, and 4. Carry food and keep plant in place. Once we tabulated the responses, we presented the data in the form of separate bar graphs for each question.
Question #5

How do roots help plants to stay alive?

<table>
<thead>
<tr>
<th>Types of students’ responses</th>
<th># of students’ responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collect food + minerals</td>
<td>15</td>
</tr>
<tr>
<td>Carries water</td>
<td>1</td>
</tr>
<tr>
<td>Carries food + keep plant in place</td>
<td>3</td>
</tr>
<tr>
<td>Keep plant in place</td>
<td>7</td>
</tr>
</tbody>
</table>

Results:

After analyzing the pre-assessment responses to the questions, we discovered that the students had misconceptions and lack of knowledge about the scientific “Big Idea” models and the functions of a stem. All the students were able to give a complete answer for question two dealing with three main parts of a plant. The majority of the students drew and labeled their ideas of a plant accurately (as flower, roots, leaves, stem). As for
question five related to the function of roots, most students’ responses revealed that they had an adequate grasp of how roots help plants stay alive.

Based upon our findings (refer to graphs for question 1) the third grade students exhibited misconceptions and lack of knowledge on models (about 79%). Therefore, our first lesson centered on models, for which both Dr. Luera our instructor and Ms. Saleh gave their approval. We wanted the students to be able to distinguish between the real object (target) and the physical model, which resembles the target. Our objectives were for students to:

- Compare and contrast between models and the real thing by using a Venn diagram.
- List three models in the classroom.
- Explain how the models they listed are different/similar to the real thing it represents.
- Define models in their own words.

These objectives align with the Benchmark for Science Literacy Project 2061: A model of something is similar to, but not exactly like, the thing being modeled. Some models are physically similar to what they are representing, but others are not.

We also took one of the GLCEs, Michigan Grade Level Content Expectations, for third grade which states:

S.RS.03.11 Demonstrate scientific concepts through various illustrations, performances, models, exhibits, and activities.

We provided three examples of objects: a hamster, a plant, and one of our team members (Seham). Then, we provided three corresponding models: a Zhu-zhu pet, a plastic plant, and a photo of Seham. We asked the three groups of students to compare and contrast each of the models and the corresponding targets using Venn diagrams. After the students had time to compose their own definitions of the word model, they
searched for models of things in the classroom (e.g. - a globe, a solar system, and a toy truck.) Based upon our formative assessment, which consisted of having students read aloud their group definitions of *models*, and having other students stand up and tell which models they chose and why, we were satisfied that the students had a much better definition of the word *model*.

Our second lesson dealt with the stem of a plant and its functions, because in our pre-assessment question four, we noted the students had limited knowledge about the functions of the stem. (Twenty-five of the students were unable to name all three functions of the stem.) The objectives for this lesson were, students will...

- Observe how water travels up the stem to the rest of the plant by placing a celery stalk in colored water.
- Draw a picture of the celery stalk and leaves, making a prediction of what will happen.
- Explain why the colored water moved up into the leaves in one celery stalk, and not as much in the other with holes.

We aligned these objectives with the Michigan GLCE’s, which states:
L.OL.03.31 Describe the function of the following plant parts: Flower, stem, root, and leaf.

With a tree trunk as our target, and a celery stalk as our model, we wanted the students to observe how colored water travels up the stalk to the leaves causing them to change color. Students first examined the celery stalk, and then placed it in a cup of water with their choice of food coloring (red, blue, or purple.) Next we asked the students to imagine that the toothpick we gave them was an insect that gets its food by boring holes in tree trunks. The students then took turns poking holes in their second celery stalk and placing it in a cup with different colored water. We asked the students to draw and write a prediction for what would happen to each stalk of celery. Many students thought that more holes would enable the stalk to draw up more water (“like more mouths,” one student said.) The students were surprised when we brought out the celery stalks that had sat over night in colored water, and they saw the stalk without holes had blue tinted leaves, but the stalk with holes had withered leaves. We left their celery stalks in colored water on the window ledge so they could compare them the next day. As part of their formative assessment, we observed the students’ drawings and predictions of what would happen to each celery stalk. We also listened to students as they explained why they thought the celery leaves received different amounts of colored water. We concluded with the discussion that celery stalk without holes transports water to the leaves more effectively than the celery stalk with the holes.
When it came time to give our post-assessment, we modified our questions in the following ways. We thought it would be best to ask the students questions related to the definition of models, and the functions of a plant stem because those were our two lesson objectives that dealt with their major misconceptions. Therefore, we revised the pre-assessment question one, which had been extremely difficult to analyze, and asked students to give us a definition of the word model in their own words. For question two, we asked the students to give us an example of a model. Finally, for question three we asked the students to specifically list three functions of the stem. This was due to the fact that in our pre-assessment question about the function of the stem, we only asked “What function does the stem perform?”, which wasn’t explicit enough. Through these three questions, we could determine if our teaching had an effect on their ideas about models and the functions of the stem.

