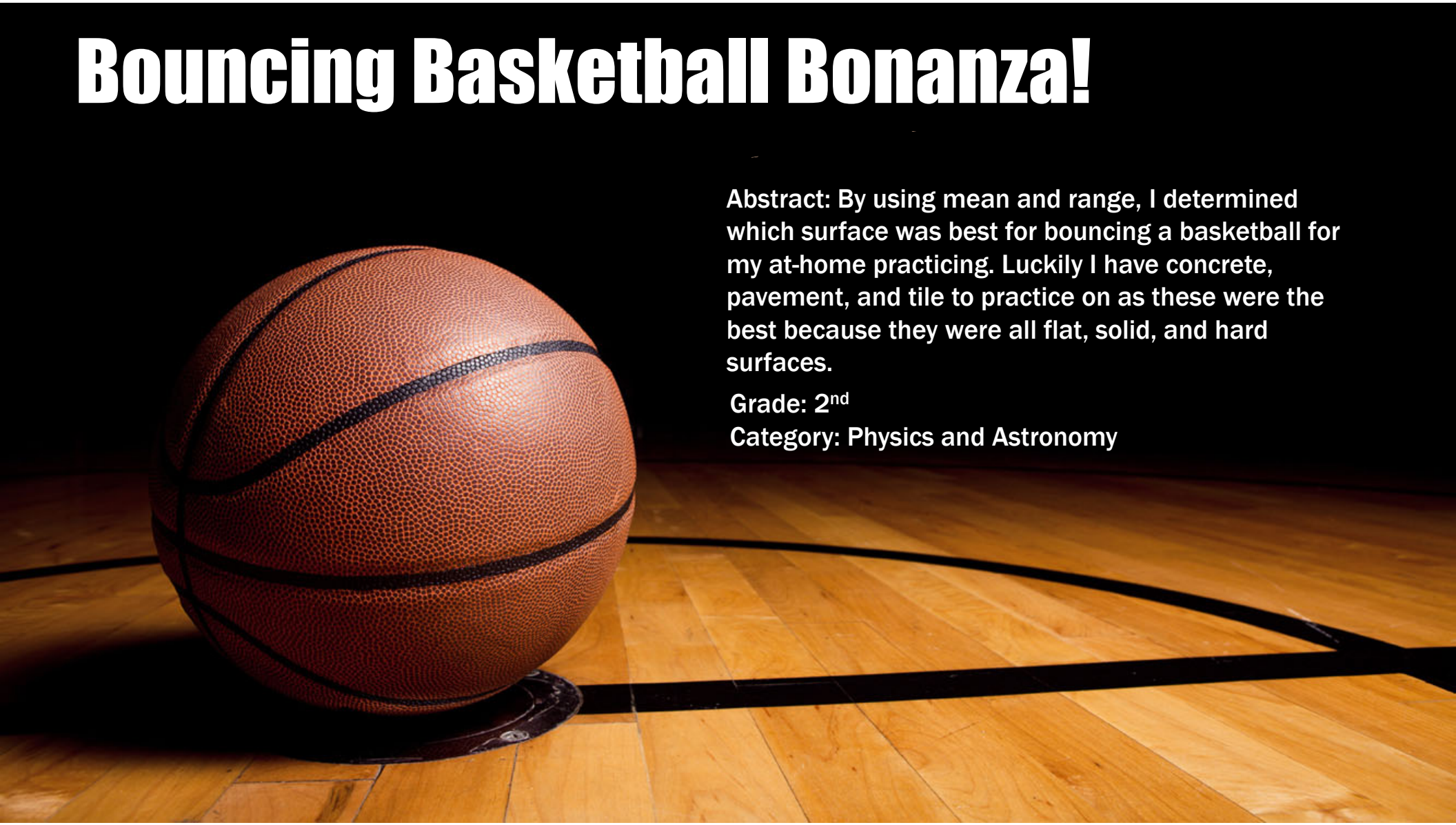
Bouncing Basketball Bonanza!



Abstract: By using mean and range, I determined which surface was best for bouncing a basketball for my at-home practicing. Luckily I have concrete, pavement, and tile to practice on as these were the best because they were all flat, solid, and hard surfaces.

Grade: 2nd

Category: Physics and Astronomy

Introduction

I have been playing basketball and I wanted to perform an experiment about basketball for SARSEF.

