Got the H.O.T.S. for Inquiry?

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Video Notes

Video Notes Directions

- This guide supports the video presentation and provides you a copy of the PowerPoint slides used in the program. There are multiple segment breaks in the video that are included to allow time for you to process the information you have seen and heard.
- The slides that are associated with the segment breaks have reflection questions to consider during the interim period.
- It is advisable to print out all of the supplemental files for this program as resources to utilize during and after viewing.
- The follow-up activities should be completed and submitted to your professional development director for possible credit

Inquiry

- Research shows inquiry produces positive results
- Ambiguously defined in the literature
  - Scientific inquiry (by scientists)
  - Inquiry learning and teaching (in education)
- The "spirit" of inquiry
  - Engage students in the investigative nature of science

Center for Science Education. 2005. Has inquiry made a difference: A synthesis of research on the impact of inquiry science on student outcomes. *Education Development Center, Inc.*, http://cse.edc.org/work/research/inquirysynth/default.asp (accessed March 19, 2005).

Anderson, Ronald D. 2002. Reforming science teaching: What research says about inquiry. *Journal of Science Teacher Education* 13(1) (February), http://web.cortland.edu/meyerd/anderson2002.pdf (accessed March 19, 2005).

The "Spirit" of Inquiry

- Reformed science instruction vs. classical
- Works best for concrete concepts (observable)
  First step: Take away premade data tables
- Types of inquiry
  - Structured
  - Guided
  - Open

The Hidden Rules of Inquiry

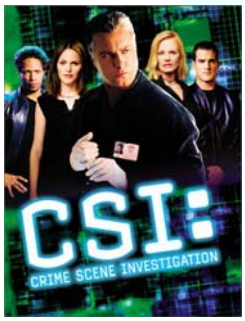
"Non-scientific method" rules

"Scientific method" rules

Students need to be ready for both sets of rules

Thank you, CSI.

"Where does the evidence lead us?"



C.S.I Crime Scene Investigation: The Complete Second Season. DVD. Directed by Danny Cannon and Kenneth Fink. 2001; Los Angeles, CA: Paramount Home Video, 2003.

Higher Order Thinking Skills

- Research shows HOTS produces positive results
- Bloom's taxonomy
  - Application, analysis, synthesis, evaluation
- Critical thinking
  - Process of determining authenticity, accuracy, or value
  - Characterized by seeking reason and alternatives
- Research shows skills are teachable and learnable

Cotton, Kathleen. 2001. Teaching thinking skills. *School Improvement Research Series*, Close-Up #11 Northwest Regional Educational Laboratory (1992-93 Series), http://www.nwrel.org/scpd/sirs/6/cu11.html (accessed March 19, 2005).

Segment 1 is now finished– Higher Order Thinking Skills

Please proceed with the activity.

Reflect on the differences between inquiry models. What model might work best for your class and why?

Continue to the next segment at the conclusion of the activity.

Comply: NSES, Current Study

- National Science Education Standards
  - As a result of activities in grades K-12, all students should develop
  - Abilities necessary to do scientific inquiry

[DO!]

  - Understanding about scientific inquiry

[UNDERSTAND!]

National Research Council. 1996. *National science education standards.* Washington, D.C.: National Academies Press.

The "DO" part

- My students' mantra: Gather data!
  - Exploratory = grounded in data
  - Relevance = on students' agenda
  - Engaging = leads to content; piques interest
- DO: Survey on Multiple Intelligences
  - Share with tablemates

Birmingham Grid for Learning. "The Multiple Intelligences Wheel." http://www.bgfl.org/services/elearn/intell.htm (accessed March 22, 2005).

