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EDUCATOR GUIDE

ALL ABOUT ME

EXHIBIT GALLERY
STANDARDS
PRE-VISIT ACTIVITY
BOOKING TRIP

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INTRODUCTION

This Guide introduces concepts and activities for teachers to use with their students centered around the All About Me gallery at the Arizona Science Center, Phoenix, Arizona. This guide is divided into standards aligned activities based on grade level. There are three types of activities in this guide. The first type introduces students to concepts found in All About Me and provides them with background experiences that will enhance their field trip and understanding. The second type of activities are those that students can perform during a field trip. These may include handouts, interactive notebooks or information challenges for the gallery. The final type of activity allows for review and reflection of the experiences following the field trip. This curriculum guide encourages the use of the 5 E's of inquiry by encouraging students, teachers, and chaperones to Engage, Explore, Explain, Elaborate, Evaluate as they explore All About Me.

ALL ABOUT ME EXHIBIT GALLERY

Achieve Balance: Balance activities vs. the foods that you consume using a scale.

Concepts: Nutrition and Digestive Systemt

Artificial Joints: A display that features real artificial joints used in joint replacement surgeries.

Concept: Skeletal System

Body Puzzle: A human anatomical model where visitors can try to figure out where different organs fit.

Concept: Body systems

Bones on a Bike: Mr. Bones is not very good at riding his unicycle. He has artificial joints down the left side of his body and as he pedals, it is clear how some artificial joints move.

Concept: Skeletal System

Choices: Family history and personal habits have an impact on health. This computer program contains several parts that deal with these subjects and how they may affect your health.

Concepts: Genetics, Family History and Personal Habits

Crack the Code: An exhibit about decoding DNA. Visitors first decode DNA to make RNA and then use RNA to make amino acids. The sequence of amino acids gives the code to open the safe.

Concepts: Genetics

Energy Use: A graphic detailing explaining the importance of foods for energy.

Concept: Nutrition and Digestive System

Eye of Inheritance: Visitors learn how to combine eye color genes from a mother and father to their child. This display only uses two eye colors: brown and blue.

Concepts: Genetics

Fever: A display showing the difference between a healthy individual and an individual with a fever.

Concept: Immune Response

Food Is Fuel: This exhibit demonstrates how much work it takes to burn off varying amounts of calories from different foods using a bicycle peddler. The time it takes to burn off the calories is measured by hour of exercise.

Concept: Nutrition and Digestive System

Food Quiz: How well do you know your foods? This is a quiz about what nutrients are found in certain foods.

Concepts: Nutrition and Digestive System

Gas Em Up: A similar exhibit to Vital Network, this display includes the lungs and traces the path of oxygenated and deoxygenated blood through the lungs and the body.

Concept: Respiratory and Circulatory Systems

Heart Beat Drum: Visitors hear their pulse played by a drum.

Concept: Circulatory System

Heart Surgery Theater: Watch as Arizona Heart Center's Dr. Dietrich performs an open-heart bypass surgery. This exhibit also includes a display of the tools heart surgeons use.

Concept: Circulatory System

Immune Response: This display demonstrates how antibodies produced by the body's immune system are unique to invaders that cause disease.

Concept: Immune Response

Just Joints: This display demonstrates the different types of joints in the body.

Concept: Skeletal System

Load Bearing Bones: A display illustrating how bones absorb stress from load-bearing exercises.

Concept: Skeletal System

Lungs-Take a Deep Breath: A display that demonstrates how the lungs and diaphragm work together when a person inhales and exhales.

Concept: Respiratory System

Micro Defense: A video display and matching game that shows the different symptoms produced by different bacteria.

Concept: Diseases

Molecules: A graphic that details the different amino acids and macromolecules in the body.

Concept: Biochemistry

Monster Stomach: Visitors learn about the digestion that occurs in the stomach.

Concept: Digestive System

Nature or Nurture: Compares physical traits and habits from a visitor's parents to estimate how a child will turn out.

Concepts: Genetics and Nutrition

Nose: Visitors throw pollen and other irritants into a giant nose which then sneezes. It illustrates the importance of nose hairs.

Concept: Immune Response

Origins-Happy Birthday: This exhibit includes a display case with models of the different stages of neonatal development. There is also a video detailing the birthing process or labor.

Concept: Neonatal Development

Parts of Blood: Demonstrates how a centrifuge works to separate out the components that make up blood.

Concept: Circulatory System

Pattern Talk: A game of communication. One visitor makes a pattern using shapes and tries to dictate the design to another person without the other person looking upon the original design.

Concept: Psychology and Communication

Play Lab: An area designed for the youngest visitors, the lab contains toys that deal with the human body.

Concept: Body Systems

Search for Balance: A video detailing the case of the Pima Native American people who have suffered from diabetes due to changes in modern diets.

Concept: Nutrition and Digestive System

Seeing with Sound: A display of various ultrasounds.

Concept: Neonatal Development and Medical Equipment

Skin: A display of how melanin produces different skin pigments.