I like dribbling and shooting to help my team. Since I don't have a wooden basketball court at home, I wanted to figure out the best surface to practice my dribbling.

Which surface will cause the basketball to bounce high and consistent?

It will help people who don't have a basketball court at home.

Research

I did my research at the library. I used its computers and books.

When a basketball hits the ground, it deforms because the air is always pushing out. It deforms for less than a second.

Newton's Third Law of Motion is that every action has an equal and opposite reaction. This means the surface pushes against the basketball.

I learned about mean, median, mode, and range. Mean is the sum of all the numbers in a set divided by the number of values. Range is the number between the biggest number and the smallest number. Median is the value that falls in the middle. The mode is the most common number in a set.

Hypothesis

In this experiment, I want to learn the surface that bounces the basketball high and consistently. I think that a surface that is flat, solid, and hard will do this. My hypothesis is that either pavement, concrete, or tile will be the most consistent and have the highest bounce.

Surface	Flat	Solid	Hard
Concrete	✓	✓	✓
Grass		✓	
Dirt		✓	✓
Pavement	✓	✓	✓
Big Rocks		✓	✓
Foam		✓	
Tile	✓	✓	✓
Water	✓		

Table 1: Noting Surface Traits

Materials and Setup

- Materials
  - Basketball
  - Air pump
  - Tape measure
  - Surfaces to test
  - Step stool
  - Safety glasses
  - Duct tape
  - Broom
  - Lab partner
- Setup
  - Place the step stool in position.
  - Duct tape the tape measure to the step stool handle.
  - Place the broom next to the step stool so you know where to drop the basketball.
  - Use the air pump and pump the basketball up.
- Control
  - Height of drop
  - Basketball air pressure
- Variables
  - Surfaces
    - Concrete
    - Grass
    - Dirt
    - Pavement
    - Big Rocks
    - Foam
    - Tile
    - Water

Image 1: Setup

Procedure

1. Use setup for each surface
2. Ensure you drop the basketball at the top of the broom
3. Drop basketball
4. Partner records bounce height
5. Describe bounce (up and down, sideways)
6. Repeat Steps 2 – 5 for 10 measurements
7. Move to new surface and repeat
8. Perform data analysis

Image 2: Mid-bounce

Data Results (All Measurements in Inches)

Test	Big Rocks	Tile	Foam	Water	Concrete	Grass	Dirt	Pavement
1	44.0	42.5	38.5	0.0	39.0	33.0	35.5	39.5
2	14.0	42.5	40.5	0.0	39.0	33.0	38.5	39.5
3	24.0	41.5	39.5	0.0	39.0	32.5	37.5	39.5
4	6.0	42.5	40.5	0.0	39.0	31.5	38.5	39.5
5	5.0	40.5	40.5	0.0	39.0	33.5	38.5	39.5
6	18.0	40.5	41.5	0.0	39.0	34.5	37.5	39.5
7	6.0	40.5	41.5	0.0	39.0	35.0	38.5	39.5
8	8.0	41.5	41.5	0.0	39.0	35.0	38.5	38.5
9	10.0	40.5	41.5	0.0	39.0	34.5	37.5	38.5
10	39.0	41.5	40.5	0.0	39.0	31.5	37.5	39.5
Mean	17.4	41.4	40.6	0.0	39.0	33.4	37.8	39.3
Median	12.0	41.5	40.5	0.0	39.0	33.3	38.0	39.5
Mode	6.0	40.5	40.5	0.0	39.0	33.0	38.5	39.5
Range	39.0	2.0	3.0	0.0	0.0	3.5	3.0	1.0

