2013

Everyday Forces

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UNDERSTANDING BY DESIGN

Unit Cover Page

Unit Title: Everyday Forces

Grade Level: 7th grade

Subject/Topic Area(s): Scientific Method, Experimental Design, Everyday Forces, Work

Designed By: Michelle Hockley

Time Frame: 5 weeks

School District: North East ISD

School: Barbara Bush Middle School

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Brief Summary of Unit (Including curricular context and unit goals):

The basis of all scientific research is the Scientific Method. Students need a strong foundation in the steps of this method. One of the goals of this unit is to provide an understanding of the scientific method.

The other goals are to encourage an understanding of everyday forces and determination of work/no work in a situation. These are basic physics concepts that are a part of the 7th grade Science TEKS. Students will incorporate their knowledge of the scientific method and create an experimental investigation focused on an everyday force.

Unit: Scientific Method & Physics (Everyday Forces & Work/No Work)
Grade: 7th Grade Science

Stage 1: Desired Results

Understandings

Students will understand that…

-One of the foundations of science is the Scientific Method.
-There are key parts (IV, DV, Constants, Control) to experimental design.
-There are forces that affect motion in everyday life.
-The physics explanation of work is different from the common term of work.
-In certain situations work is occurring and in other situations work is not occurring.

Essential Questions

How do we make new discoveries?
Is the Force important to you?

Knowledge

Students will know…
-the steps of the Scientific Method.
-Vocabulary: comparative investigation, descriptive investigation, experimental investigation, independent variable, dependent variable, constant, control, gravity, balanced force, unbalanced force, work.
-DRY MIX: In graphing, the dependent variable goes on the y-axis and the independent variable goes on the x-axis.
-unbalanced forces may act upon an object to change its state of motion (cause acceleration or deceleration)
-balanced forces means that there is no motion.
-force and motion in same direction =work; force and motion not in the same direction=no work.

Skills

Students will be able to…
-determine the parts of an experimental investigation such as independent variable, dependent variable, constant, control.
-(7.7c)demonstrate and illustrate forces that affect motion in everyday life and determine is those forces are balanced or unbalanced.
-(7.7a)contrast situations where work is occurring or not occurring.
-(7.2b) design and implement experimental investigations by making observations, asking well-defined questions, formulating testable hypotheses, and using appropriate equipment and technology.
-(7.2d) construct tables and graphs to organize data and identify patterns.
-(7.2e) analyze their results, make a conclusion based on those results, and communicate that conclusion.

Stage 2: Assessment Evidence

Performance Task:

Working with a partner of their choice or by themselves, students will work as scientists for Southwest Research Institute. As scientists, they will use an example of an everyday force (such as the force they chose to represent in their previous assignment of an everyday force poster) and use the Scientific Method to investigate some aspect of that force. Students must develop a question/problem and conduct background research. They must create a hypothesis, design and implement an experiment, analyze results, and draw a conclusion based on those results.

Students will present their work on Knowmia (video presentation) to their colleagues/classmates.

Other evidence:

(quizzes, tests, academic prompts, self-assessments, etc.
note – these are usually included where appropriate in Stage 3 as well)

Quizzes, Test, Informal Check for Understanding, Exit Ticket

Stage 3: Learning Activities

(Steps taken to get students to answer Stage 1 questions and complete performance task)

EQ-How do we make new discoveries?

Day 1: Flipped Instruction of the Scientific Method

- As homework the night before, students will watch a video of the steps of the Scientific Method. They will need to complete the top portion of the corresponding handout.
- In class as a lab group, students will complete a card sort with the steps of the Scientific Method. Students will complete the bottom portion of the corresponding handout.

Day 2: Creating a Hypothesis

- Students will be given different Questions/Problems and they will need to write down potential hypotheses using If…then… format.

Day 3: Parts of an Experiment

- Group discussion-How do we determine what the independent variable, dependent variable, constants and control are in an experiment?
- In a lab group, students will complete a card sort with the parts of an experiment.
- From the hypotheses created the day before, students will choose one of the hypotheses and create an experiment to test the hypothesis while incorporating the parts of an experiment.

Day 4: Reading & Constructing Data Tables

- Students will be given several data tables and asked to identify each part of the data table (title, constant, variable, units, data in ordered pairs). They will also have to answer questions about the data tables and create data tables based on given information.

