Measuring the Human Body

An Annotated Lesson Plan for Mathematics and Science

March 20, 2007

Katrina M. Krull
I. Background Information
Background Information

JP Name: Katrina M. Krull

Time & Date of Delivery: Tuesday, March 20, 2007  2:55 - 3:40 PM

Time: 45 minutes

Grade/Level: 5

Subject(s): Mathematics & Science

Topic or Unit of Study: Measurement, The Human Body

Physical Space & Class Grouping: The students will be working at and around their tables in the classroom, arranged in small groups of two or three. The students will work together in their groups, helping each other measure the various body parts and then answering the questions together. Each group will have one ruler, one yardstick, and one measuring tape. Each student will have a worksheet to complete. Ashley (the other JP) and I will be circulating the room, making sure the groups are staying on task and answering any questions the students may have.

Purpose: This lesson is following four lessons relating to the human skeletal system. The idea is to transition to mathematics from science using a lesson that incorporates both and deals with a relevant science topic as well as reviewing an important concept that the students have gone recently covered in mathematics. The students will be able to choose which measuring tool they will use and then explain why they chose that particular tool. The students will also be finding relationships between the measurements of various body parts.

Resources: The resources used for this lesson include:
http://illuminations.nctm.org/LessonDetail.aspx?id=L659
http://illuminations.nctm.org/LessonDetail.aspx?ID=L635
http://www.teachervision.fen.com/human-body-parts/printable/25983.html

Materials:
• rulers (one per group)
• yardsticks (one per group)
• measuring tapes (one per group)
• string
• measuring worksheet
• measuring posters (ruler, yardstick, and measuring tape)
II. Theoretical Framework
Theoretical Framework

This lesson plan has three main objectives. These are: students will determine which tool should be used to measure each body part given; students will explain why the tool they picked was most efficient to use; and students will identify relationships among the measurements of various parts of the human body. Each of these objectives corresponds to Benjamin Bloom’s Taxonomy (1984).

The first objective, students will determine which tool should be used to measure each body part given, fits into the application level of Bloom’s Taxonomy (1984). In this level, the students use information in order to solve problems. In this instance, the students are using their knowledge of the measuring tools and the length of the body parts given to find the best way to measure.

The second objective of the lesson, students will explain why the tool they picked was most efficient to use, corresponds to Bloom’s analysis level (Bloom, 1984). At the analysis level, the students show understanding by explaining what they know about the individual parts. In this level, they recognize relationships between parts and find patterns. In this lesson, the students must explain why they picked the measuring tool that they did and why it was most efficient to measure the body part given. When the students do this, they are clearing analyzing the measurement tool and the body part.

The third and final objective, students will identify relationships among the measurements of the various parts of the human body, relates to the knowledge level of Bloom’s cognitive processes (1984). The knowledge level of Bloom’s Taxonomy deals with finding factual information. The students, in this objective, must find the connections among the body parts they are instructed to measure. Finding the relationships requires the students to look at the data they have collected and make a generalization about the facts.

This lesson also involves a lot of peer interaction. This is important because it directly relates to Erik Erikson’s Eight Stages of Development (1956). The stage at which the students in this classroom are at is identified as Industry vs. Inferiority. In this stage, the students should learn to: cooperate and work with peers, acknowledge rules when playing and learning, and mastering the core subjects in school. This
lesson on measurement of the human body fits directly into this stage because the students are working with their peers, paying attention to rules by completing a structured activity guided by the teachers in the classroom, and developing an important skill in mathematics, which is measuring.

Another educational theorist is Jerome Bruner, who came up with three principles, which include: 1. Instruction must be concerned with the experiences and contexts that make the student willing and able to learn (readiness); 2. Instruction must be structured so that it can be easily grasped by the student (spiral organization); and 3. Instruction should be designed to facilitate extrapolation and/or fill in the gaps (going beyond the information given) (Bruner, 1960). Bruner’s ideas were primarily focused on science and mathematics (Bruner, 1960). This lesson plan, dealing with mathematics and science, uses Bruner’s three principles. The students are at the level where they are ready to complete this activity and they are developmentally able to participate in the tasks that they are assigned to complete. The instruction is certainly structured so that the students can understand it. If they have additional questions, they are able to ask for additional scaffolding. Finally, the instruction does not provide too much information, so the students are able to complete what they need to independently or in their small groups, without too much aid from the teachers in the classroom. Overall, this lesson is in line with Bruner’s theory.