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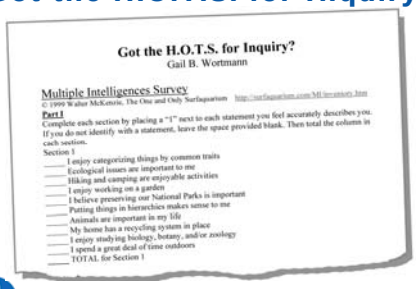

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Multiple Intelligences Survey
© 1999 Walter McKenzie, The One and Only Surfaquarium http://surfaquarium.com/MI/inventory.htm

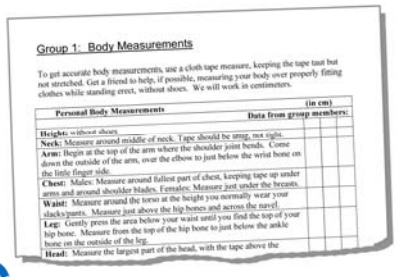
Part I
Complete each section by placing a "1" next to each statement you feel accurately describes you. If you do not identify with a statement, leave the space provided blank. Then total the column in each section.

Section 1
_____ I enjoy categorizing things by common traits
_____ Ecological issues are important to me
_____ Hiking and camping are enjoyable activities
_____ I enjoy working on a garden
_____ I believe preserving our National Parks is important
_____ Putting things in hierarchies makes sense to me
_____ Animals are important in my life
_____ My home has a recycling system in place
_____ I enjoy studying biology, botany, and/or zoology
_____ I spend a great deal of time outdoors
_____ TOTAL for Section 1

Multitask "Doing"

- Group one:
  - Body measurements (V/S)
- Group two:
  - Bone counter (N)

Group 1: Body Measurements

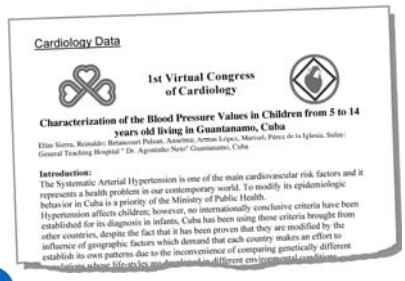


Group 1: Body Measurements

To get accurate body measurements, use a cloth tape measure, keeping the tape taut but not stretched. Get a friend to help, if possible, measuring your body over properly fitting clothes while standing erect, without shoes. We will work in centimeters.

Personal Body Measurements (in cm)	Data from group members:			
Height: without shoes				
Neck: Measure around middle of neck. Tape should be snug, not tight.				
Arm: Begin at the top of the arm where the shoulder joint bends. Come down the outside of the arm, over the elbow to just below the wrist bone on the little finger side.				
Chest: Males: Measure around fullest part of chest, keeping tape up under arms and around shoulder blades. Females: Measure just under the breasts.				
Waist: Measure around the torso at the height you normally wear your slacks/pants. Measure just above the hip bones and across the navel.				
Leg: Gently press the area below your waist until you find the top of your hip bone. Measure from the top of the hip bone to just below the ankle bone on the outside of the leg.				
Head: Measure the largest part of the head, with the tape above the				

Cardiology Data



Cardiology Data

1st Virtual Congress of Cardiology

Characterization of the Blood Pressure Values in Children from 5 to 14 years old living in Guantanamo, Cuba

Elias Sierra, Reinaldo; Betancourt Pulsan, Anselmo; Armas López, Marisel; Pérez de la Iglesia, Solen: General Teaching Hospital " Dr. Agostinho Neto" Guantanamo, Cuba

Introduction:

The Systematic Arterial Hypertension is one of the main cardiovascular risk factors and it represents a health problem in our contemporary world. To modify its epidemiologic behavior in Cuba is a priority of the Ministry of Public Health.

Hypertension affects children; however, no internationally conclusive criteria have been established for its diagnosis in infants, Cuba has been using those criteria brought from other countries, despite the fact that it has been proven that they are modified by the influence of geographic factors which demand that each country makes an effort to establish its own patterns due to the inconvenience of comparing genetically different

Build-A-Body

- Body measurements
  - Build-a-body; anatomical descriptors
- Bone counter
  - Group processing; learn names of bones

Gather Data! - Other Examples

- Caffeine lab
- Blood pressures for teens

Student	Blood P	C.M.	106/58
L.A.	125/78	A.S.	120/78
L.B.	115/64	E.W.	110/60
S.B.	128/80	J.A.	118/58
A.L.	125/67	Mrs. W.	106/65

Segment 2 is now finished– Connecting Inquiry to NCES

Please proceed with the activity.

