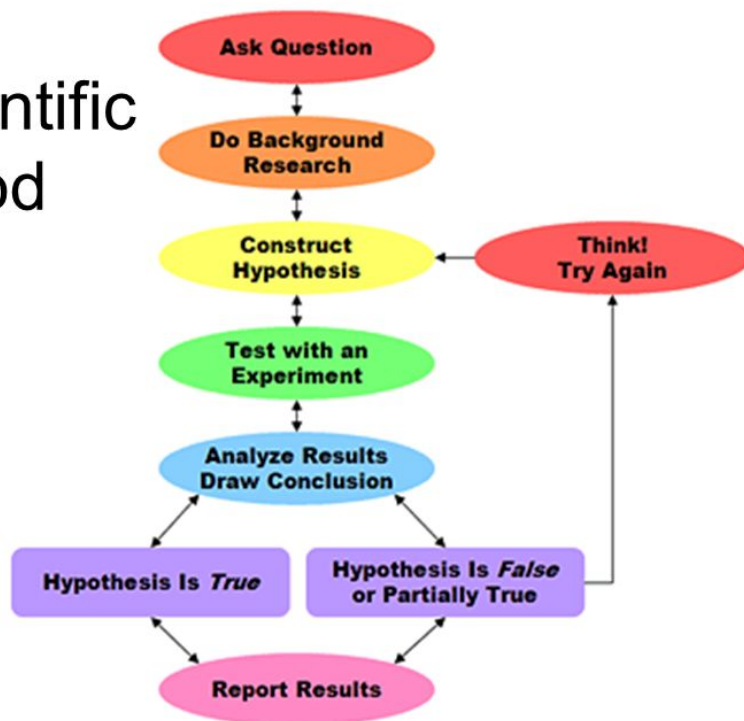


Lesson # 7 The Scientific Method



1. How do we know anything to be true? You know your name, your birthday, the number of people around you at this moment, and any number of facts. But how does anyone fundamentally know anything to be true? Knowledge and facts are acquired by measurement and empirically observed (through the senses).
2. There is a systematic way of knowing and that way is called the Scientific Method. The scientific method consists of asking questions, doing background research, constructing hypotheses, testing hypotheses through experimentation, analysis of data and reporting results.

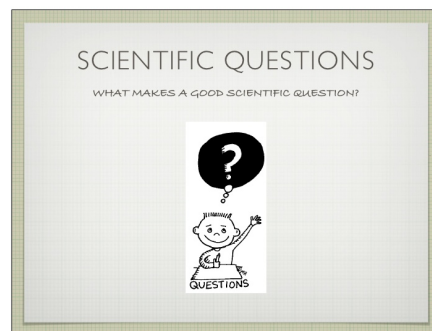
The Scientific Method



3. The scientific method is the only reliable way of knowing things to be true. It minimizes personal bias and belief. It reduces things and systems of things to

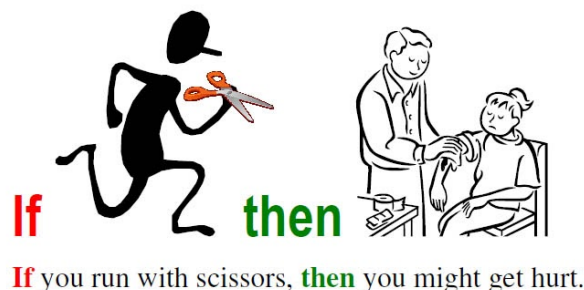
their empirical root in order to uncover the truth. Science and the scientific method allows us to continually verify our observations of the natural world using facts, hypotheses, laws and theories.

4. The scientific method can also be used to test the effectiveness of an engineered designed solution. Once a prototype is built, the prototype can be put through a testing process that determines to what extent the solution meets the design parameters.
5. The first step in the scientific method is to ask a question. A good questions is one that can have an answer and possibly lead to other questions. Good questions tend to build on something you already know and can result in empirical data collection.



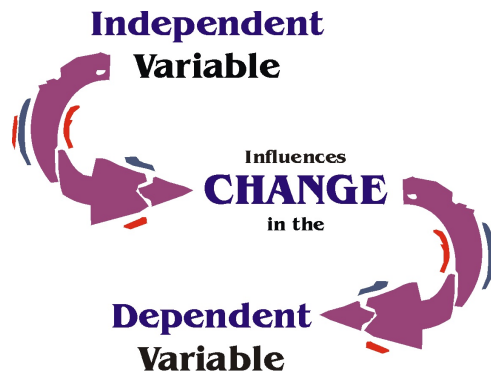
Example: What material has the best cost to strength ratio when used to build a bridge? Is a better question than “What type of bridge is better looking?”

6. The next step in the scientific method is to state a hypothesis. A hypothesis is a statement about an idea that you can test, based on your observations. Your test will involve comparing two things (independent and dependent variables) to find the relationship between them. It can be stated as an “If _____ then _____” statement.



If you run with scissors, then you might get hurt.

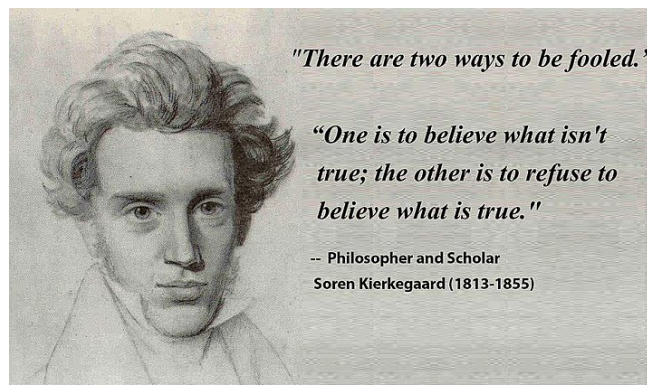
7. Factors that affect your experimental results are known as variables. It is important to test only one variable at a time, this is known as controlling your variables. Variables can be controlled by only changing one variable at a time. The variable you change or manipulate is known as the independent variable and the variable that responds is known as the dependent variable.



8. Designing a fair test involves controlling all the variables so that you can be sure of the cause-effect relationship. Once a fair test is designed then the experiment can be conducted. A large sample size needs to be collected in order to ensure the reliability of data. Test the apparatus at least 30 times.



9. Once the empirical data has been collected then the results can be analysed using basic statistics of mean (average), median (middle value), mode (occurs the most often) or more complex methods such as correlation to show statistical significance. The results can then be reported/communicated to the interested parties.



10. The last and most important step in the scientific method is to **revisit the hypothesis if it is not supported by the results**. This is last step is what gives the scientific method its power. **In the face of contradictory empirical evidence, the researcher does not dogmatically hold to their hypothesis. If new evidence is discovered then new theories need to be explored.**