Jean Piaget was a very influential psychologist in the 20th century. He identified four stages of cognitive development. The students in fifth grade are at Piaget’s third stage, which is the concrete operational stage. At this stage, operational thinking is developed, egocentric thought diminishes, and the ability to conserve develops (Piaget, 1921). There are seven types of conservation at this level, including: number, length, liquid, mass, weight, area, and volume. The students in the classroom this lesson was designed for were ready for this lesson according to Piaget’s concrete operational stage.
III. Lesson Plan
Objective(s): Students will:
• determine which tool should be used to measure each body part given
• explain why the tool they picked was most efficient to use
• identify relationships among the measurements of various parts of the human body

STANDARDS:
NY- New York State Standards

• Learning Standard 3: Mathematics (2005 update)
  Students will:
  • understand the concepts of and become proficient with the skills of mathematics;
  • communicate and reason mathematically;
  • become problem solvers by using appropriate tools and strategies;
  through the integrated study of number sense and operations, algebra, geometry, measurement, and statistics and probability.

  • Grade/Subject : Grade 5
  • Area : Content Strands
  • Strand : Measurement Strand
  • Standard : Students will determine what can be measured and how, using appropriate methods and formulas.

  Performance Indicator : 5.M.1 Use a ruler to measure to the nearest inch, 1/2, 1/4, and 1/8 inch.
  Performance Indicator : 5.M.6 Determine the tool and technique to measure with an appropriate level of precision: lengths and angles.

• Learning Standard 6 : Interconnectedness: Common Themes
  Students will understand the relationships and common themes that connect mathematics, science, and technology and apply the themes to these and other areas of learning.

  • Level : Elementary
  • Key Idea : Systems Thinking 1:
    Through systems thinking, people can recognize the commonalities that exist among all systems and how parts of a system interrelate and combine to perform specific functions.
    Performance Indicator : Identify common things that can be considered to be systems (e.g., a plant population, a subway system, human beings).
PROCEDURE:

Anticipatory Set: "Since we've been talking about the human body, we thought we'd tie it into math today and do a little measuring activity. Today we are going to measure different parts of our bodies. You're going to be working in groups with the people at your tables to determine how you should measure each of the body parts on the list."

Input:
1. Create groups. “To start off, we’re going to divide everyone into groups.” (Divide the students into groups. Two or three students should be placed in each group.)

2. Introduce worksheets. “We’re going to pass out the worksheets for you to look over. You’re going to be receiving a participation grade for the worksheets. First, we’re going to explain what you’re going to do and then we'll pass out the rulers, yardsticks, and measuring tapes.” (Pass out worksheets.) Explain each part of the worksheet.
   • The first part of the worksheet has a table on it. In this table, there are several different body parts to measure. You will choose if you will use the ruler, the yardstick, or the measuring tape. After taking the measurement in inches, write it down in the appropriate column. We’re going to be measuring to the nearest quarter inch. Then write what tool you used and carefully explain why in the last column. You will do this for each of the body parts. At this point, model what the students are going to do. Two teachers will be required to do this or a teacher and a student. Take the measurement of total arm length because it is not one of the body parts to measure on the worksheet. Also, let students know that they may use string in their measurements. For instance, to measure their smiles.
   • The body parts to measure on the worksheet are:
      - Length of your arms spread
      - Length of your thumb
      - Length of your foot
      - Length of your forearm
      - Length around your waist
      - Length around your wrist
      - Length around your neck
      - Your height
      - Your smile
   • The back of the worksheet has five questions. These questions relate to the measurements you took and the connections between the various body parts that you measured. They will also ask you about the tools you used. You’re going to answer the questions in complete sentences.
   • The questions are:
      1. What measuring tool did you use the most often? Explain why.
      2. Why do you think it is important to have a choice of tools to use to measure? Explain.
      3. There is an old saying: “Once around the waist, twice around the neck. Once around the neck, twice around the waist.” Is this saying true for you? Explain.
      4. Have you ever heard that the length of your outstretched arms and your
height are the same? Is this true for you? Explain.
5. Do you see any other relationships between any of the other body measurements you took? For example, are there measurements of body parts that are the same or nearly the same? Explain.

3. **Pass out the measuring tools.** “Each group is going to receive a ruler, a yardstick, and a measuring tape. If anybody starts using these tools as weapons, they will be taken away and you won’t receive credit for the activity today. As soon as you get your materials, you can begin. Are there any questions before we start?”

**Modeling:** We will show the students how to measure their height with a ruler, the yardstick, and the measuring tape. By demonstrating each of these to the students prior to them doing the activity, it will show them which tool will be most useful and easy when measuring. Be sure to discuss what tool would be most useful for measuring shorter body parts (the index finger – the ruler), longer things (the leg – the yardstick), and things that need to be measured around (the waist – the measuring tape).