In analyzing the post-assessment results, we discovered that out of twenty-six students’ responses for question one: fourteen had correct answers, nine had misconceptions, and three were incorrect. We looked through each student’s answers, and
gave the score of “correct” as long as the student said either “a model is a cope [sic] of the real thing”, or “a model is something that repersents [sic] another thing.” If the student said “a model is real,” or “a model is not fake,” then we gave those answers a score of “incorrect.” If the student was vague in their answer, or had an incomplete definition such as “a model is something fake,” or “a model is like a plant that is not a living thing,” then we assessed those answers as a “misconception.”

Question number two, “Can you give an example of a model?” was also a question, which came directly from our first lesson. Twenty-two out of twenty-six students (approximately 85%) were able to give one or more “correct” examples of a model (e.g. – a Zhu-zhu Pet, a plastic plant, a toy car). There were only four “incorrect” answers, with the responses such as, “A tree is a model because it is not fake. It is real.”

In our third post-assessment question concerning the functions of the stem of a plant, we scored these responses by saying that if the student named all three functions (carries water and minerals to the leaves, holds the plant up straight, and takes food from the leaves to the rest of the plant) then it was “correct.” If the student named two of the functions, we gave that response “partial” credit, and if the student had no answer, then we gave it “incorrect.”
Post-assessment Results

<table>
<thead>
<tr>
<th>Questions on Models and Functions of a Stem</th>
<th>Correct</th>
<th>Partial</th>
<th>Incorrect</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is a model?</td>
<td>14</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Example of model</td>
<td>22</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Functions of stem</td>
<td>4</td>
<td>21</td>
<td>1</td>
</tr>
</tbody>
</table>

We also felt that we needed to go back to the students’ answers for question one on the pre-assessment, and review them. (See Appendix B Pre-assessment Questions.) We re-defined the criteria to fit the “definition of a model” question, weighing their answers carefully in the “why do you think this is a model” portions of question one. Because so many students had a wide range of answers for their reasoning, it was a difficult task. But, we arrived at the consensus of opinion that only three students in the class were approximately correct in their definition for model. Twelve students had
“misconceptions” about what a model was, and eleven students said “I don’t know” or said the object was “fake” when it was real or vice versa; these we considered “incorrect.”

However, we also had to return and re-examine the pre-assessment question one answers, and determine if the students thought the picture of a plant, or the plastic plant were models. (See Appendix B Pre-assessment Questions.) Again, we had to weigh their answers carefully, and come to an agreement of which students were “correct,” “incorrect” (due to lack of knowledge), or had a “misconception” as to what a model was.

Our third post-assessment question, concerning the functions of the stem of a plant, once again showed our group that a difference in wording means a great deal to these students. In our pre-assessment, we asked “What function does the stem of a plant perform?” Only a few students gave more than one function of the stem; we were actually hoping the students would give two or three functions. Only one student knew all three functions of the stem and wrote them all out. Our group agreed that twenty-five students could give one, but not all three answers; therefore we chose to score them as “incorrect.” Ms Saleh told us after lesson two that if we were looking for three answers to the question, then we should have said, “give three examples” and put three blanks under the question. The reason the students only put one answer was that we did not word the question correctly for them. We should have been more specific and said three functions, and left three blanks, as these third graders need explicit instructions. This following graph shows how we revised the pre-assessment data in order to compare it to the post-assessment data, in a more understandable way.
Revised Pre-assessment Results

<table>
<thead>
<tr>
<th>Questions on Models and Functions of a Stem</th>
<th>Correct</th>
<th>Misconception</th>
<th>Incorrect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Define model</td>
<td>3</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>Example of model</td>
<td>4</td>
<td>14</td>
<td>8</td>
</tr>
<tr>
<td>Functions of stem</td>
<td>1</td>
<td>0</td>
<td>25</td>
</tr>
</tbody>
</table>

Conclusion:

The purpose for this action research project was to answer our initial question, “What do third graders know about structure and function of plants, and models? How does our instruction impact their knowledge?” After completing our lessons and the post-assessment, we came to a conclusion that the students in Ms. Saleh’s third grade classroom have gained new understanding of concrete physical models by defining models in their own words, as well as identifying them. As for the function of the stem,
the majority of the students had an incomplete understanding of all three functions of the stem. Whether it was due to a lack of comprehending a vocabulary term (i.e. function), or the students needed more instruction time, we feel that the results could have been better.

The number of correct definitions for the term model rose from three students to fourteen students (or from 11% to 54%), which is a significant amount. Also, twenty-two out of twenty-six students (approximately 85%) were able to give one or more “correct” examples of a model. However, on the third question most students (n=21) got two out of three answers which was a “partial” response, an improvement over the pre-assessment in which twenty-five were incorrect.