Select a unit of study from your curriculum. What data collection opportunity can you provide for students that will motivate them to seek other information?

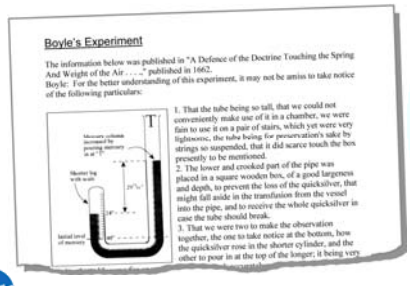
Continue to the next segment at the conclusion of the activity.

Variables and Problem Statement

- The problem is the statement
- Body temperature example - give parts
- Boyle
  - Friendly reminders
  - Original source document
  - Translate and identify variables, problem statement (I)

The ChemTeam. "Robert Boyle and his Data." http://dbhs.wvusd.k12.ca.us/webdocs/GasLaw/Gas-Boyle-Data.html (accessed March 22, 2005).

Boyle's Experiment



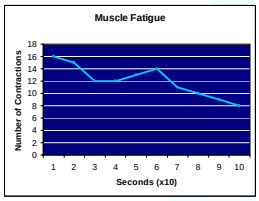
Boyle's Experiment

The information below was published in "A Defence of the Doctrine Touching the Spring And Weight of the Air . . . ." published in 1662.
Boyle: For the better understanding of this experiment, it may not be amiss to take notice of the following particulars:

1. That the tube being so tall, that we could not conveniently make use of it in a chamber, we were fain to use it on a pair of stairs, which yet were very lightsome, the tube being for perservation's sake by strings so suspended, that it did scarce touch the box presently to be mentioned.
2. The lower and crooked part of the pipe was placed in a square wooden box, of a good largeness and depth, to prevent the loss of the quicksilver, that might fall aside in the transfusion from the vessel into the pipe, and to receive the whole quicksilver in case the tube should break.
3. That we were two to make the observation together, the one to take notice at the bottom, how the quicksilver rose in the shorter cylinder, and the other to pour in at the top of the longer; it being very

Hypotheses

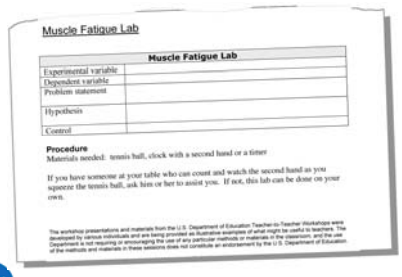
- Add hypotheses and practice!
- Muscle fatigue lab (K)
- Heart rate lab



% Increase of Pulse Rate

	Jumping Jacks	Sit-ups	Toe Touches
Lindsey	59%	48%	21%
Jason	74%	43%	38%
Esther	51%	26%	37%
Average	**61%**	**39%**	**32%**

Muscle Fatigue Lab



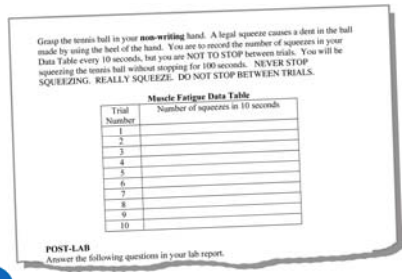
Muscle Fatigue Lab

Muscle Fatigue Lab	
Experimental variable	
Dependent variable	
Problem statement	
Hypothesis	
Control	

Procedure
Materials needed: tennis ball, clock with a second hand or a timer

If you have someone at your table who can count and watch the second hand as you squeeze the tennis ball, ask him or her to assist you. If not, this lab can be done on your own.

Muscle Fatigue Data Table



Grasp the tennis ball in your **non-writing** hand. A legal squeeze causes a dent in the ball made by using the heel of the hand. You are to record the number of squeezes in your Data Table every 10 seconds, but you are NOT TO STOP between trials. You will be squeezing the tennis ball without stopping for 100 seconds. NEVER STOP SQUEEZING. REALLY SQUEEZE. DO NOT STOP BETWEEN TRIALS.