**Check for Understanding:** Make sure students have a good grasp of what each measurement should be used for. Ask the students what would be a good body part to measure with the ruler. Then ask the same question for the yardstick and the measuring tape. Use the posters for the students to use as a reference.

**Guided Practice:** The students will be measuring themselves and each other while the teachers circulate the classroom, helping the students with questions they may have and taking anecdotal notes.

**Closure:** Ask students questions to review the lesson. “Can somebody raise their hand and tell me one thing that you learned about your body today? Can somebody raise their hand and tell me one thing you learned about measuring?” (Students should say that they learned a few trends in the body. Students should also mention what they’ve learned about measuring and the tools they can use to measure.) “Are there any questions about what we did today?” (Answer any questions the students may have.)

**ASSESSMENT:**

**Assessment Plan:** Students will be expected to complete the measuring activity worksheet while in their groups. This will be collected and graded.

**Assessment/Rubrics:**
- Students’ participations throughout the measuring activity will be noted anecdotally.
- Students will be expected to complete the worksheet in their groups. The students will receive a participation grade for this worksheet.
IV. Evidence of Student Learning
Evidence of Student Learning

Judging from how the students performed on the worksheet, I would say that they did very well with the measuring aspect of the activity, but failed to understand the meaning of the questions they needed to answer.

Before the lesson, the students have had experience with measuring, but the cooperating teacher was glad to have a review on measuring since some of the students do need extra reinforcement. The students had never made connections among the body parts, so this was a good skill for them to gain, especially since the unit they are covering in science is the human body.

Student A* worked alone on his worksheet. He managed to do nearly all of the measurements, but his explanations for why he used the tool he did were lacking. Also, the validity of his measurements do not seem correct. I believe this is a result of doing the project alone. Additionally, he did not label his measurements with the correct unit. This is something that the students need to realize is important, especially when taking state math tests or when using measurements in their everyday lives. If the unit is not there, it is useless. He had the right idea and when I asked him during the activity what he meant by his written answers, he explained better why he chose the measuring instruments that he did than he did on paper. As far as the questions on the back of the worksheet, he answered them all, but I do not believe he knew exactly what the questions were asking. This particular student has a tendency to want to do his work independently and I feel that had he not, he would have done better on this activity.

Student B, in my opinion, did one of the best jobs in the entire class of justifying which measuring tool she used and why. Her answers described the measuring tools well and fit with whichever body part she happened to be measuring at the time. Her measurements seem to be fairly accurate. She also did a good job of labeling her measurements with the correct unit. She worked well with two other girls in the class and I observed as they helped each other take the measurements and then compared them to each other. I believe that doing that in itself was helpful because they could compare their measurements with each other, offering a check to make sure they were accurate. I think that if this student was given more time, she would have been able to answer the questions on the second side of the worksheet in completion. Looking back at the activity, I would have assigned the remainder of the worksheet that the students did not complete for homework.
Student C spent a lot of time on taking the measurements, then hurried through his explanations and answering the questions on the back of the worksheet. This student is typically a good mathematics and science student and frequently participates during class and helps his classmates when completing assignments. This student worked with two other students in the class. His measurements seem to be accurate. He also remembered to label the measurements that he took, another good skill to have when measuring. Student C’s answers for the reasons why he used the measuring tool he used were very vague and did not illustrate descriptively enough why he used the tools he did. Again, if I teach this lesson again in the future, I will be sure to explain the directions in more detail to ensure that I will receive better answers from the students. Student C’s second side of the worksheet was complete, but obviously done quickly and without a lot of thought. The student failed to explain in detail why the measurements were the way they were and failed to realize the connections between different measurements of the body. However, this student’s use of the word “phalanges” demonstrates to me that he retained a fact from the skeletal system lessons that Ashley and I taught in the past couple of weeks. It shows that he connected this lesson to the entire unit, which is excellent.

I believe that the problems that the students ran into with the worksheet were a result of a lack of explanation on mine and Ashley’s part and a lack of time to complete the entire activity. When we were giving the students directions, they were more excited about being able to use rulers, yardsticks, and measuring tapes than bothering to ask questions about the assignment we had given them. In the future, I will remember to keep manipulatives hidden until all of the directions are explained. I will also assign the worksheet for homework if it is incomplete. This way, I can allow the students to focus on taking measurements, providing them with more time to complete the worksheet. Looking at the students’ work in-depth helps me to realize what I need to work on with my teaching as well as gives me insight into what the students may need extra explanations on in the future.