Table 2: Data Results and Calculations

Experiment Pictures and Observations

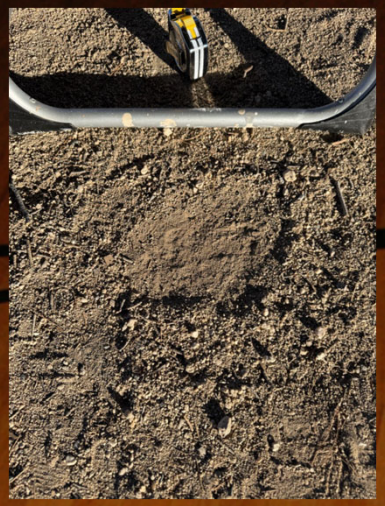


Image 3: Dirt

Image 4: Big Rocks

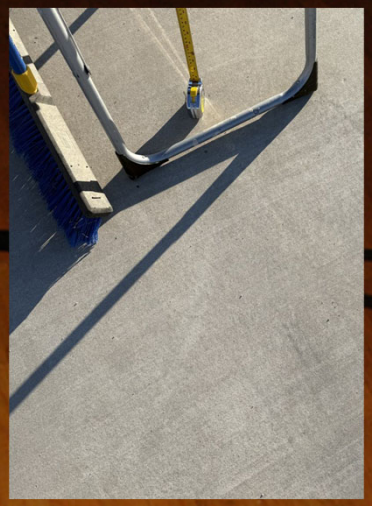


Image 5: Concrete

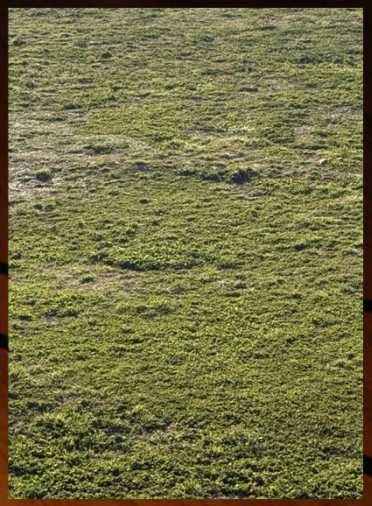


Image 6: Grass

Observations:

- Dirt – Bounced up and down
- Big Rocks – Random bouncing
- Concrete – Bounced up and down
- Grass – A little to the side, but mainly up and down