Muscle Fatigue Data Table

Trial Number	Number of squeezes in 10 seconds
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

POST-LAB
Answer the following questions in your lab report.

Segment 3 is now finished– Disaggregation

Please proceed with the activity.

Select a unit of study from your curriculum. Write three questions for each level of Bloom's taxonomy. Use the stems provided only if necessary.

Continue to the next segment at the conclusion of the activity.

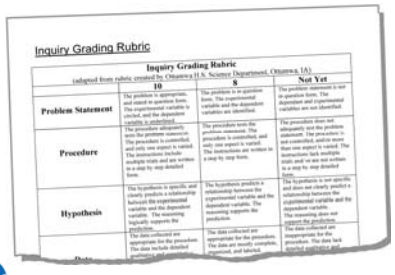
OHS Inquiry Rubric

- Ottumwa High School Science Department
  - Relate to HOTS
  - Example: Smell Lab
    - Not until Unit 6 (November)
  - Special needs adaptations (Prebiology)

Hypothesis (A Prediction and a Reason for the Prediction)	The hypothesis is specific and clearly predicts a relationship between the experimental variable and the dependent variable. The reasoning logically supports the prediction.	The hypothesis predicts a relationship between the experimental variable and the dependent variable. The reasoning supports the prediction.	The hypothesis is not specific, and does not clearly predict a relationship between the experimental variable and the dependent variable. The reasoning does not support the prediction.

Ottumwa High School Science Department. 2003. OHS Inquiry Rubric.

Inquiry Grading Rubric


Inquiry Grading Rubric

Inquiry Grading Rubric

(adapted from rubric created by Ottumwa H.S. Science Department, Ottumwa, IA)

	10	8	Not Yet
Problem Statement	The problem is appropriate, and stated in question form. The experimental variable is circled, and the dependent variable is underlined.	The problem is in question form. The experimental variable and the dependent variables are identified.	The problem statement is not in question form. The dependent and experimental variables are not identified.
Procedure	The procedure is adequate, tests the problem statement, is controlled, and only one aspect is varied. The instructions include multiple trials and are written in a step by step detailed form.	The procedure tests the problem statement. The procedure is controlled, and only one aspect is varied. The instructions are written in a step by step form.	The procedure does not adequately test the problem statement. The procedure is not controlled, and/or more than one aspect is varied. The instructions lack multiple trials and/ or are not written in a step by step detailed form.
Hypothesis	The hypothesis is specific and clearly predicts a relationship between the experimental variable and the dependent variable. The reasoning logically supports the prediction.	The hypothesis predicts a relationship between the experimental variable and the dependent variable. The reasoning supports the prediction.	The hypothesis is not specific and does not clearly predict a relationship between the experimental variable and the dependent variable. The reasoning does not support the prediction.
Data	The data collected are appropriate for the procedure. The data include detailed [illegible]	The data collected are appropriate for the procedure. The data are mostly complete, organized, and labeled.	The data collected are inappropriate for the procedure. The data lack detailed statistics and

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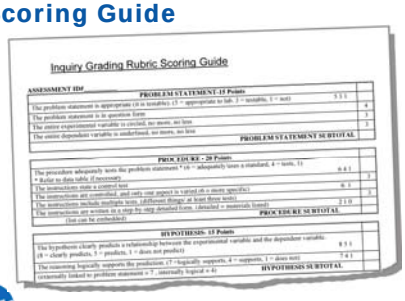
Ottumwa High School Science Department. 2003. OHS Inquiry Rubric.