*Refer to the next six pages for examples of student work.
Measuring the Human Body

Directions: Measure the following body parts using a ruler, a yardstick, or a measuring tape. In the table, write down the measurement in inches. Then, name the tool you used to measure that body part and explain why you used that tool. When you’re finished, answer the questions on the back.

<table>
<thead>
<tr>
<th>Body Part</th>
<th>Measurement (inches)</th>
<th>Tool used</th>
<th>Explain why you used that tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of your arms spread</td>
<td>60</td>
<td>Ruler</td>
<td>It could reach far</td>
</tr>
<tr>
<td>Length of your thumb</td>
<td>2</td>
<td>Ruler</td>
<td>It measures, lit. things</td>
</tr>
<tr>
<td>Length of your foot</td>
<td>10</td>
<td>Yardstick</td>
<td>It could reach</td>
</tr>
<tr>
<td>Length of your forearm</td>
<td>11</td>
<td>Measuring stick</td>
<td>It has long</td>
</tr>
<tr>
<td>Length around your waist</td>
<td>11</td>
<td>Measuring tape</td>
<td>It could reach</td>
</tr>
<tr>
<td>Length around your wrist</td>
<td>7.81</td>
<td>Measuring tape</td>
<td>It could reach</td>
</tr>
<tr>
<td>Length around your neck</td>
<td>12</td>
<td>Measuring tape</td>
<td>It could reach</td>
</tr>
<tr>
<td>Your smile</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Your height</td>
<td>34</td>
<td>Yardstick</td>
<td>It was long</td>
</tr>
</tbody>
</table>
1. What measuring tool did you use most frequently? Explain why.

2. Why do you think it is important to have a choice of what tools to use to measure? Explain.

3. There is an old saying: “Once around the waist, twice around the neck; Once around the neck, twice around the wrist.” Is this saying true for you? Explain.

4. Have you ever heard that the length of your outstretched arms and your height are the same? Is this true for you? Explain.

5. Do you see any other relationships between any of the other body measurements you took? For example, are there measurements of body parts that are the same or nearly the same? Explain.
Measuring the Human Body

Directions: Measure the following body parts using a ruler, a yardstick, or a measuring tape. In the table, write down the measurement in inches. Then, name the tool you used to measure that body part and explain why you used that tool. When you’re finished, answer the questions on the back.

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<th>Measurement (inches)</th>
<th>Tool used</th>
<th>Explain why you used that tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of your arms spread</td>
<td>60 in.</td>
<td>measuring tape</td>
<td>Because the yardstick was not long enough</td>
</tr>
<tr>
<td>Length of your thumb</td>
<td>3 in.</td>
<td>ruler</td>
<td>It is the Smallest</td>
</tr>
<tr>
<td>Length of your foot</td>
<td>9 in.</td>
<td>ruler</td>
<td>It is the Smallest</td>
</tr>
<tr>
<td>Length of your forearm</td>
<td>9 in.</td>
<td>yard stick</td>
<td></td>
</tr>
<tr>
<td>Length around your waist</td>
<td>25 in.</td>
<td>measuring tape</td>
<td>Because it is flexible</td>
</tr>
<tr>
<td>Length around your wrist</td>
<td>5 in.</td>
<td>measuring tape</td>
<td>Because it is flexible</td>
</tr>
<tr>
<td>Length around your neck</td>
<td>12 in.</td>
<td>measuring tape</td>
<td>Because it is flexible</td>
</tr>
<tr>
<td>Your smile</td>
<td>2 in.</td>
<td>measuring tape</td>
<td>Because it is small</td>
</tr>
<tr>
<td>Your height</td>
<td>5 ft 7 in.</td>
<td>measuring tape</td>
<td>A yardstick is too small</td>
</tr>
</tbody>
</table>
1. What measuring tool did you use most frequently? Explain why.

Measuring tape

2. Why do you think it is important to have a choice of what tools to use to measure? Explain.

Because sometimes you need different things to measure with.

3. There is an old saying: “Once around the waist, twice around the neck; Once around the neck, twice around the wrist.” Is this saying true for you? Explain.

4. Have you ever heard that the length of your outstretched arms and your height are the same? Is this true for you? Explain.

5. Do you see any other relationships between any of the other body measurements you took? For example, are there measurements of body parts that are the same or nearly the same? Explain.
### Measuring the Human Body

**Name:** Jesus

**Directions:** Measure the following body parts using a ruler, a yardstick, or a measuring tape. In the table, write down the measurement in inches. Then, name the tool you used to measure that body part and explain why you used that tool. When you're finished, answer the questions on the back.