Experiment Pictures and Observations

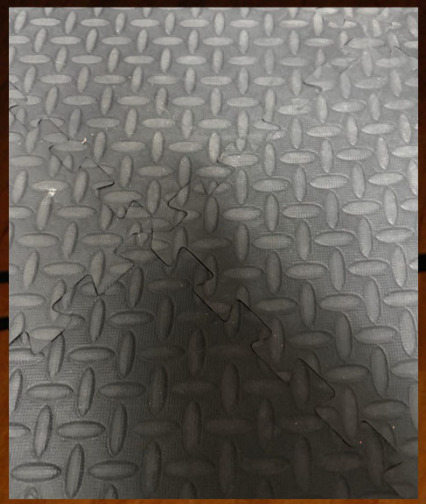


Image 7: Foam

Image 8: Tile

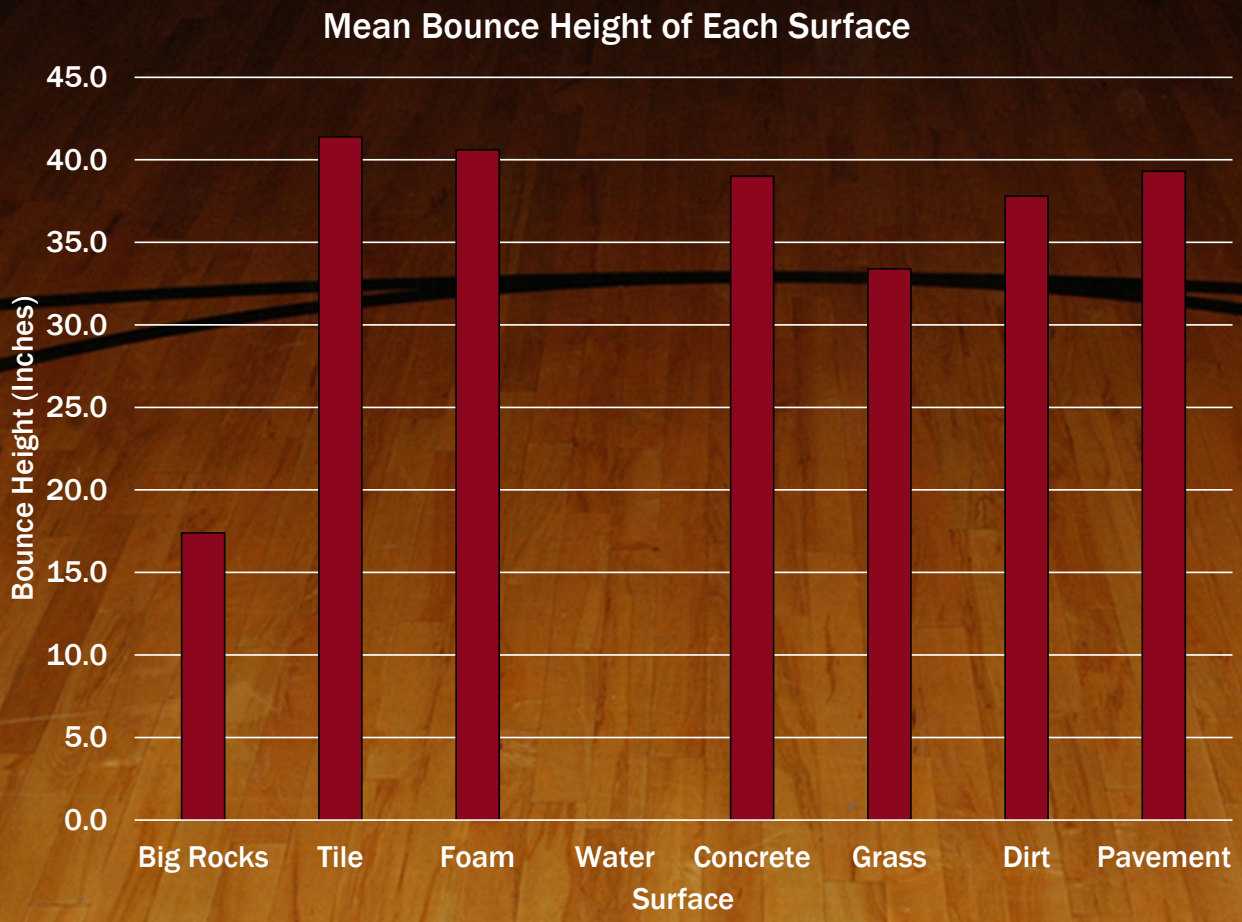
Image 9: Water

Image 10: Pavement

Observations:

- Foam – Bounced up and down
- Tile – Bounced up and down
- Water – No bounce
- Pavement – Bounced up and down