Using the scientific “Big Idea” models as our first lesson, the students were able to learn how models help us interpret and make sense of ideas, objects, and events from the real world and into the classroom. Giving the students this initial lesson on models, we were able to use models to correct the students’ misconceptions on the functions of stem, visually and hands-on. The students were able to manipulate a plant model (the celery stalk using toothpicks) to construct an understanding of how important the job of a stem is in keeping the plant healthy and alive. The students constructed their knowledge of plants and the function of plant parts, which will expand the base of what English language learners know about plants, comparing it to C. R. Barman, Stein, N. S. Barman, and McNair (2003). These researchers assessed students’ ideas about what plants need to grow. Our students have learned the functions of the plants’ parts, such as the stem, which transports water and nutrients to the leaves to enable them to grow. In addition, our instructions allowed for the teacher, Saleh, to see how exposing her students to scientific models can help her students construct their own knowledge and reasoning behind their
understanding of any given scientific topic. Our action research project will also be beneficial to others seeking ways to address and correct their students’ misconceptions on plant structure and functions, with the help of the scientific “Big Idea” models in their classroom that is similar to Saleh’s.
Resources


Appendix A

Time Schedule

Our group members are Carol Allie, Jabra Elward, and Seham Mohamed.

**First visit**-9:40 a.m.-11:00 Thursday, February 3, 2011

Observed classroom

All three went.

**2nd Visit**- 9:40-11:00 Thursday, February 17, 2011

Observed/approval of pre assessment questions.

All three went.

**3rd Visit**- 8:40 – 9:10 Thursday, March 24, 2011

Give students the Pre-assessment

All three went, and afterwards analyzed raw data.

All three researched, and wrote the lesson #1

**4th Visit**- 9:40 – 11:00 Monday, April 4, 2011

Taught lesson #1

All three went.

**5th Visit**- 9:40 – 11:00 Thursday, April 7, 2011

Taught lesson #2

All three went.

**6th Visit** – 8:40 – 9:15 Tuesday, April 12, 2011

Gave students the Post-assessment

All three went.

**PRESENTED** our Action Research Project in class April 23, 2011.
Appendix B

Pre-Assessment Questions

Questions about Plant Structure and Functions

1. (At the front of the room the students will see three objects displayed, a picture of a plant on overhead, a plastic plant, and a real plant on a table.) “Is this a model? Write a short explanation of why you think it is or isn’t a model.”

First Object:

Second Object:

Third Object:

2. What three structures do most plants have?

3. Draw a picture of a plant and label the parts.
4. What function does the stem of a plant perform?

5. How do roots help plants to stay alive?
Appendix C

Lesson Plan One: Understanding Concrete Models

Grade level: 3rd grade

Science Concept:
To distinguish between a real object and the model which resembles it. Enable the students to address and correct their misconceptions about models by using Venn diagrams to compare/contrast between models and their targets.

Benchmarks:
Michigan Grade Level Content Expectation:

- S.RS.03.11 Demonstrate scientific concepts through various illustrations, performances, models, exhibits, and activities.

Project 2061 for Science Literacy:

- A model of something is similar to, but not exactly like, the thing being modeled. Some models are physically similar to what they are representing, but others are not. 11B/E3** (SFAA)

Lesson Objectives:
Students will....

- Compare and contrast between models and the real thing by using a Venn diagram.
- List three models in the classroom.
- Explain how the models they listed are different/similar to the real thing it represents.
- Define models in their own words.

Materials:
Hamster
Zhu-zhu pet hamster
Plastic plant
Real plant
Picture of Seham
Seham
Venn Diagram
Safety Concerns:
Don’t not touch hamster.

References:


Engage:

Tell students “The last time we met you were asked to answer some questions about plants and models. Based on those results, we came to the conclusion that most students didn’t really understand what models were”. We will then ask the students to put the thumbs up sign if they really know what models are, and thumbs down if they do not. For those who put thumbs up, we will ask them to share their ideas. We anticipate that students will not have a complete answer based on the pre-assessment we did. We will then tell the students that today’s lesson will help them understand what a model is.

Explorable question: How are the two objects in each group similar and different?

Explore:

Students will be placed in three groups. Each group will have an object and a model of the object on their desks. Using a Venn diagram, students will list similarities and differences between the two objects. One group will have the real hamster and a model of a hamster (a zhu-zhu pet). The second group will have Seham and a picture of Seham. The third group will have a real plant and a plastic plant. After five minutes of observing, discussing, and writing their findings, we will rotate the set of objects between each group. All students will have the opportunity to view and collect information about each set of objects.

