Title: Muscular and Skeletal Systems

Introduction: In this lesson, students will create a moving model of the hand that shows how muscles move bones. Through a series of explorations, students will learn the key functions of bones, muscles, and joints in the body. In addition, students will use technology to further their understanding by examining a digital "patient", and attempting to diagnose and treat based on research done on each vital body part.

Learning Outcomes:

The student will analyze how muscles move bone by experimenting with a constructed model of a hand.

The student will use their hand models to demonstrate their understanding of the function of bones, muscles, and joints.

Curriculum Alignment

Fifth Grade Science Essential Standards

5.L.1 Understand how structures and systems of organisms (to include the human body) perform functions necessary for life.

5.L.1.2 Compare the major systems of the human body (digestive, respiratory, circulatory, muscular, skeletal, and cardiovascular) in terms of their functions necessary for life.

Fifth Grade Reading Common Core

Informational Text (Craft and Structure)

Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 5 topic or subject area.

Fifth Grade Informational and Technology Essential Standards

5.IN.1 Analyze appropriate strategies when reading for enjoyment and for information.

5.TT.1 Use technology tools and skills to reinforce and extend classroom concepts and activities.

National Science Standards

Standard A : Science as Inquiry : Students develop abilities necessary to do scientific inquiry. Students develop understandings about scientific inquiry.

Classroom Time Required

This lesson will take two 45 minute sessions.

Teacher Preparation

Day One: The teacher will need to gather all materials listed for day one and have copies of the recording chart for Model Hand activity. (***Model Hand Activity***-attached) The teacher will also need to pull up the ***Interactive Muscular/Skeletal Slides*** on the Smart Board.

Day Two: The teacher will need to have access to a laptop for pairs of students, or schedule time in a computer lab for students to access the Smart Notebook files. In addition, the students will need copies of the questions that accompany the web quest. (***Muscular/Skeletal System Internet Research Questions***- attached) Students and teacher will need internet access to model and complete the internet research necessary. The teacher will need to place the Smart file on the laptops, or on a school server so that students can have access.

Before using the entire unit, the teacher should make sure the links for Day 2 of each lesson are still active and working. The links are located in the Smart lesson and are indicated on each slide. Please check by clicking on the noted area and see if you are redirected to the correct website. If by some chance, a link does not work- changes would need to be made to match the questions on the worksheet.

Materials Needed

Day One:

Each student will need:

- half of a manila folder (large enough to trace their hand with their fingers spread out.)
- five pieces of string (long enough to go from the tip of the longest finger to the wrist of the hand.)
- five pieces of masking tape (about 2 inches long each)
- ***Model Hand Activity*** worksheet
- Slide 7 of ***Interactive Muscular/Skeletal Slides (tree map)***

Each group of two students will need a copy of slide one with images of living things with different types of skeletons. Students will also need a pair of scissors to cut out the images for sorting.

Day Two: Students will need the technology resources mentioned in the next section as well as their worksheet (***Muscular/Skeletal System Internet Research Questions***) with web quest questions.

Technology Resources

Day One: The teacher will need a Smart board to display images and interactive slides.

Day Two: The students will need to either be able to use a laptop individually, with a partner, or have access to a computer lab. Students need to have Smart Notebook 10 software on the computers they are accessing, because the lesson is a Smart interactive lesson. In addition, students will need headsets if they will be allowed to listen to the text on the websites.

****This lesson is one of five human body lessons, and the "prior knowledge" activity could be used before any of the systems were taught. There is not a particular order for the systems to be taught, so**

the Circle Map would be done at the beginning of the Human Body Unit of study, before the FIRST system. It is not necessary to repeat this before each system, but students could be encouraged to add to their maps as part of the closing each day, then additions could be discussed prior to the start of each new system.

Pre-Activities

Prior Knowledge: Students should be introduced to the concept of the human body as many different parts that work together. Creating a Circle Map (slide one of the ***Muscular/Skeletal Interactive Slides***) to assess what students already know about the human body would be a great pre-lesson activity. This allows the teacher to be aware of what concepts, vocabulary, and possible misconceptions students may have before starting the unit.