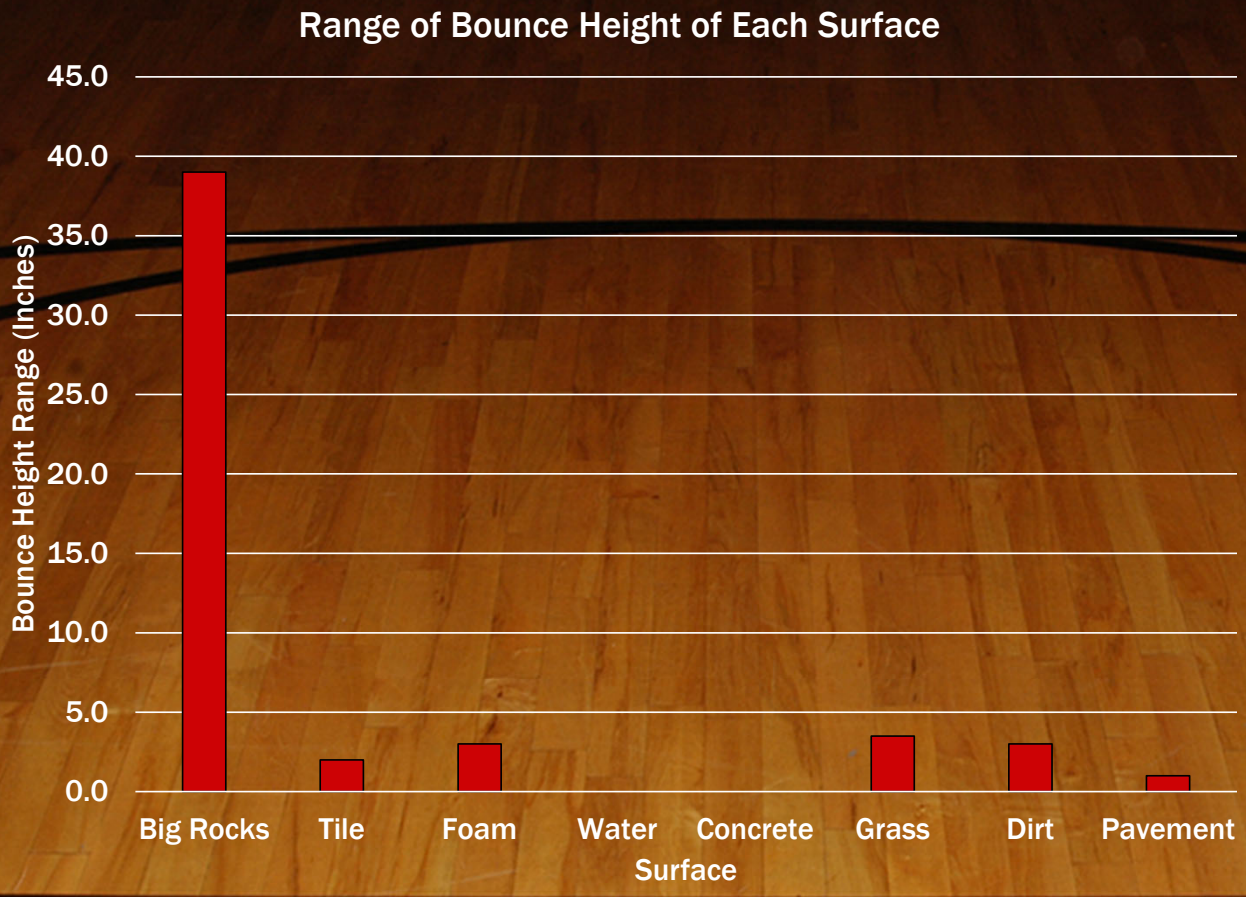
Data Analysis



Surface	Mean Bounce Height (Inches)
Big Rocks	17.4
Tile	41.4
Foam	40.6
Water	0.0
Concrete	39.0
Grass	33.4
Dirt	37.8
Pavement	39.3

Table 3: Mean Bounce Heights

Data Analysis



Surface	Range of Bounce Height (Inches)
Big Rocks	39
Tile	2
Foam	3
Water	0
Concrete	0
Grass	3.5
Dirt	3
Pavement	1

Table 4: Range of Heights

Data Analysis

Rank	Surface	Mean Bounce Height (Inches)
1	Tile	41.4
2	Foam	40.6
3	Pavement	39.3
4	Concrete	39.0
5	Dirt	37.8
6	Grass	33.4
7	Big Rocks	17.4
8	Water	0.0

Table 5: Ranking of Mean Bounce Heights

Rank	Surface	Range of Height (Inches)
1	Water	0.0
2	Concrete	0.0
3	Pavement	1.0
4	Tile	2.0
5	Foam	3.0
6	Dirt	3.0
7	Grass	3.5
8	Big Rocks	39.0

Table 6: Ranking of Range of Heights

Discussion and Interpretation

In review of the data, the highest mean bounces are tile, foam, pavement, and concrete. The lowest ranges are water and concrete, pavement, and tile. I think the highest mean shows the average bounce and the lowest range is important because low range gives you a good estimate of the bounce consistency. We need to look at both the range and mean together because we want a consistently high bounce. For example, if you look only at range, you won't know what bounces the highest. Water is tied for best range but is last in bounce height.

In conclusion, my hypothesis was correct because concrete, pavement, and tile had the best results for mean and range combination.

Implications and Ideas for Future Research

If I were to perform this experiment again, I would use a camera to see how high the basketball bounced to be more accurate. It was hard to follow with the eye. It was especially hard bouncing on the big rocks since it would bounce to the side or up.

I would experiment on the wooden court to see how it compared to the other surfaces and to see if the other surfaces were better.

This research will help people who don't have a wooden basketball court at home.

It was cool to learn about how the NBA performed experiments on new basketball material to see if the new material was easier to control than leather. It was not.

I would like to perform experiments for the NBA.

