Blood Spatter

Part of: **Dartmouth Rural STEM Educator Partnership**
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Driving Question	Overview
Single big question addressed by this lesson.	Brief (1-2 sentence) description of the lesson.
How can we use simulated blood spatter to determine where the blood could have come from?	**The students will make fake blood and utilize fake it to simulate blood spatter. They will then use scientific tools to record observations between height the blood was dropped and the diameter of the blood droplets.**
NGSS Standards	**Objectives**
MS-PS2-2. The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion.	Through this lesson, students will (2-3 measurable objectives):
CCC: MS-PS2-3. & MS-PS2-5. Cause and effect relationships may be used to predict phenomena in natural or designed systems.	1. **Determine how the size of blood spatter correlates to the distance from which the blood fell** 2. **Graph the distance the blood fell with the average diameter of the blood droplets to observe the trend.**
SEP: MS-PS2-2. Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.	

Materials

What materials are needed to run the lesson?

Simulated blood
- Cornstarch
- Corn syrup
- Red food coloring
- Water
- Fork or spoon

- Tablespoon
- Paper bowl

Blood spatter experiment
- Scissors
- Pen or pencil
- Paper or cardboard
- Tape measure
- Ruler with millimeter marks
- Chair or stepping stool

Graphing data
- Graph paper or computer with graphing sheet software

Preparation
What needs to be prepared before the lesson?

- Cut paper/cardboard to the proper size (~ 12 x 12 inches)
- Acquire enough materials for each group

Background information
Any background information that may be helpful to the teachers?

Blood spatter found at a crime scene can be an important part of understanding where a person who was injured at a crime scene was when they were injured.

Story line to frame the lesson

You are looking forward to having your favorite snack when you get home from school, cheese and crackers. But then you get home you notice the cutting board and knife on the counter but your favorite block of cheese is nowhere to be found.

While looking for evidence of who stole the cheese you notice some droplets of blood on the counter and floor. Interestingly, it appears that someone must have cut themselves while slicing the cheese. How can you use this blood spatter to find the culprit? You could follow the trail of blood droplets, find someone who has a fresh knife wound, or even match the sequence of the DNA in the blood. But did you also know that you can use the diameter of the blood spatter droplets to give you information about how far the blood fell. Learning this technique of blood spatter analysis could provide valuable information about how tall the person is or where they cut themselves.

Lesson
Detailed description of the lesson with sub-headings as needed.

Make simulated blood
1. Measure 2 tablespoons of cornstarch and place into the bowl
2. Add 2 tablespoons (or 30 mL) of water to the bowl and mix with fork until smooth
3. Add 4 tablespoons (or 60 mL) of corn syrup to the bowl and mix until smooth

4. Add several drops of food coloring until you reach the desired red color

Blood spattering
1. Label a piece of paper/cardboard for each of the heights you intend to test (ex: 10, 30, & 90 cm) and lay them out apart from each other.
2. Work with a partner, one partner will hold the tape measure at the height you decided on and the other partner will fill the dropper with the simulated blood and drop ~20 drops onto the paper/cardboard.
3. Repeat step 2 with each of the height you decided on. Note: The greater difference in heights you drop the simulated blood from the greater difference you will see in drop diameter.
4. Once the drops have dried, ~20 minutes, measure the diameter of each of the drops for each condition. Be sure to record the data in a table similar to the example table below, this can be in your lab notebook on on the computer.

	Drop height (cm), Drop diameter (mm)		
Drop number	**10 cm**	**30 cm**	**90 cm**
1	5 mm	6 mm	6
2	4 mm	6 mm	7
…	5 mm	6 mm	6
20	6 mm	5 mm	7

5. Once you have record the data graph the data calculate the average diameter of the drops for each condition. (Sum of the diameter of all the drops/number of drops = average for each condition)
6. Once you have calculated the average of each drop height then graph the drop diameter on the x-axis and the drop height on the y-axis.
7. Think about your data and write down what trends you notice and how could that help you solve a mystery where you found blood spatter.

Evidence of Learning
How will students demonstrate their learning? Exit questions?

Extensions
How could this lesson be extended?

- Instead of dropping straight down you could try dropping the blood from different angles or while moving

Glossary of terms
Include a glossary of terms if needed.

Appendices
References or other materials as needed.

Science Buddies: https://www.sciencebuddies.org/science-fair-projects/project-ideas/Phys_p066/physics/forensics-measure-blood-spatter