Students do not need any specific content knowledge about the muscular or skeletal system prior to starting this lesson. For the lesson, they will be working with materials with a partner, so having clear expectations for management is important. For example, distributing the materials in closed bags, having students keep materials in the bag until given directions, asking students to use materials in a respectful manner, and having verbal and non-verbal cues for directions during the activity will help the lesson flow well.

Day One: (Prior to teaching any specific content) In order to help students become curious about the material, the teacher will display slide one of ***Muscular Skeletal Interactive Slides*** and give out the worksheet (also slide one) to partners of students. The worksheet matches the slide. Students will cut out and sort the images into groups. When pictures have been sorted, allow students time to walk around and see how others grouped their images and ask each other why and how they made their decisions.

Day Two: Orally review key functions of the body parts using slides and images from day one (***Muscular Skeletal Interactive Slides***-attached) and distribute handouts ***(Muscular Skeletal System Internet Research Questions-attached***) for the web quest. Tell students that we have a patient today that is suffering from muscular and skeletal issues and that it is up to us to learn more about each part of the body and its function within the system. As his "doctor" they will need to correctly diagnose and treat him o he can continue to live a healthy life.

Activities

Day One: After pictures from the pre-activity have been sorted and discussed, distribute the materials and recording chart for the **Model Hand Activity**. This model hand activity was adapted from: http://www.sciencekids.co.nz/projects/modelhand.html

Once students have materials, display the directions for building the hand, and walk students through the construction.

Take the piece of folder and trace the outline of your hand with a pen or pencil.

Cut out the shape of your hand with scissors.

Cut the string into 5 pieces that are about the length of your hand.

Tie or tape securely a piece of string to the tip of each finger and thumb and stretch it to the base of the palm. Tape the string to the card at the same points where you have joints in your fingers and thumb. Label the tip of each finger "A", the first joint "B", the second joint (where the finger meet the hand) "C", and the base of the palm, "D". Tape all strings across the base of the palm.

Discuss with students: "Try gently pulling the strings from the base of the palm, what happens?" Have them jot notes in the "I Wonder/I Notice" section.

Allow students to explore and record what happens when they work through the chart, isolating movement to a specific area of the hand. Have them continue to jot notes in the "I Wonder/I Notice" section as they develop questions about what happens on the hand.

When students have completed the chart, allow them to share the results and compare findings. Guide discussion by asking, "What happens when you pull between C and D on any finger?" (more than one finger moves forward) "What happens when you pull between A and B on any finger?" (only the tip of the finger moves forward) "What would happen if the strings were not attached to the fingers?" (the string would come off when pulled, it would not move the fingers)

Explain Learning Objectives with students (slide 4 of ***Interactive Muscular/Skeletal Slides***). Move to slide 5 and have students come up to board to pull tabs on the side of the screen and predict which system (skeletal or muscular) is being described. Tell student to place the description at the bottom of the side they think is correct. Prompt students to tell why they are making their decisions and remind them to refer back to the model during this activity. Answers are on the following slide. Using the slide and the hand model, have students label their paper hands as "bones" and the string on the hands as "muscles." Ask students if they are aware of what the tape might represent and explain that there is a special name for where two bones meet and that is a joint. Show slide 7 which is an image of a knee joint.

Close by having students summarize what they learned today on the tree map (Slide 8 of ***Interactive Muscular/Skeletal Slides)*** or move this to homework if necessary. This graphic organizer sorts information into categories.

Guided Practice

Day Two:

1. Display the Learning Outcomes again, using yesterday's model system as a reference for discussion. Show students the "Is There a Doctor in the House?" Smart lesson. Tell students they are going to be "visiting" Patient 1 today and diagnosing his problem involving the skeletal system.

