What is an Effective Way to Teach Science Topics Such as Objects That Sink or Float?

What is the most effective way to teach children about objects that sink and float (perhaps in an effort to correct misconceptions)? There are many answers to this question. Most published programs focus on a set of questions and investigation is done by following step by step instructions (Henser, 2005). These programs will align with standards, but student motivation may be low and hands-on investigations limited. Research has indicated that the most effective way to teach topics of science such as objects that sink and float is through hands-on learning experiences and more specifically through inquiry learning. Researchers/authors tend to agree that hands-on learning experiences are the most effective way to learn about science. Hands-on learning, during a science unit on things that sink and float allows children to explore the concepts of mass and density (Bryner, 2005; Kim & Smithenry, 2010). What is different however is the approach to hands on learning. The authors have claimed that hands-on science means that children will have opportunities to think like scientists. They make predictions, observe what happens during the experiments, and then explain their observations (Henser, 2005; Yin, Tomita, & Shavelson, 2008; Kim & Smithenry, 2010).

The amount of freedom children have in determining the type of investigations they conduct and questions they seek to answer will vary depending on the teacher leading them and student experience with the inquiry approach. With very young children and sometimes with older, a narrow experiment will be planned and then lead by the teacher as the children observe (Kim & Smithenry, 2010). Ideally science inquiry features these three elements; student choice, hands
one experiments, and opportunities for discussion and writing so that student can process thoughts from the investigation (Henser, 2005; Kur & Heitzmann, 2008). Science inquiry should help students gain scientific insight and increase their understanding of science principals. During times of science inquiry students sort and classify materials, design experiments that will answer their wonderings or research questions, and then explain their findings. These children think, test, and explain, much like true scientists might (Henser, 2005; Sharkawy, 2010; Kur & Heitzmann, 2008).

Inquiry Science looks different depending on the classroom culture. Workshops are a popular instructional design for English Language Arts, but a workshop can also be used for science. Science workshop capitalizes on a child’s natural curiosity, by allowing them to ask their own questions and run their investigations. Science workshops are conducted in three phases, explorations, investigation, and reflection. The teacher acts as a guide and facilitator during the workshops, but considerable student choice in questions and procedures ensure that students will be motivated and the investigation will make sense to them. (Henser, 2005)

A key skill that needs to be developed in order for inquiry science to be effective is, asking investigable questions, that is, questions or wonderings that can be answered through science investigation (Sharkawy, 2010). These investigable questions are explored during investigation and then answered and/or presented during science talks. Science talks are an opportunity for children to apply the evidence they collected to support their answers and claims (Kur & Heitzmann, 2008). Their understanding is deepened with the use of science talks. This time for reflection is important because children learn from one another and strengthen their own understanding. Inquiry science approaches encourage the use of science talks, development of
wonderings, and answering of investigable questions through experimentation (Sharkawy, 2010; Kur & Heitzmann, 2008).

Another strategies used in the English Language Arts classroom that could be beneficial in the science classroom is the “Think-Aloud”. Think Aloud is a strategy that develops a student’s ability to think for his or herself, as they question, design investigations, and then support their conclusions with evidence (Martin-Hansen & Johnson, 2006).

In addition to science talks, science notebooks are a valuable tool for the science classroom. There are several ways to use notebook in the science classroom. Importantly, a teacher should be aware of student capabilities, which means significant efforts to scaffold student use of the science notebook may be required. A teacher should also have clear expectations for content and organization for science notebooks (Joyner, 2010). Science notebooks may be used as a place for children to reflect on their science investigations as well as track their questions (Henser, 2005).

What Materials Are Needed to Teach About Objects That Sink or Float?

The materials needed to conduct an experiment around the concept of item that sink and float will depend on the research questions and the depth of learning desired. It is possible to conduct an experiment using ice cubes and water. This experiment is narrow but a visual way to teach how density, mass and volume affect an objects ability to float or capacity to sink (Bryner, 2005). Similar to that experiment is one using plastic eggs and marbles. Students can observe how an item can remain the same volume, but change mass and density as marbles are added causing the egg to sink. The author encourages teachers to take the experiment a step further by allowing children to each choose an item from to test (Kim & Smithenry, 2010). When working with very young children, this type of controlled experiment maybe simpler and more
manageable than an open experiment. A better rounded experiment will result when objects of varied mass, density, volume, shape, and material composition are used. Items may be usual household or classroom objects (Yin, Tomita & Shevelson, 2008; Kur & Heitzmann, 2008, Kim & Smithenry, 2010). Teachers can increase the chances of students debunking their misconceptions by intentionally including objects that will provide counter evidence to preconceived idea (Yin, Tomita, Shavelson, 2008). Teachers may also consider providing a variety of liquids to expand the exploration.

**How Can a Teacher Assess Student Learning During Inquiry Science?**

Pre-assessments taken before the start of a new unit, should engage students, elicit prior knowledge, and identify possible misconceptions. A pretest may consist of several items of varied shape, size, and weight. A student would predict, based on prior knowledge, whether and object would sink, float, or subsurface float. The teacher may choose to have the children further explain their reasoning. (Yin, Tomita, & Shavelson, 2008). Other pre-assessment methods are anticipations guides consisting of true or false statements followed by a groups discussion (Melin & Schiller, 2011)

Formative assessments may take the form of drawings, journals, labeling models, individual interviews, graphic organizers, verbal or written responses, and constructions or demonstrations of what is known (Ashbrook, 2010; McNair, 2004). Rubrics are a valuable tool for the inquiry classroom. Rubrics allow for performance standards to be set. Child friendly rubrics help guide students so that they are aware of the expectations (Melin & Schiller, 2011). Rubrics may be used for assessment of hands-on activities, for science notebook compliance, and
other activities that may inform instruction (Henser, 2005; Joyner, 2010; Melin & Schiller, 2011)
The challenge is ensuring that the assessment aligns with the learning goals.

Conclusion

Research indicates that an effective way to teach science is through inquiry learning. Once prior knowledge and misconceptions have been assessed, a teacher can use this knowledge to plan science instruction that fits the unique class needs. Science in the elementary classroom is both beneficial and engaging to the students when it is hands-on and interactive. Learning takes place when children ask questions and seek answers. Inquiry learning takes advantage of a child’s natural curiosity, Children learn science methods as they record learning in notebooks, ask questions, and conduct experiments using materials that can be found in the home and classroom.
References