Multiple Means Assessment

- Inquiry Grading Rubric Scoring Guide
- Inter-relater reliability
- Iowa's Multiple Means along with ITEDs

PROBLEM STATEMENT-15 Points		
The problem statement is appropriate (It is testable). (5 = appropriate to lab. 3 = testable, 1 = not)	5 3 1	
The problem statement is in question form.		4
The entire experimental variable is circled, no more, no less.		3
The entire dependent variable is underlined, no more, no less.		3
	PROBLEM STATEMENT SUBTOTAL	

Inquiry Grading Rubric Scoring Guide


Inquiry Grading Rubric Scoring Guide

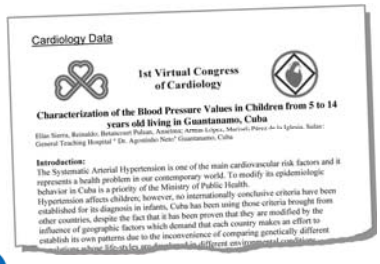
The "UNDERSTAND" Part

- Analyze research (L)
  - Characterization of the blood pressure values in children from year of living in Guantanamo, Cuba

1st Virtual Congress of Cardiology. "Characterization of the blood pressure values in children from 5 to 14 years old living in Guantanamo, Cuba." http://pcvc.sminter.com.ar/cvirtual/tlibres/tnn2528i/tnn2528i.htm (accessed March 22, 2005).

- Navajo experiment
  - Explain Elsu Featherstone
  - Write experiment, but don't do
  - Include
    - Problem statement
    - Instructions/procedures
    - Hypothesis
    - How you plan to collect and organize data

Cardiology Data



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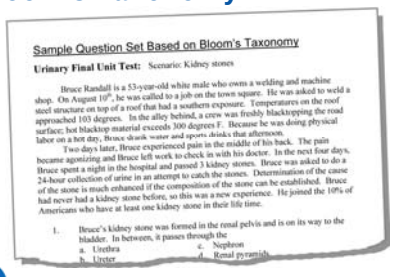
Assessments Using HOTS

- Multiple assessments
- Embedded scenarios in Iowa Learning Online Anatomy course
  - Telemedicine
  - RoseAnn
  - Corrupted data

Assessment Using Application

- Bloom's Connect
- Sources for question stems
- Find on test (V/L) and write one
- Give question scenarios before test

Sample Questions Set Based on Bloom's Taxonomy



Sample Question Set Based on Bloom's Taxonomy

Urinary Final Unit Test: Scenario: Kidney stones

Bruce Randall is a 53-year-old white male who owns a welding and machine shop. On August 10th, he was called to a job on the town square. He was asked to weld a steel structure on top of a roof that had a southern exposure. Temperatures on the roof approached 103 degrees. In the alley behind, a crew was freshly blacktopping the road surface; hot blacktop material exceeds 300 degrees F. Because he was doing physical labor on a hot day, Bruce drank water and sports drinks that afternoon.

Two days later, Bruce experienced pain in the middle of his back. The pain became agonizing and Bruce left work to check in with his doctor. In the next four days, Bruce spent a night in the hospital and passed 3 kidney stones. Bruce was asked to do a 24-hour collection of urine in an attempt to catch the stones. Determination of the cause of the stone is much enhanced if the composition of the stone can be established. Bruce had never had a kidney stone before, so this was a new experience. He joined the 10% of Americans who have at least one kidney stone in their life time.

1. Bruce's kidney stone was formed in the renal pelvis and is on its way to the bladder. In between, it passes through the
   a. Urethra
   b. Ureter
   c. Nephron
   d. Renal pyramids

Student Test Results

- "Argue for points" concept (try on #6)
- Jason and Esther missed #2 (chose "D")
  – Lindsey missed #4 (chose "A")
- Answers were:

1) B	2) A	3) C
4) D	5) D	6) B

- Bloom's identification:

1) K	2) C	3) AP
4) AN	5) S	6) E

Making a Difference

- Inquiry: Higher results with special needs students
- Student examples:

Before	PS: The more time spent in space, the increased risk of developing kidney stones
After	PS: What is the relationship between the amount of aerobic training an individual does and his or her level of fitness as measured by the Step Test? H: If the fitness level is related to the amount of aerobic training, then I predict that, after aerobic activity, the time it will take your heart to return to its normal pulse will be based on how physically fit you are

Go forth and gather data!

Thanks for your kind attention.

Segment 4 is now finished– Assessing H.O.T.S.

Please proceed with the activity.

In what ways does a rubric aid in student success?