Particle Theory Demonstration

This project will target 5th grade students and will meet Standard 5.2.1: “Develop and use a model to describe that matter is made of particles on a scale that is too small to be seen.” It is designed for homebound students and will teach them the states of matter using the particle model, in which molecules are represented by small spheres (Bitesize, n.d.). The video will be animated and will demonstrate the behavior of particles in each of the three basic states of matter. Solids are made of tightly packed, fixed, vibrating particles and for the purposes of the video, they will be arranged into a square. Liquids consist of particles that are close together but move past each other freely. They will be represented by a translucent box containing a mass of particles that are constantly moving, never straying too far from the other particles. Gases consist of particles that are fast moving but far apart. They will be represented by a translucent box filled with few particles to emphasize the particles’ chaotic nature. They will move quickly and bounce against the corners of their container.

The demonstration will depict the ideas expressed in the video using household objects. It will involve blue beads, a large sandwich bag (i.e. Ziploc), a large bowl, and an empty milk jug with a cap. Presumably, the teacher or student performing the demonstration will already have the sandwich bag, bowl, and milk jug in their house. The blue beads can be found at Walmart for less than $10. The beads should be kept out of reach of any small children that live with the student or teacher. The bag and jug can be thrown in the trash or the recycling bin. First, the demonstrator will fit as many beads as they can into the sandwich bag until it is completely full. They will seal the bag and then shake it. This represents the solid state. The demonstrator will then place a handful of beads into the bowl and then move it from side to side. This represents the liquid state. The demonstrator will place 3-5 beads into the milk jug, twist the cap on, and then shake it. This represents the gas state.

The accompanying activity will be a worksheet that invites students to write down observations based on both the demonstration and the video. They will write about how the sandwich bag demonstrates the solid state, the bowl represents the liquid state, and how the milk jug represents the gas state. They will connect what they learned to the three states of water and will be asked to illustrate the particles in a block of ice, a glass of water, and a balloon filled with water vapor, emphasizing the motion in each particle.

Inviting students to build a physical model of the particle model instead of using an online simulation will increase engagement with the material (Langbeheim & Levy, 2019). Combining this activity with the accompanying animation and water worksheets will help students engage the material in different contexts, allowing students “to practice the new concept on similar tasks as well as to apply it to everyday phenomena” (Nieswandt, 2001).

Bibliography

Bitesize (n.d.). *The three states of matter*. London, England: BBC. Retrieved from <https://www.bbc.co.uk/bitesize/guides/z93jfcw/revision/1#:~:text=The%20three%20states%20of%20matter%20are%20solid%2C%20liquid%20and%20gas,of%20particles%20in%20a%20substance>.

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