Concept: Integumentary System

Sneeze: Similar to the nose, this display sneezes on visitors when the doors are open. The graphics discuss how diseases are spread by this method.

Concept: Disease Transmission

Square Feet of Skin: Measure your height to determine the number of square feet of skin on your body.

Concept: Integumentary System

Stretch: A test of flexibility via horizontal toe-touching.

Concept: Muscular System

Sweat-Get Wet, Get Cool: This display allows visitors to find the surface temperature of their skin and compare that to after they have "sweated" via a squirt of water.

Concept: Integumentary System and Homeostasis

TAM: An interactive display by the Transparent Anatomical Model system. Visitors can choose different body parts to explore and TAM presents more information on them in short talks.

Concepts: Body systems

The Dark Side of the Sun: A video display about the dangers of spending too much time in the sun.

Concept: Integumentary System and Diseases

The Food Tube: A full display that illustrates the entire length of the GI tract.

Concept: Digestive System

Toddler Heart: A giant heart designed for toddlers. The balls represent blood cells; some are oxygenated, others are not (all of them are a pain when we have school groups visit).

Concept: Circulatory System

Views into You: An interactive scanner that visitors can use to learn more about the various body systems.

Concepts: Body systems: Skeletal, Muscular, Digestive, Neurological

Vital Network: This light-up display illustrates the network of blood vessels in the human body at the touch of a button.

Concept: Circulatory System

What is in Your Body: A breakdown of the percentages of different elements that make up the human body.

Concept: Biochemistry

What Others Say: A public service video created by school children about the dangers of smoking.

Concept: Respiratory System

Wheelchair Racer: A race between two wheelchairs. The point of the activity is to note the difference in heart rate before and after the race.

Concept: Circulatory System and Muscular System

You are Unique: A quiz that compares your physical traits to others that have taken the quiz at the museum.

Concept: Genetics

You're Not Alone: This is a graphical display of the different microbes that live inside the human body.

Concept: Microflora

Your Father's Nose: There are two mirrored displays that allow visitors to compare their facial features to that of another guest.

Concepts: Genetics

Your Insides Voice: A stethoscope hooked up to a speaker. This is a tool that can amplify the sounds that the human body makes such as the popping of joints to a heart beating.

Concept: Body systems

Zit: A cutaway display of a growing zit.

Concept: Immune Response and Integumentary System

Zoom: A spin browser animation detailing the relative sizes of small objects starting with a coffee bean and ending with a carbon atom.

Concept: Size and Scale

ESSENTIAL QUESTIONS

These questions provide the framework for guiding learning through the All About Me Gallery. *(4 Questions)*

How are the connections between your long bones similar to doors?

When you are active, why is it important that your heart beats faster?

What causes your body to sneeze?

Compare and contrast the differences in yourself when you feel well as opposed to when you feel ill.

EDUCATOR RESOURCES

Types of Bones

Make a working model of a hopping frog leg

Interactive human anatomy - Human Anatomy - Great for "Smart Boards"

PBS - Hunting the Elements - Interactive Periodic Table and other great resources. Hunting the Elements

Human Anatomy App - Most operating systems - Essential Anatomy

Augmented Reality Anatomy App - iOS Anatomy 4D, Android Anatomy 4D

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STANDARDS BY GRADE LEVEL *(Third and Fourth and Seventh Grades Not Available)*

FIFTH GRADE

STRAND 4	CONCEPT 1	PO 1	Identify the functions and parts of the skeletal system: protection (rib cage, cranium), support (vertebrae) movement (pelvis, femur, hip)
STRAND 4	CONCEPT 1	PO 1	Identify the following types of muscles: cardiac/heart, smooth/stomach and skeletal/biceps
STRAND 4	CONCEPT 1	PO 1	Identify the functions and parts of the nervous system. Control center/brain, relay mechanism/spinal cord and transport messages/nerves

SIX GRADE

STRAND 4	CONCEPT 1	PO 1	Identify the functions and parts of the skeletal system: protection (rib cage, cranium), support (vertebrae) movement (pelvis, femur, hip)
STRAND 4	CONCEPT 1	PO 1	Identify the following types of muscles: cardiac/heart, smooth/stomach and skeletal/biceps
STRAND 4	CONCEPT 1	PO 1	Identify the functions and parts of the nervous system. Control center/brain, relay mechanism/spinal cord and transport messages/nerves

EIGHTH GRADE

STRAND 4	CONCEPT 1	PO 1	Explain the purposes of cell division: growth, repair and reproduction
STRAND 4	CONCEPT 1	PO 1	Explain the basic principles of heredity using the human examples of: eye color, widow's peak and blood type
STRAND 4	CONCEPT 1	PO 1	Distinguish between the nature of dominant and recessive traits in humans.

PRE VISIT ACTIVITY "TOOLS OF THE TRADE"

by Casey Crowley

OVERVIEW/DESCRIPTION

This activity focuses on surgical instrument design. Teams of students will work as "biomedical engineers" to design and construct surgical instruments from everyday materials. They will then test their surgical instruments to determine how well they can perform in a simulated "surgical procedure".

