

Teaching Concepts

Philosophy of Teaching and Learning by Meg Davis

An effective science program can offer skills, knowledge, and attitudes that differ from those presented in other subject areas. Doing and understanding science requires a particular set of skills and attitudes.

Understanding scientific principles and how people do science can help make sense of the universe. Several principles govern the study of science. There is the belief that by working together we can possibly gain an understanding of how the world works. Therefore, it is important for scientists to develop the attitude of value in working together. Making a cooperative effort toward understanding phenomena and solving problems requires that people are willing to share their talents and ideas and respect the ideas of others.

It is also believed the universe is ordered and interconnected and knowledge gained by studying a part of it can often be generalized to the understanding of other parts. Scientists rely on data to explain the natural world and have a respect for the value of patterns of thought that lead from observations to explanations.

Knowledge in science is both stable and changing. Scientists must be reasonably skeptical, knowing when to challenge ideas. They must be willing to modify present beliefs and explanations. Investigation often yields new perspectives that are based on an understanding of accepted knowledge and new data.

Developing a set of attitudes toward life can help a person think and make decisions in a scientific way. A desire for knowledge enables one to persist when things become difficult. Cooperation can lead to faster and more reliable solutions. Challenging authority can be the first step to new knowledge. Respecting reasoning and honest observations can lead to new understandings.

It may be difficult for children to develop these attitudes and beliefs, but a good science program can help them begin to appreciate the uniqueness of scientific thinking and reasoning.

A science program that models the attitudes and methods of scientists can give students the opportunity to acquire skills that can lead to the development of these abilities. When developing positive attitudes toward science and their own abilities to understand and manipulate their environment, children can become adept at gathering information, analyzing that information and drawing conclusions based on their observations. They can begin to understand the order of the universe and the value of reasoning.

A curriculum based in cooperative problem solving can provide the climate for constructing knowledge and developing the skills necessary to independently investigate and make sense of the natural world. The basic skills of using equipment and making observations are critical parts of working in a scientific way.

There are teaching behaviors that will enable students to develop these skills. Teachers should be accepting of student autonomy, initiative and leadership. Lessons should be organized around the thinking of the students. Teachers should ask open ended questions that require thinking and should increase their wait time when questioning students. They should give students time to elaborate on their answers. Students should be encouraged to explain their thinking and they should listen to the thinking of others. Students should receive training in effective group processes and should be given ample opportunity to collaborate with others. Teachers should recognize student misconceptions and design lessons that address those misconceptions.

A curriculum that focuses on subjects that are familiar to students offers a means of gaining the interest of students as well as aiding them in making connections between the science content and their own lives. Students can relate to those things that are most familiar to them. When they have gained a basic understanding of those things that are close to home, they may better be able to branch out into the unfamiliar.

Teaching broad concepts will enable students to make more sense of science learning than concentrating on disconnected facts. Often times a series of facts are given to students and they are unable to make connections between them. These facts then become relatively meaningless. When broad concepts are understood, they can be applied to many similar situations so that students are able to explain other phenomena.