References

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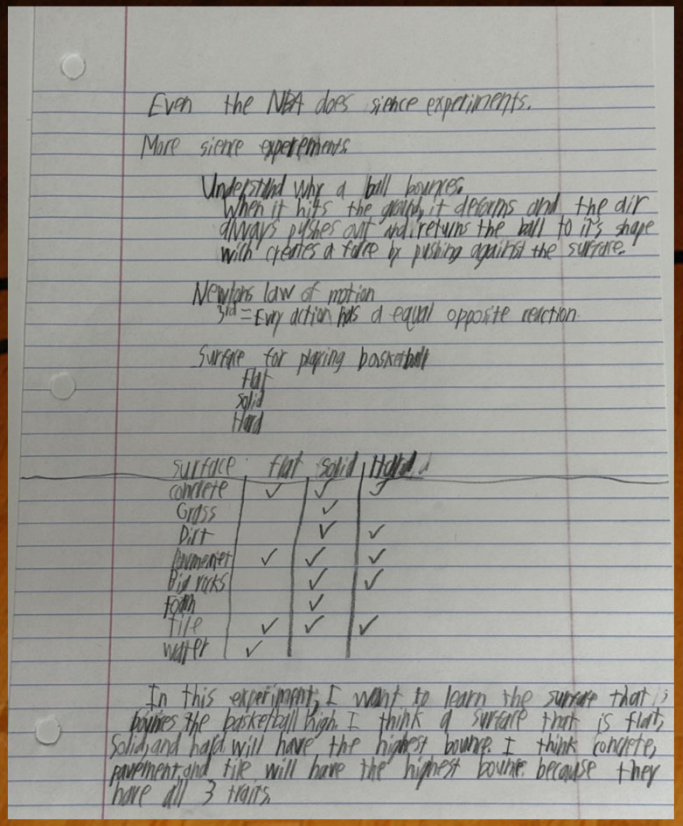
Lab Notebook



Even the NBA does science experiments.

More science experiments

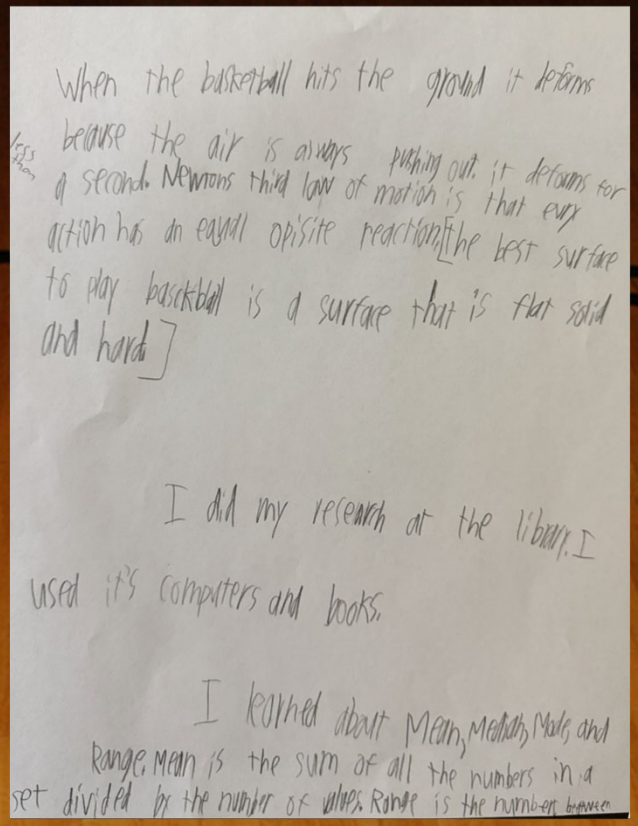
Understand why a ball bounces.
When it hits the ground, it deforms and the air always pushes out and returns the ball to it's shape which creates a force by pushing against the surface.

Newtons law of motion
3rd = Every action has a equal opposite reaction

Surface for playing basketball
Flat
Solid
Hard

Surface	Flat	Solid	Hard
concrete	✓	✓	✓
Grass		✓	
Dirt		✓	✓
pavement	✓	✓	✓
big rocks		✓	✓
foam		✓	
Tile	✓	✓	✓
water	✓		