Day 5: Graphing-bar graphs

- Quiz over the steps of the Scientific Method
- Review setting up of graphs. Direct teach of DRY MIX: the dependent variable goes on the Y-axis and the independent variable goes on the X-axis.
- In lab groups, students will measure and calculate the densities of several liquids. They will create a data table to put the information into as well create a bar graph of the data.

Day 6: Graphing-line graphs

- Students will be given a set of data tables and a set of line graphs that they must match together. Then they will be given several data tables that they must create line graphs.

Day 7: Pendulum Puzzles Lab

- In lab groups, students will conduct a lab based on the Question: How can we get this pendulum to swing faster? They must follow the procedures, make a data table, and make a bar and line graph. Direct teach on making conclusions based on an analysis of the results. Students will need to make a conclusion about the lab.

Day 8: Test

- Test over Scientific Method & Parts of an Experiment & Making Data Tables and Graphs

EQ-Is the Force important to you?

Day 9: What is a Force?

- Pre-Assessment writing piece about a cat sitting on a tree limb. What is a force? What are the forces acting upon the cat?
- Notes on Forces/Vocabulary
- Examples of Forces, balanced & unbalanced Venn Diagram as Think Pair Share.
- Homework: Students will complete a handout that includes determining the net force of two vectors and if a scenario is balanced forces or unbalanced forces.

Day 10: What is Work?

- Students will go over homework as a class discussion leading into the concept of physics work. Several visual examples of work will be given in class such as rolling a ball down the aisle of the classroom, etc.

Day 11: Work/No Work Scenarios

- Students will be given several scenarios and they will need to decide if work is occurring or not occurring.
- Exit ticket- students will create their own scenarios with one example of work occurring and one example of work not occurring.

Day 12: Flipped Instruction of How to Calculate Work

- As homework the night before, students will watch a video of the steps on how to calculate work. They will need to complete the corresponding handout.
- In class as a lab group, students will work together in a competition against the other lab groups to answer as many calculating work questions in the shortest about of time while being accurate with procedure and answers.

Day 13: Stations of Calculating More Work & Ramps/No Ramps

- Brief review of simple machines (focusing on ramps) which were covered in 6^{th} grade.
- In a lab group, students will circulate around the room to stations. Some of the stations will require them to calculate work and other stations will have a ramp so they must calculate work with and without the ramp.
- Then the lab group must analysis work with and without a ramp. How does force required change or not? How does distance required change or not?

Day 14: Everyday Forces & Motion Poster

- Powerpoint presentation over examples of "everyday forces".
- In a lab group, students will need to illustrate and demonstrate an example of forces that affect the motion of something in everyday life. On poster paper, the group will need to identify the everyday event, the forces at work, and balanced/unbalanced forces. The picture will need to show the direction of the forces using arrows.

Day 15: Presentation of Everyday Forces & Motion Poster

- In a lab group, students will present their poster to classmates.

Day 16: Elodea Leaf Lab-Turgor Pressure

- Brief review of microscopes and brief direct teach of cell walls in plants.
- In a lab group, students will follow procedures to identify turgor pressure as an everyday force exerted on the cell wall of a plant.

Day 17: Physics Test over Work and Everyday Forces & Assign Performance Task

Day 18: Performance Task

- Students will be developing their Question/Problem & Hypothesis.

Day 19: Performance Task

- Question/Problem & Hypothesis due today.
- Students will be developing their Experiment Plan.

Day 20: Performance Task

- Experiment Plan due.
- Students will be making model & start Experiment if approved by teacher.

Day 21: Performance Task

- Students will be performing Experiment if approved by teacher.

Day 22: Performance Task

- Students will be performing Experiment, graphing results, making conclusions.

Day 23: Performance Task

- Students will be developing their Knowmia video presentations.

Day 24: Performance Task

- Knowmia video presentations due.
- Students will be presenting their video of their work to classmates.

Day 25: Performance Task

- Students will be presenting their video of their work to classmates.

THE SCIENTIFIC METHOD

Video Guide: Go to MyBigCampus.com to access the Scientific Method video.

Complete the chart below as you watch the video.