<table>
<thead>
<tr>
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<th>Measurement (inches)</th>
<th>Tool used</th>
<th>Explain why you used that tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of your arms spread</td>
<td>53 in</td>
<td>Measuring tape</td>
<td>it was long enough</td>
</tr>
<tr>
<td>Length of your thumb</td>
<td>2 in</td>
<td>ruler</td>
<td>it was short</td>
</tr>
<tr>
<td>Length of your foot</td>
<td>27 in</td>
<td>yardi</td>
<td>it was long</td>
</tr>
<tr>
<td>Length of your forearm</td>
<td>10 in</td>
<td>ruler</td>
<td>it was fine</td>
</tr>
<tr>
<td>Length around your waist</td>
<td>23 in</td>
<td>Measuring tape</td>
<td>it needed to go around</td>
</tr>
<tr>
<td>Length around your wrist</td>
<td>5 ½ in</td>
<td>Measuring tape</td>
<td>something else</td>
</tr>
<tr>
<td>Length around your neck</td>
<td>12 ½ in</td>
<td>Measuring tape</td>
<td>something else</td>
</tr>
<tr>
<td>Your smile</td>
<td>2 ½ in</td>
<td>Measuring tape</td>
<td>it could go around your smile</td>
</tr>
<tr>
<td>Your height</td>
<td>63 ½ in</td>
<td>Measuring tape</td>
<td>something else</td>
</tr>
</tbody>
</table>
1. What measuring tool did you use most frequently? Explain why.

Measure tape because their more stuff

2. Why do you think it is important to have a choice of what tools to use to measure? Explain.

Because some measurements are more round

3. There is an old saying: “Once around the waist, twice around the neck; Once around the neck, twice around the wrist.” Is this saying true for you? Explain.

No because it’s not true

4. Have you ever heard that the length of your outstretched arms and your height are the same? Is this true for you? Explain. No it’s not true

5. Do you see any other relationships between any of the other body measurements you took? For example, are there measurements of body parts that are the same or nearly the same? Explain. Yes the phalanges
V. Reflections
Reflections

Overall, I feel that the lesson went well when Ashley and I co-taught it. The introduction motivated the students, especially when they saw Ashley and I bringing rulers, yardsticks, and measuring tapes up to the front of the class. The students in this class tend to enjoy moving around versus sitting still. The students understood what they needed to do as far as taking the measurements, even though not all of them understood what was being asked of them in the question part of the worksheet. Some students ran out of time, but I wouldn’t attribute the lack of time to goofing around or doing anything off task. I feel that the activity just took longer than we initially anticipated.

The students worked well in their groups and did a great job of staying on task throughout the whole time given to complete the activity. If the students had questions about the activity, they waited with their hands up until either Ashley or I were able to tend to their needs. They also helped each other if Ashley and I were busy helping other groups. This class is excellent with group activities because they work very well together and they are used to working together.

There were not any problems with the measuring tools, such as using them as swords, which I was afraid of. The students in this classroom can get out of hand if they are not given clear instructions and know what consequences they will meet if they do not listen to the teacher.

After reviewing the students’ worksheets after teaching the lesson, I found that many of the students didn’t understand the point of the last column of the table. In the future, I would explain it better, making sure that the students understood that they are supposed to explain more
in-depth about why they chose the measuring tool that they did.

Frankly, there was not enough time to complete the back side of the worksheet. I felt that the students that did complete it, completed it quickly and without much regard for what was really being asked of them in each question. If I were to teach this lesson again in the future, I would either allow the students more time to complete the work or assign the back of the worksheet as a homework assignment.

The feedback from the cooperating teacher was very positive. She thought that the lesson was outstanding and that the presentation was very good. However, she did also offer a suggestion. When we introduced the posters to the students with each of the measuring tools on them, the cooperating teacher suggested that we provide the students with an example before we recommend what measuring tool would be best to use with each body part. For example, the arm. Instead of saying right away that the ruler would probably be the most useful in measuring the students’ arms, we should have asked the students which tool would have been most helpful in measuring their arms. That would encourage the students to participate more and teach them the important math concept relating to measuring. It would also provide the students with a better idea of what the right hand column of the worksheet, side one, was asking for.

I will continue to evaluate myself throughout my future lessons with my own criticisms of myself, the students’ work as a reference, and the suggestions of my cooperating teachers and my supervising instructors.