**Factors affecting ball bounce**

**Levels:** 4-5  
**NoS achievement aims:** Understanding about science, Investigating in science   
**Contextual strands:** Material world   
**Topic:** Sports studies

**Rationale**

The combination of the material properties of a ball (surface textures, actual materials, amount of air, hardness/ softness, and so on) affects the height of its bounce.

The complexity of this investigation encourages students to begin to think critically about the design and results of the investigation.

**What you need**

* A variety of balls that could be grouped according to one or more of their properties, for example:
  + table tennis ball, golf ball, squash ball, solid rubber ball (similar sizes)
  + solid rubber balls in different sizes (similar materials)
  + old and new tennis balls (different surface textures/ages).
* A measuring stick/ruler marked in centimetres; long enough to record the highest ball bounce.
* A similar length stick, marked in 5–10cm bands of colour.

**Focus**

* What makes a ball bouncy? Collect a range of ideas from the students.
* How can you tell which factor (for example, size, material, surface texture, age) is most important in making the ball bouncy? How could you test this?
* How would you make sure your method could be repeated in the same conditions?
* What measurements would you take to gather your data?
* Encourage students to rank a series of balls based on what they think is important, and prepare to test them in that order. For example, if they think size is important, they might prepare to test balls of similar materials, ranging from small to large.
* Could the same ball act differently in different conditions?

**Exploration**

Note: In this situation, no single fair test will give a conclusive result (which is typical of scientific work); even though students may do their best to design a fair test, it will not be possible to isolate the material variables of each ball, which combine to make it bouncy.

Note: This activity may pose difficulties with stopping the ball in the moment of its greatest bounce height, and dealing with parallax. Using a camera, and/or a banded ruler, can help overcome these problems.

1. Get the students to develop a fair test to compare the height of bounce for each ball, using the first measuring stick/ruler.
2. Have them list all the variables they think will affect ball bounce. (Their ideas might include surface texture, colour, size, what it’s made of, squashiness, opacity, weight, air pockets, temperature, cost, shininess/dullness, hardness/softness, age, layers of materials.)
3. Get them to share their ideas on which variables they can test, which they cannot test, and why.
4. Have them take turns:
   * dropping each ball from an agreed height
   * determining the maximum height of the bounce.
5. Have them record their results.
6. Discuss any variation in measurements, and get the students to suggest what the possible variables might be. For example, you could ask:
   * What are the variables around dropping the ball?
   * What are the variables around determining the height of the bounce? (For example, deciding when the ball is at its height.)
   * Does the height of the person making the reading have any effect on the reading itself? (For example, do taller students consistently take a different reading, compared with shorter students?) If so, why?
7. Use this line of questioning to lead to a discussion on parallax (an apparent displacement of an object, for example, a ball, with respect to a more distant background (for example, a measuring stick, when viewed from two different positions.)
8. Get students to repeat the measuring exercise using the colour-banded stick, and record where, within the bands, each type of ball bounces.
9. Focus the students on the aim of the experiment (that is, to determine a pattern from which to make comparisons, rather than to gather specific measurements), and discuss:
   * Which is the better method for this activity?
   * Why one method might be chosen over the other in different circumstances?

**Reflection**

* How much data do you need to collect before you can develop some degree of certainty for making a statement about the patterns in your data?
* What pattern(s) did your tests show? How did the pattern(s) compare with what you expected?
* How relevant do you think your data is? How certain are you about its accuracy?
* How could you improve the accuracy of the information you have collected?
* When you were setting up the fair tests, how did you decide what to test?
* On the basis of the fair tests you carried out, what seem to be the material properties of bounciness? What other tests might you need to do to check these assumptions?
* Can you isolate the most important property which determines the ball height?
* Do you think you have carried out even one fair test? Is it a fair test if you can’t account for all the variables in a ball?