	STEP	DEFINITION	EXAMPLE
1			
2			
3			
4			
5			
6			

Stop: Do NOT do the rest of this page as homework.

Southwest Research Institute Scientist

Southwest Research Institute (SwRI) is an independent, nonprofit applied research and development organization. The purpose of this organization is for scientists to create and share knowledge in engineering and the physical sciences. There is a wide range of topics covered at SwRI such as engine design and development, engineering emissions certification testing, fuels and lubricants evaluation, chemistry, space science, nondestructive evaluation, automation, mechanical, electronics, and more.

Working with a partner of your choice or by yourself, you will work as scientists for Southwest Research Institute. You will use an example of an everyday force (such as the force you chose to represent in your everyday force poster) and use the Scientific Method to investigate some aspect of that force. You must develop a question/problem and conduct background research. You must create a hypothesis, design and implement an experiment, analyze results, and draw a conclusion based on those results.

Depending on what experiment you design, you will need to create a model to conduct your testing or if you are using plants you will need to plant them and let them grow.

To get some ideas on physics projects, use the link below:
http://www.juliantrubin.com/physicsprojects.html

Final Product: You will create a video presentation on Knowmia to share your scientific research with your fellow colleagues.

Due Dates:

1. Question/Problem & Hypothesis: _____
2. Experiment Plan: _____
3. Model (if needed): _____
4. *Experiment results (data table & graph): _____
5. *Conclusions: _____
6. *Knowmia Presentation: _____

*If you choose a force concerning plants that requires an extended period of time for them to grow, requirement due dates with an asterisk will be extended.

Southwest Research Institute Scientist-RUBRIC

CATEGORY	4	3	2	1
Idea/Question	Independently identified a question which was interesting to the student and which could be investigated.	Identified, with adult help, a question which was interesting to the student and which could be investigated.	Identified, with adult help, a question which could be investigated.	Identified a question that could not be tested/investigated or one that did not merit investigation.
Background/Research	Several reputable background sources were used and cited correctly. Material is translated into student\'s own words.	A few reputable background sources are used and cited correctly. Material is translated into student\'s own words.	A few background sources are used and cited correctly, but some are not reputable sources. Material is translated into student\'s own words.	Material is directly copied rather than put into students own words and/or background sources are cited incorrectly.
Hypothesis Development	Independently developed an hypothesis well-substantiated by a literature review and observation of similar phenomena.	Independently developed an hypothesis somewhat substantiated by a literature review and observation of similar phenomena.	Independently developed an hypothesis somewhat substantiated by a literature review or observation of similar phenomena.	Needed adult assistance to develop an hypothesis or to do a basic literature review.
Experimental Design	Experimental design is a well-constructed test of the stated hypothesis.	Experimental design is adequate to test the hypothesis, but leaves some unanswered questions.	Experimental design is relevant to the hypothesis, but is not a complete test.	Experimental design is not relevant to the hypothesis.
Variables	Independently identified and clearly defined which variables were going to be changed (independent variables) and which were going to be measured (dependent variables).	Independently identified which variables were going to be changed (independent variables) and which were going to be measured (dependent variables). Some feedback was needed to clearly define the variables.	With adult help, identified and clearly defined which variables were going to be changed (independent variables) and which were going to be measured (dependent variables).	Adult help needed to identify and define almost all the variables.

Data Collection	Data was collected several times. It was summarized, independently, in a way that clearly describes what was discovered.	Data was collected more than one time. It was summarized, independently, in a way that clearly describes what was discovered.	Data was collected more than one time. Adult assistance was needed to clearly summarize what was discovered.	Data was collected only once and adult assistance was needed to clearly summarize what was discovered.
Conclusion	Conclusion includes whether the findings supported the hypothesis, possible sources of error, and what was learned from the experiment.	Conclusion includes whether the findings supported the hypothesis and what was learned from the experiment.	Conclusion includes what was learned from the experiment.	No conclusion was included in the report OR shows little effort and reflection.
Knowmia Presentation	All required elements are present and additional elements that add to the report (e.g., thoughtful comments, graphics) have been added.	All required elements are present.	One required element is missing, but additional elements that add to the report (e.g., thoughtful comments, graphics) have been added.	Several required elements are missing.