

Exhibit Descriptions

Private Statistics

Purpose: To measure height, weight, and how each student compares to all others who volunteer their measurements. Displays information of sample population as a “normal distribution.”

Utah State Core Connections: 8th Grade standard four, objective 2a and objective 4e.

What is Being Measured/Observed: Height and weight of a sample population.

How is the Measurement Made: Height- Vernier ultrasonic distance sensor, weight- Vernier force plate pressure sensor.

How is the Measurement Displayed: The distribution curve is displayed for male and female population through a computer interface and monitor.

Significance: Acts as an actual record of how the student’s personal statistics compare to their schoolmates. This is an objective measurement that may contradict their subjective image of themselves.

More Experiments: Body mass index, bell curves and normal distribution statistics, ultrasonic measurements and devices.

More Information: www.howstuffworks.com- how motion sensing lights and burglar alarms work, www.Vernier.com- engineer of force plate and ultrasonic height device, www.camcode.com/help/distributions/normal_distribution.htm- normal distribution.

Geographic Information Systems (GIS)

Purpose: To expose students to the world of Geographic Information Systems and introduce the technology of satellite photography and computer cartography.

Utah State Core Connections: 8th grade standard two, objective 3a.

What is Being Measured/Observed: An actual snapshot of the earth’s surface from a previous moment in time. County boundaries and school locations are also displayed on the monitor.

How is the Measurement Made: The photograph is taken from space via a satellite (Landsat) as it orbits the earth. The pixel resolution is 30 square meters.

How is the Measurement Displayed: The photograph is geo-referenced according to known coordinates upon the Earth’s surface. The digital image is then displayed through a computer monitor and geographic data processing interface.

Significance: Scientists can use these images to measure the effects, rates, and degrees of change upon the Earth's surface and see these changes over time.

More Experiments: Geo-caching, cartography, Earth changes, natural resource exploration.

More Information: www.esri.com- engineers of GIS software and research institution, www.earth.google.com- Google Earth website with high quality visualization site displays geographic data of all areas on Earth.

Static Electricity

Purpose: To introduce students to the concept of electricity in terms of the movement of electrons.

Utah State Core Connections: 7th grade standard one, objective 1a and objective 3a.

What is Being Measured/Observed: The flow of electrons from a generating source to an area of lower electron density.

How is the Measurement Made: A rubber belt revolves around plastic and felt pulleys which transfer electrons to a metal sphere. When an object (such as a student's hand) comes near enough to the sphere, the electrons concentrated there will jump to the object.

How is the Measurement Displayed: When the electrons jump from the sphere to an object a visible static charge resembling a small lightning bolt will be seen.

Significance: This exhibit demonstrates the simplicity of producing electricity and its constant presence around us in the natural world. It also shows the power contained in even the smallest amounts of electricity and puts into context the destructive, deadly force of a bolt of lightning.

More Experiments: Electron collection/static production, atomic structure, physics of lightning, insulators and conductors.

More Information: www.howstuffworks.com.

Whisper Dishes

Purpose: To display the properties of deflection and collection of sound waves.

Utah State Core Connections: 8th grade standard four, objective 1a, 1c, and objective 4e.

What is Being Measured/Observed: The directional focusing of sound waves.

How is the Measurement Made: One dish reflects sound while the dish at the opposite side collects the sounds transmitted from the original dish.

How is the Measurement Displayed: The measurement is displayed by the audibility of a participant's voice as it travels from one dish to the other.

Significance: The parabolic shape of the dishes is the same principle used to construct satellite television transmitters and receivers.

More Experiments: Distance waves travel, reflector dishes, how hearing works.

More Information: www.sf.ca/sonicstudio/handbook/Parabolic_Reflector.html - parabolic reflectors.

Voice Print

Purpose: To graphically display a participant's voice or background noise.

Utah State Core Connections: 8th grade standard four, objective 1a, and 1c, and objective 4e.

What is Being Measured/Observed: The frequency and amplitude of the sound that enters the microphone.

How is the Measurement Made: Amadeus sound software which displays a real-time sound spectrum of any noise.

How is the Measurement Displayed: On a two-axis graph with amplitude plotted on the y-axis and frequency plotted on the x-axis.

Significance: All sounds are just waves. This exhibit illustrates the actual shape of the sound waves that surround us at all times.

More Experiments: Hearing aids, noise cancellation/reduction, sound amplification.

More Information: <http://snipurl.com/t2uk> - sound properties and perception.

Light Island

Purpose: To display the reflection and refraction of light waves.

Utah State Core Connections: 6th grade standard six, objective 2a, 2b, and 2c; 8th grade standard four, objective 1b, 1c, and 1e.

What is Being Measured/Observed: The shape of the lenses change the direction of a light wave.

How is the Measurement Made: A halogen light source produces a continual output of light that passes through acrylic lenses or is reflected by a small glass mirror.

How is the Measurement Displayed: Light waves pass through an acrylic lens and are visible against the black background of the cart top.

Significance: Lenses in objects such as cameras, glasses, and your eyes focus light waves according to their shape.

More Experiments: How optics work, prisms and light wave separation, reflection and mirror shape.

More Information: www.howstuffworks.com/light.htm.

Balance Plate

Purpose: To explore the dynamics of personal balance and controlled movement.

Utah State Core Connections: 8th grade standard four, objective 4e.

What is Being Measured/Observed: The participant's ability to direct their balance in a controlled manner and the ability to hold still, perfect balance.

How is the Measurement Made: NeuroCom balance plate. This plate was originally used to diagnose nervous system disorders that affect the portion of the brain responsible for balance.