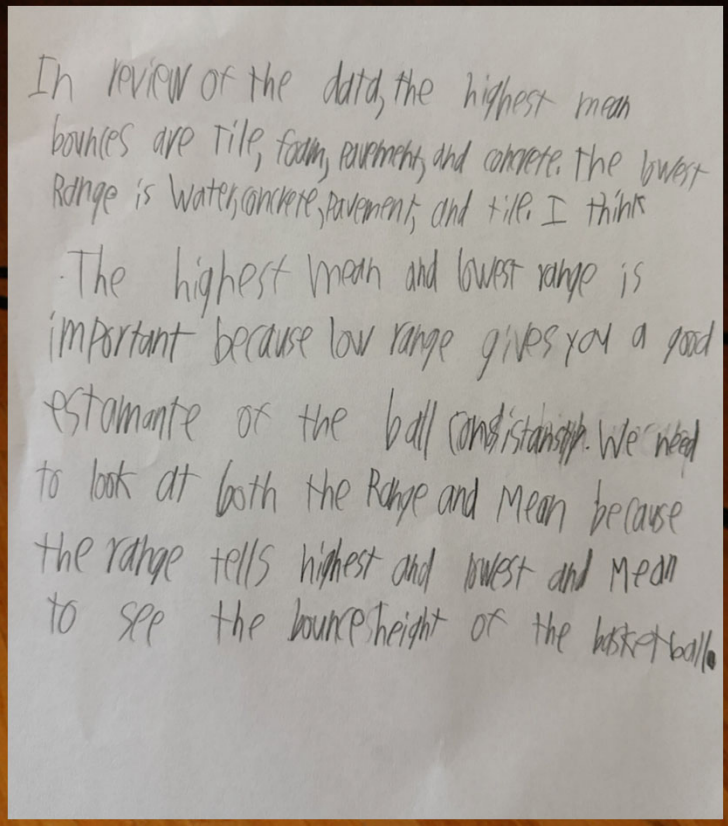
In this experiment, I want to learn the surface that bounces the basketball high. I think a surface that is flat, solid, and hard will have the highest bounce. I think concrete, pavement, and tile will have the highest bounce because they have all 3 traits.



When the basketball hits the ground it deforms because the air is always pushing out. it deforms for a second. Newtons third law of motion is that every action has an equal opisite reaction. The best surface to play basketball is a surface that is flat solid and hard.

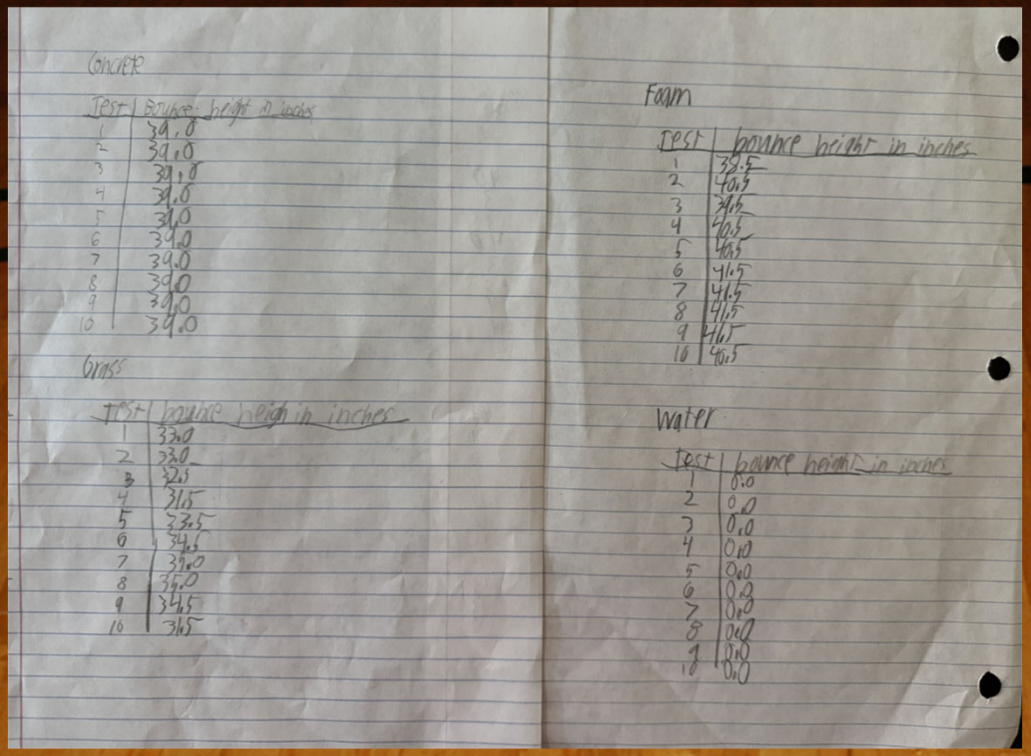
I did my research at the library. I used it's computers and books.

