

Investigative Design Worksheet

On the following pages, you will find the questions that students discussed in small groups and as a whole class during this lesson.

Learning Target: I can plan an accurate inquiry that addresses the impact the weight of the car has on its' speed.

- 1. Complete** your analysis of the cars and ramps system. Back of yesterdays entry task or on the front table. It must be **checked** and **initialed** by your table partners.
- 2. Plan** how you will approach an investigation to find out the answer to this question.

Investigative design

Question: How does the weight of the car affect its' speed?

Identify the variables:

Manipulated Variable-

Responding Variable-

Two Controlled variables-

Write a hypothesis:

Without the CPO timer, make some **observations** as you change the weight and **record** the ones below that you think will help you answer the question.

What data will answer the question?

How will you organize the data to present the clearest answer to the question?

What did you learn in class today?

Instructional Plan

Teacher Steven English	School Shaw Middle School	Subject/Course Science	Grade 8th	Class Length 53 minutes
Topic/Lesson Title Force and Motion-Cars and Ramps: What influences the speed of the car – weight or ramp position?				

DESIRED RESULTS

Content Standards/GLEs/District Curriculum Expectations

Washington State GLEs

- Science 1.2.1 Analyze how parts of a system interconnect and influence one another.
- Science 1.1.4 Understand energy is a property of matter, objects, and systems and comes in many forms.
- Science 1.2.2 Understand how various factors affect energy and that energy can be transformed from one form to another.
- Science 1.3.1 Understand factors that affect strength and direction of forces.
- Science 1.3.2 Understand how balanced and unbalanced forces can change the motion of objects.
- Science 2.1.2 Understand how to plan and conduct scientific investigations.
- Science 2.1.3 Apply understanding of how to construct a scientific explanation using evidence and inferential logic.

Learning Targets/Lesson Objectives

- I can identify the parts of a system.
- I can identify the variables and behaviors in a system.
- I can identify the types of energy in a system.
- I can analyze a system and determine the energy transformations that occur.
- I can conduct a fair and accurate inquiry investigation.

BACKGROUND INFORMATION

<p>Resources Used To Develop Lesson</p> <ul style="list-style-type: none"> • Cars and ramp apparatus • Motion detectors 	<p>Interdisciplinary Connections</p> <ul style="list-style-type: none"> • Math–Constructing and plotting coordinate pairs on a graph
<p>Assessment Of Prior Learning</p> <ul style="list-style-type: none"> • Conduct a formal open inquiry of the pendulum to see how they "do science" • Entry tasks that call upon students to identify variables, analyze data tables, and write a hypothesis and procedures 	<p>Materials/Equipment/Tools</p> <ul style="list-style-type: none"> • Cars and ramps system

FORMATIVE AND SUMMATIVE ASSESSMENT

Formative Assessment

- Use colored cards to communicate levels of understanding
- Identify variables in an investigative question
- Write a hypothesis
- Construct a data table
- Write a procedure with variables identified
- Construct a graph

Summative Assessment

Formal lab report will be presented including:

- hypothesis
- materials list
- step by step procedure
- graph
- variables identified
- data table constructed
- written conclusion

(This is a three day process.)

LESSON PLAN

Lesson Overview

1. Complete prior day's lab.
2. Work in small groups on new lab.
3. Teacher monitors student progress.
4. Clean up.
5. Class shares what was learned during lab.

Teacher Tasks

1. Entry Task: Introduce the new lab with a reading about Galileo.
2. Have students finish the entry task for the prior day's lab.
3. Provide necessary components for new lab.
4. Monitor to answer and ask clarifying questions.
5. Facilitate class discussion.

Student Tasks

1. Finish the entry task for the prior day's lab.
2. Begin new lab to determine the relationship between the weight of a car and its rate of acceleration.
3. Clean up.
4. Share what was learned during lab.

LESSON REFLECTIONS

Biggest blunder—forgot to check in with kids and realized they had not finished their “system” analysis and I gave them the structural handout for the inquiry. I adjusted by checking with each table and had them back on track.

The debrief of the entry task proved to be an excellent dialogue regarding the variables in an investigation. I uncovered the misconception as I “stamped” the entry task and decided it was worthwhile to debrief the entry task and have a discussion about “variables.”