How is the Measurement Displayed: Each participant receives a "score" rated in time taken to move a target around a circle.

Significance: Motion is a function of body coordination, and balance coordinates bodily movement. Without the balance created by our inner ears we would not be able to stand or walk.

More Experiments: Gravity deprivation, water tank balance, sense of direction.

More Information: www.onbalance.com - NeuroCom's web page.

Velocity Tracks

Purpose: To explore the properties of velocity and investigate how variables influence the scientific method.

Utah State Core Connections: 6th grade standard six, objective 3a, 3b, and 3c; 8th grade standard four, objectives 2b, 3e, and 4a.

What is Being Measured/Observed: The time taken for each of three balls to travel a specific distance along three different tracks.

How is the Measurement Made: Releasing a start button from the gate where the balls are dropped and stopping the time sensor when the balls cross under a light gate at the finish line.

How is the Measurement Displayed: An electronic timer that displays elapsed time down to the thousandth of a second.

Significance: To highlight the effect of multiple variables (mass, acceleration, and travel distance) in a repeatable experiment.

More Experiments: Motion mechanics – resistance, travel efficiency, gravity.

More Information: <http://www.funderstanding.com/k12/coaster>- design your own coaster according to the principles of physics.

Microworlds

Purpose: To give an often unseen view of the world around us.

Utah State Core Connections: 6th grade standard five, objective 1a; 7th grade standard three, objective 1a; 7th grade standard 5, objective 1b.

What is Being Measured/Observed: An object such as a dollar bill, feather, and your own skin and hair is greatly magnified revealing details and features that would otherwise go unnoticed or unknown.

How is the Measurement Made: Lenses magnify the image of an object and USB Shot software displays the enlarged image on the computer screen.

How is the Measurement Displayed: Lenses in the microscope enlarge and project the image of an object on the computer screen. The image displayed is inverted and reversed from the way the actual object would appear to the naked eye.

Significance: Allows us to visually explore the world around us that we rarely take time or have the ability to see.

More Experiments: Lens structure and function, focal length, microscopic imaging.

More Information: <http://science.howstuffworks.com/light-microscope.htm>.

Generator Bike

Purpose: To demonstrate how electricity is produced and illustrate the difference in energy needed to power incandescent vs. fluorescent light bulbs.

Utah State Core Connections: 8th grade standard four, objective 4a and 4b.

What is Being Measured/Observed: The amount of electrical power (in watts) produced by muscle power of an individual's legs.

How is the Measurement Made: The pedals turn a generator which makes electricity via magnetic induction and sends the electricity made to the light bulbs and watt meter mounted in the cart.

How is the Measurement Displayed: The amount of electricity produced is observed qualitatively by the number of light bulbs the participant is able to light and quantitatively by the reading on the watt meter.

Significance: This exhibit gives a “real world” context to how much more energy is required to power regular light bulbs in comparison to fluorescent light bulbs and builds the groundwork for energy conservation by the participant in their own life.

More Experiments: Types of energy production, light bulb types, energy conservation techniques, alternate energy sources, atomic structure.

More Information: <http://science.howstuffworks.com/electricity.htm>.

Chance, Risk, and Uncertainty

Purpose: Explore the relationship between probability and chance.

Utah State Core Connections: Mathematics Pre-Algebra standard five, objective 2.

What is Being Measured/Observed: The relationship between probability and chance is displayed using eleven rows of lights.

How is the Measurement Made: An electronic pulse is sent from a push button to a row of LED lights. Microchip circuits send the pulses to a total counter display.

How is the Measurement Displayed: 11 rows of LED lights correspond to each possible combination of two six sided dice. Users roll the dice and then press the corresponding sum. A total number of rolls is kept in a digital counter display.

Significance: Looking at games of chance through the use of statistics, users are asked to determine if “luck” actually exists.

More Experiments: Random sampling; genetic probability; distribution curves; luck, risk, and reward.

More Information: http://www.mathgoodies.com/lessons/vol6/intro_probability.html.

Anatomy

Purpose: To demonstrate the physical anatomy of a human (internal and external) through a computer dissection of a real cadaver.

Utah State Core Connections: 7th grade standard 3, objective 2b and 2c.

What is Being Measured/Observed: Photos and illustrations of the body systems and organs of a dissected human cadaver.

How is the Measurement Made: Photos and illustrations are selected via a computer interface.

How is the Measurement Displayed: Real anatomy photos and illustrations are compiled into a user-friendly interface that allows a participant to navigate through the organ layers of a human body.

Significance: This exhibit is a unique opportunity to literally look inside a human being and discover how our organs and systems work and fit together.

More Experiments: Animal anatomy/comparative anatomy, illness and disease, organ transplant, art and drawing.

More Information: <http://www.bodyworlds.com/en.html>.

Making Waves

Purpose: To simulate interference patterns formed by waves in a pool of water when contacting other waves or solid barriers.

Utah State Core Connections: 8th grade standard 4, objective 1b and 1c.

What is Being Measured/Observed: The pattern of waves produced by a disturbance in a simulated calm pool of water.

How is the Measurement Made: Simulated waves are produced by touching a computer screen, imitating dropping a rock into a still pond.

How is the Measurement Displayed: Wave patterns and interactions are observed qualitatively on the computer screen simulation.

Significance: By building barriers and openings for the waves to reflect off of and diffract through, the participant can directly observe the properties of water waves.

More Experiments: Types of waves, parts of waves, ocean weather and surf.

More Information: <http://www.colorado.edu/physics/phet/simulations/stringwave/stringWave.swf>.