I learned about Mean, Median, Mode, and Range. Mean is the sum of all the numbers in a set divided by the number of values. Range is the number between



In review of the data, the highest mean bounces are Tile, foam, pavement, and concrete. The lowest Range is Water, concrete, pavement, and tile. I think the highest Mean and lowest range is important because low range gives you a good estamante of the ball consistansiph. We need to look at both the Range and Mean because the range tells highest and lowest and Mean to see the bounce height of the basketball.

Lab Notebook



Concrete

Test	Bounce height in inches
1	34.0
2	34.0
3	34.0
4	34.0
5	34.0
6	34.0
7	34.0
8	34.0
9	34.0
10	34.0

Grass

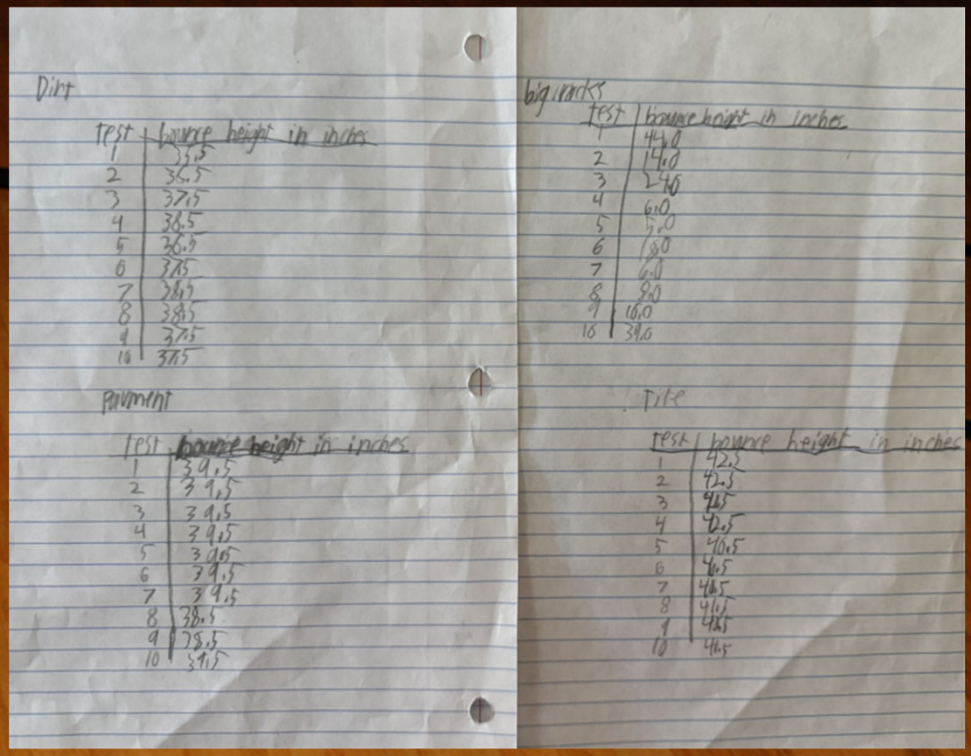
Test	bounce height in inches
1	33.0
2	33.0
3	32.5
4	31.5
5	33.5
6	34.5
7	34.0
8	34.0
9	34.5
10	36.5

Foam

Test	bounce height in inches
1	32.5
2	40.5
3	34.5
4	40.5
5	40.5
6	41.5
7	41.5
8	41.5
9	41.5
10	40.5

Water

Test	bounce height in inches
1	0.0
2	0.0
3	0.0
4	0.0
5	0.0
6	0.0
7	0.0
8	0.0
9	0.0
10	0.0



Dirt

Test	bounce height in inches
1	35.5
2	36.5
3	37.5
4	38.5
5	36.5
6	38.5
7	38.5
8	38.5
9	37.5
10	37.5

Pavement

Test	bounce height in inches
1	39.5
2	39.5
3	39.5
4	39.5
5	39.5
6	39.5
7	39.5
8	38.5
9	38.5
10	39.5

big rocks

Test	bounce height in inches
1	44.0
2	14.0
3	46
4	6.0
5	4.0
6	8.0
7	6.0
8	8.0
9	16.0
10	34.0

Bike

Test	bounce height in inches
1	42.5
2	42.5
3	42.5
4	42.5
5	40.5
6	46.5
7	46.5
8	41.5
9	42.5
10	41.5