making sense of evidence

alternative explanations

theory modification

9-12

In matters that can be investigated in a scientific way, evidence for the value of a scientific approach is given by the improving ability of scientists to offer reliable explanations and make accurate predictions.

From time to time, major shifts occur in the scientific view of how things work. More often, however, the changes that take place in the body of scientific knowledge are small modifications of prior knowledge. Continuity and change are

In science, the testing, revising, and occasional discarding of theories, new and old, never ends. This ongoing process leads to a better understanding of how things work in the world but not to absolute truth.

No matter how well one theory fits observations, a new theory might fit them just as well or better, or might fit a wider range of observations.

The usefulness of a model can be tested by comparing its predictions to actual observations in the real world. But a close match does not necessarily mean that other models would not work equally well or better.

New ideas in science are limited by the context in which they are conceived, and are often rejected by the scientific establishment.

In the long run, theories are judged by the range of observations they explain, how well they explain observations, and how useful they are in making accurate predictions.

Notice and criticize arguments in which data, reasoning, or claims are represented as the only ones worth considering, with no mention of other possibilities.

Hypotheses are widely used in science for choosing what data to pay attention to and what additional data to seek, and for guiding the interpretation of the data (both new and previously available).

In the short run, new ideas that do not mesh well with mainstream ideas in science often encounter vigorous criticism.

6-8

Some scientific knowledge is very old and yet is still applicable today.

Scientific knowledge is subject to modification as new information challenges prevailing theories and as a new theory leads to looking at old observations in a new way.

Different models can be used to represent the same thing. What model to use depends on its purpose.

Scientific investigations usually involve the collection of relevant data, the use of logical reasoning, and the application of imagination in devising hypotheses and explanations to make sense of the collected

Often different explanations can be given for the same observations, and it is not always possible to tell which one is correct.

Hypotheses are valuable, even if they turn out not to be true, if they lead to fruitful investigations.

3-5

Sometimes scientists have different explanations for the same set of observations. That usually leads to their making more observations to resolve the differences.

Keep written or electronic records of information so that the records are understandable weeks or months later.

Scientists' explanations about what happens in the world come partly from what they observe, partly from what they think.

K-2

Raise questions about the world and be willing to seek answers to these questions by making careful observations and trying things out.

When people give different descriptions of the same thing, it is usually a good idea to make some fresh observations instead of just arguing about who is right.