BACKGROUND

Bioengineering/biomedical engineering combines engineering expertise with medical needs to improve health care. Biomedical engineers design instruments and devices, develop new procedures, or carry out research to solve new problems. Some examples of advances in bioengineering include the development of artificial joints, magnetic resonance imaging (MRI), the heart pacemaker, arthroscopy, angioplasty, prosthetics, genomics, and the heart-lung machine.

STEM CONCEPTS

Anatomy

Engineering Design

Bioengineering

Teamwork

5 E'S OF INQUIRY

Engage:

How many of you have ever had surgery? Or have you ever seen a surgery performed on TV? What do surgeons need to perform a surgery successfully? Tell students that they will be working as "biomedical engineers" to design a surgical instrument that can perform detailed procedures without disturbing surrounding tissue or organs.

Explore:

Show students the "operating table" which consists of a shoebox with 3 small objects in it (marshmallow, eraser, noodle etc.). Each small object will be surrounded by dominoes placed upright. The surgical instrument they design should be able to remove the 3 objects (intact) from the box without knocking the dominoes over (kind of like the game "Operation").

5 E'S OF INQUIRY

(Explore continued)

Divide students into groups of 2-3. Each group will draw a plan for their instrument prior to building it. Show the students what materials they will have to use to build their instruments and them give them sufficient time to plan their design. Once the groups have come up with a plan and a materials list they may gather their materials and begin building their design. If they need to modify their design as they are building it, they must also revise their drawing and their materials list.

Each group will briefly present their design to the class, discussing how they came up with the design and what modifications they made as they built it and why. Then they will test their design as the other groups observe. Students should make note of what worked and didn't work in each design.

Explain:

Have students discuss what design features of their instruments seemed to work best and any other observations they want to share. Show students some photos of actual surgical instruments and compare and contrast them to the instruments they built.

Elaborate:

Why is it important to have surgical instruments that work well and that are precise? What kinds of things do you think biomedical engineers have to consider when designing a surgical instrument? What other kinds of tools or procedures do you think biomedical engineers create? What will the future of surgical procedures be? Will everything be done by robots? (See resources for articles on robotic surgery)

If you have time, give students the opportunity to improve upon their original design and then retest.

Evaluate:

Each group will self-evaluate their designs by answering the following questions:

Did your design succeed in removing all three objects without knocking over the dominoes? What worked well in your design and what didn't work as you planned? Did you have to modify your original plan at all? If so, what did you change? What did you see other teams try that worked well? If you had more time and materials, would you change your design?

TAKE HOME MESSAGES

Students will have a better understanding of what biomedical engineers do, as well as a better understanding of the intricacies of surgical procedures and what the future of the field may look like.

SUPPLIES

Shoebox

3 small differently shaped objects *(e.g. marshmallow, eraser, grape, noodle)*

Dominoes or small rectangular blocks

The following materials for each group: pencil, popsicle stick, plastic spoon, chopstick, construction paper, brass fasteners, string, paper clips, rubber bands, clothespins, binder clips, tape, wire, etc.

TALKING POINTS/OPEN ENDED QUESTIONS

Do you think real engineers have to make modifications to their designs as they are building them?
Do you think they always succeed perfectly the first time?

RESOURCES

This activity was modified from: http://tryengineering.org/lesson-plans/smooth-operator

How robotic surgery will work: http://health.howstuffworks.com/medicine/modern-technology/robotic-surgery1.htm

Videos of surgeries being performed with robotic assistance: http://www.cts.usc.edu/rsi-videosandarticles.html

Examples of real surgical instruments: https://quizlet.com/2306139/surgical-instruments-flash-cards/

NEXT GENERATION SCIENCE STANDARDS

4th grade

3-5. Engineering Design

3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.MS. Engineering Design

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NEXT GENERATION SCIENCE STANDARDS

8th grade

MS. Engineering Design

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

ARIZONA STATE SCIENCE STANDARDS

4th grade

Strand 1: Inquiry Process
- Concept 4: Communication
  - PO 1: Communicate verbally or in writing the results of an inquiry.
  - PO 3. Communicate with other groups or individuals to compare the results of a common investigation.

Strand 2: History and Nature of Science
- Concept 2: History of Science as a Human Endeavor
  - PO 2: Describe science-related career opportunities

Strand 3: Science in Personal and Social Perspectives
- Concept 2: Science and Technology in Society
  - PO 3: Design and construct a technological solution to a common problem or need using common materials.

8th grade

Strand 3: Science in Personal and Social Perspectives
- Concept 2: Science and Technology in Society
  - PO 3: Design and construct a solution to an identified need or problem using simple classroom materials.

Strand 2: History and Nature of Science
- Concept 2: History of Science as a Human Endeavor
  - PO 4: Evaluate career opportunities related to life and physical sciences.

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