Use of cards for quick formative assessment always a good idea, yet need to remember it is a “cursory” or “shallow” assessment without the dialogue. Needed more time to debrief student learning regarding their day in the lab. I would have stopped earlier and had them write down a learning they had and had a share out.

In looking at quality instruction, look for the piece that was not specifically addressed, classroom community. Watch to see how I consistently tried to manage myself throughout the lesson even when I knew I forgot where I started, Galileo’s “quote” or story and anything that appeared unexpected. My goal is to keep the community “vibrant” for early adolescents. Look at humor, how I share “power” and model how this is a room where we can all spend time, learn together, and be very OK with what we share with one another.

Teacher Commentary

Show Your Cards!

Question: You ask students to show a red, yellow, or green card at various points in this lesson. Can you describe several different situations where you use the colored cards?

Answer: Sure. I use the cards to:

- check for understanding after discussing an entry task
- check for understanding of vocabulary when new words appear
- determine readiness to learn a new idea
- check content understanding at entry points in our learning
- monitor students' understanding in the middle of an activity (i.e., "How are you doing with this lab, activity, reading?")

Question: What actions might you take based on what you find out from the colored cards?

Answer:

- If I see too many red or yellow cards, I might ask, "Help me understand what is missing or needs clarification." I can then have a student who displayed a green card explain his or her thinking or I can do some re-teaching. Afterward, I often have students show their cards again.
- Another action I take if many students show red or yellow cards is to have students discuss with their table partners what they need to move up to yellow (if they are red) or green (if they are yellow).
- When there is a big mix of card colors in class, I try to provide more opportunities to situate the content in a more relevant context.
- When I see a lot of green cards, I might have several students share out an important concept or idea that helped them be "green."

Question: Are the colored cards about you assessing students or students assessing themselves?

Answer: Both. I want students to own their learning by recognizing that they need an emotional connection to the content if they are to learn something new. It is a natural dynamic to be frustrated or pissed off when on a steep learning curve. Also, it is their learning; I am there to help them get as far as possible. I also believe that any feedback they get from me needs to focus on strengths and areas for improvement. The cards help me target this feedback. Consistently involving students in self-reflection and asking students to publicly share their cards has built safety and trust. Our community is strong, which builds motivation and meets psychological needs.

Question: How does the colored card strategy differ from other forms of formative assessment?

Answer: It is different because of the emotional investment students have in it, and it can be used spontaneously.

Question: How do you envision strengthening the way you use the colored cards?

Answer: If I get more intentional with the cards, they will be something that students will not forget. Here are a few adjustments I will make:

- I need to remind students more often just how we created these cards. Many drew pictures or put quotes on them but over time, they may have lost track of why they did so.
- In the future, I will be certain to have the cards in the rings of their binders so they do not lose them.
- I want to be more deliberate about having students compare the words and pictures that they placed on their cards at various points in the year. This helps solidify their ownership in their learning.

Young Scientists' Think Time and Student Work

On the following pages, you will find the entry task assignment that students worked on at the start of the class. The sample of student work illustrates how one learner approached the task.

Young Scientists' Think Time

Force & Motion 15

Circle the action or 'to do' words and underline the key words that will help you answer the questions.

Question: How does the angle of the ramp affect the speed of the car?

- **Identify** the Manipulated, responding and two variables you would keep the same.
- **Write** a hypothesis for this question.

Young Scientists' Think Time

Force & Motion 15

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Question: How does the angle of the ramp affect the speed of the car?

Identify the Manipulated, responding and two variables you would keep the same.

Write a hypothesis for this question.

speed
~~angle~~ and the ramp I will
keep the same.

I think the angle of the ramp will affect the speed of the car because back ground knowlage.

Identify the parts of the Cars and ramps system: Stand, Ramp, Car, wires, Timer 11e, weights, CPO science,

What are the behaviors of the system? In other words what can the system do?

Drive down the ramp

What are the variables that you can change?

Weights, height of the ramp

What types of energy exist in the system? Where are they present?

Kinetic when the car is moving, Potential before car starts moving and when it stops. Heat - when car is moving, Sound when car is moving

Energy transformations

Energy starts as..	Energy transforms to..	Where in the system it happens is..
Potential	Kinetic	when car is on top of the ramp. Kinetic when car goes down the ramp.
Potential	Heat	car is on top of the ramp and heat when car goes down.
Potential	Sound	when car is on top of the ramp. Sound when it goes down the ramp. Sound when car bumps at the end of the ramp.