Explain:

Students will then share their findings with the rest of the class, explaining what they have found. We anticipate that students will recognize the similarities between a model and its target. With this new knowledge, we can then reintroduce the term *models* and how models interpret, or make sense, of the target object (as in the hamster, the plant, and Seham). Next, students will be asked to come up with their own group’s definition of models. Students will then share their definitions with the rest of the class, as one group member writes them up on the board.
Extend:

Students are to find three models in their classroom and state how they are similar/different to the actual thing it represents.

Performance Assessment:

Each member of our group will rotate among the student groups, along with the models and target. Students will be assessed as they are discussing their ideas about the items placed in front of them. We will listen to their ideas on what makes a model similar/different to the real thing. Our group members will also assess their understanding with questions they might ask while the students are exploring and writing down their ideas on the Venn diagram. Also, members of our group can assess as students discuss their answers, and definition of models, with the rest of the class. We will also look at their Venn diagrams when they hand them in.

Use of Big Idea ‘Models’:

Three concrete models were used to explain models and compare them to the real thing. Students will be able to explain what model
Lesson Plan Two:

How water moves up a tree trunk, using a functional model.

Grade: 3rd

Science Concept:

One function of a plant is to carry minerals and water from the roots to the rest of the plant. Using two functional models of celery stalks (placed in colored water, one with holes, the other without) will help students visually see how water moves in a tree. The celery is a concrete functional model of a tree trunk. The toothpicks, used to make holes in one stalk, represent insects making holes in a tree trunk.

Standard/Benchmarks:
L.OL.03.31 Describe the function of the following plant parts: Flower, stem, root, and leaf.

Lesson Objectives:
Students will......
- Observe how water travels up the stem to the rest of the plant by placing a celery stalk in colored water.
- Draw a picture of the celery stalk and leaves, making a prediction of what will happen.
- Explain why the colored water moved up into the leaves in one celery stalk, and not as much in the other with holes.

Materials:
- Celery stalks
- Two pictures of a plant (one withered, one healthy)
- Food coloring (blue, red, purple)
- Water
- Cups
- Toothpicks
- Paper
- Markers
- Colored pencils
- Paper towels

Safety Concerns:
Wipe up any spills. Do not drink colored water. Be careful when poking holes in the celery. Do not eat celery.

References:

Engage:

Team members will remind students of the previous lesson taught on models. One team member will show two picture models of a plant (one that is green, the other withered). Students will be asked what are their ideas on what's happening to the plants in each picture. Some answers we are anticipating are: no water, no sunlight, and not enough nutrients. We will ask the students, “How can the withered plant look healthier, like the plant in the other picture?” Students will say give it water. We then will ask how does the water get in the plant? Students will probably say through the roots. We will also discuss with them that trees are plants as well, and lead them to the explorable question.

Explore Questions:

Where does the water go when a plant is watered?

Explore:

Students will be placed into 4 groups. We will give each group two stalks of celery, two cups with water, food coloring, toothpicks, and paper towels. We will suggest that the students examine their celery stalks carefully, and try to hypothesize about how the water travels. We will talk with the students about the possibility of insects, some of which attack trees, making holes in one of the tree trunks. Students will put food coloring in water and place one celery stalk inside. Another cup will also have water and food coloring. But before placing the celery stalk inside, the students will imagine the toothpick is an insect, and poke holes in the celery using a toothpick. Next, the students will be asked to draw their prediction of what will happen to each celery stalk, using colored pencils to show the movement of the water inside the celery stalks.

Explain:

While the students are drawing their pictures we will circulate around the classroom observing their predictions. Then we will let some of the students show their drawings on the overhead. The students will describe their predictions. Then a team member will bring out the celery stalks that have been in water over night. A team member then will explain that we cannot be here for five hours while the celery stalks are absorbing the colored water. Therefore, we had these prepared ahead of time. Students can now observe
and refer back to their predictions. Students will discuss their ideas on what happened to the colored water in each of celery stalks. Students will write a short explanation stating why the celery leaves received different amounts of colored water. Students should notice that the celery stalk with holes transported less water to the leaves; therefore, the leaves were withered. Students can share their answers with the rest of the class.

**Extend:**

Students will draw their model of how they would explain to a kindergartener or first grader what happened to the tree trunk (that is the celery stalk) that had holes made in it by an insect in a plant. We will also ask the students to think of any trees they might have seen in their yard, or in the neighborhood, that have withered or died. Ask the students to hypothesize what may have happened to it.

**Performance Assessment:**

Each group member will circulate between the four groups. We will conduct formative assessments as students are discussing and explaining their predictions. We will also listen to their explanations of why each celery stalk received different amounts of colored water. We will also observe the students’ drawings of the model celery stalk with holes in it. All students’ answers will then be collected and reviewed for further assessment on how well they understood the concept of transportation of water to the leaves.
Appendix D

Post-Assessment Questions

1. In your own words, what is a model?

2. Can you give an example of a model?

3. Name three functions of a stem.
   1)
   2)
   3)