*At this point, have students move to computers in a lab or laptops and view the Smart lesson. Guide students to click on Patient 1 and read the patients chart. Following the directions under the chart, students will click on each of the body parts, using the text to answer the questions on the worksheet. They will continue through the worksheet clicking on the links, reading, and answering questions.

*Students will need guidance doing this if they have never done it before. It is beneficial to instruct them to read the worksheet questions before going to each link. Also, explain to them that they should read the screen looking for key words from the questions in order to locate the answers properly.

As students finish, the teacher should start a discussion about what the patient's problem might have been and what the proper diagnosis and treatment would be. For example, "What were some of Michael's problems?" (he hit the ground hard and suddenly) "How could you tell this was a problem with his skeletal system?" (bones can break in these conditions) The purpose of this discussion and activity is not to have students accurately diagnose the patient necessarily, but to hypothesize and have a purpose to learn more about each organ in the cardiovascular system. **Remember that this activity is to give them a real life application of their learning, and to give a reason to learn more about each part of the system you are focusing on today- NOT to make a perfect diagnosis. (Accept any diagnosis related to the heart, as long as students support their thinking. Ex: cast to set arm, x-ray to get picture, brace to keep it still)

Assessment

As an informal, formative assessment, students could add to their circle map from before the lesson began to show knowledge gained from the lesson. I suggest students add learned information in a different color from the prior knowledge so they can see what they are adding to the circle map.

Formative assessments can be the students writing and recording on the chart and I Notice/I Wonder section, tree map, from their model system activity as well as their answers to the questions from the web quest.

Modifications: This lesson provides a large variety of activities appropriate for meeting the needs of multiple learning styles.

Students with physical disabilities may need assistance with hand tracing and cutting. They would benefit from a partnership during this time.

Students with disabilities with written language may need terms from the lesson (the tabs from the interactive slide) to cut and paste into the Tree Map rather than writing all of the information out.

Day Two:

Some of the websites will read the text on each page aloud to students. If students need or want this modification, please provide headphones on the computer they will be working on. Students with reading disabilities will benefit from this modification because it will allow them to read the content

without misunderstanding key terms from the articles. *Students that are auditory learners would benefit from this as well.

Alternative Assessments- students could develop a model of a different body part that could show how muscles move bones. The three main concepts (bones, muscles, and joints) could be required to be labeled.

Critical Vocabulary

Bone: the hard connective tissue forming the substance of the skeleton of most vertebrates

Muscle: a tissue composed of cells or fibers, the contraction of which produces movement in the body.

Joint: the location at which two or more bones make contact

Contraction: the change in a muscle by which it becomes thickened and shortened**.**

Websites

http://www.sciencekids.co.nz/projects/modelhand.html

http://yucky.discovery.com/flash/body/pg000124.html

http://kidshealth.org/kid/ill_injure/aches/broken_bones.html?tracking=K_RelatedArticle#

http://kidshealth.org/parent/general/body_basics/bones_muscles_joints.html#

http://kidshealth.org/kid/cancer_center/HTBW/muscles.html

http://sv.berkeley.edu/showcase/pages/bones.html

http://kidshealth.org/kid/htbw/_bfs_MSquizsource.html

http://kidshealth.org/PageManager.jsp?lic=1&article_set=29673&ps=110

Comments: There is an additional game slide in the ***Interactive Muscular/Skeletal Slides*** with bodies to match with their skeletons.

As students diagnose and treat the patient, it is not about that being a perfect process. The real purpose of the activity is to expose students to more informational text about each organ and provide them with an "authentic" reason to research.

Author Info:

Tracy Pendry is a fifth grade teacher at Shoals Elementary School in Pinnacle, NC. She is a National Board Certified Teacher and has a master's degree in Educational Technology. Tracy loves teaching science as well as all other subjects daily. It gives her great pleasure to see students get excited and motivated to learn through the investigation process. She developed this lesson to spark students'

interest in the body system as well as to help students' have a deeper understanding and visualization of what the muscular and skeletal system does in the body. Finally, Tracy wanted students to see a personal connection to their own life as they try to diagnose and treat their patient.