

Dealing in Hypotheticals

How to use the Scientific Method to solve problems and make better-informed decisions

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Do the words “Scientific Method” conjure up unfortunate memories of junior high school science laboratories with Bunsen burners and formaldehyde-soaked frogs? You might be surprised to realize how this long-forgotten process can help you solve problems you face every day.

From their first days on the job, employees are told that they must be problem solvers. Unfortunately, most employees have never been shown how to analyze problems and research potential solutions. The Scientific Method addresses this issue in a straightforward and easy-to-follow manner.

As you may remember from that science class long ago, the Scientific Method includes these steps: (Adapted from *NFPA 921: Guide for Fire and Explosion Investigations*, National Fire Protection Association)

1. Identify the problem.
2. Collect and analyze data (inductive reasoning).
3. Develop a hypothesis.
4. Test the hypothesis (deductive reasoning).
5. Select final hypothesis.

The Scientific Method follows some straightforward rules to test out theories. You start by defining the problem you are trying to solve. You collect data about the problem and organize it into a useful form. Then you develop a hypothesis to test. A hypothesis is a tentative assumption made in order to draw out and test its logical consequences. You test that hypothesis and accept it, modify it, or replace it with another hypothesis. After completing the testing, you select a final hypothesis.

Let's study each step in more detail.

1. Identify the problem. State the problem clearly and succinctly. In beginning to develop the hypothesis, you may realize that you have an entirely different problem than you originally thought. There's an old joke about a consumer who called the help desk for assistance with a computer monitor that appeared to have turned itself off. After a certain amount of time spent asking questions trying to determine what was wrong, the help desk staff member suggested that the consumer confirm the cords were plugged in tight. The consumer responded that he couldn't see well enough to tell as it was too dark. Why was it dark? Because the power was out! Having a clear understanding of the problem would have saved an enormous amount of time.

If your boss requests a trip to Lisbon, Portugal, in 24 hours, it doesn't matter

how you get it done. Several factors may limit your choices, such as time of departure or arrival required, corporate budget, the necessity for a visa, etc. Some factors may shut down the process if they are not addressed immediately, such as an expired passport. Recognizing which factors actually influence the process will enable you to efficiently find an answer.

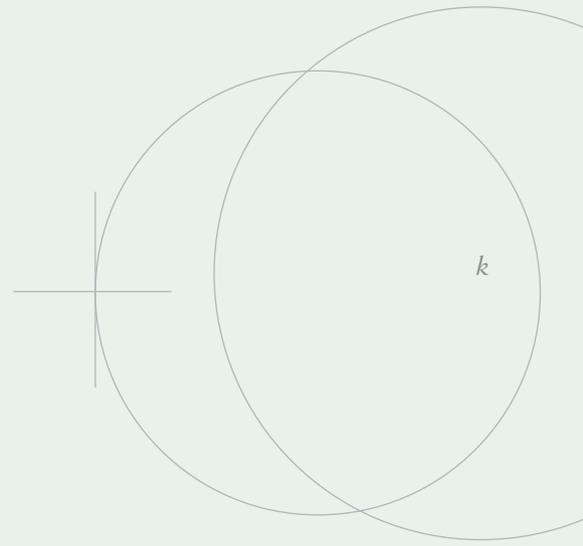
2. Collect and analyze data (researching the problem). Researching the problem ensures you have a clear understanding of what is needed for a solution. Questions you should ask yourself include:

- What is the greatest limiting factor? In scenarios, the limiting factors may vary.
- What deadlines are involved?
- What are the human resource requirements?
- What is the budget available?
- Is any special equipment or machinery required?
- Is any step dependent on any other step being completed first?
- Do we need the final product/data in any particular format?
- Are any forms or permits required?

Taking the time now to notify the appropriate parties can save you time later. For example, it would be unwise to roll out a new computer-training program without involving the accounting department (to confirm the budget is approved) and information technology department (the physical software needs to be installed on the machine), the administrative professionals (who may need to coordinate the attendees' schedules), etc.

3. Develop a hypothesis. This step includes examining as many hypotheses

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as possible, eliminating obviously poor choices, and evaluating likely choices. You shouldn't be too quick to dismiss an idea that appears unworkable on the surface. It may serve as a springboard to a solution that would work with a little tweaking. You might choose to perform a simple side-by-side comparison weighing the pros and cons to help narrow down the choices.

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Finally, you have to choose a hypothesis. This is only a theory. It hasn't yet been proven that it is the only answer or even a solution. You should not pre-judge what alternative is best.

The process of pre-judging a solution (the "early blur theory") has been studied extensively. Two groups were shown blurred images on a screen. One group was told to guess up front what the image was (as it was gradually brought into focus) and the other group was told not to say anything until they were positive what the image was. The group that was told to guess took longer to get the answer correct because they were looking at elements of the image to prove that their guess was correct, rather than looking for elements to prove that the guess was wrong. The other group came to the correct conclusion earlier because they waited until they had sufficient facts to make their decision.

Companies have wasted hundreds of thousands of dollars by making assumptions about best choices too early in the process. A well-known beverage manufacturer introduced a modified version of

its flagship product, which ultimately caused an enormous and unpopular backlash from consumers. A car manufacturer introduced a vehicle in Mexico and then discovered that the name translated into something unfortunate in Spanish. Additional research might have prevented these incidents from happening.

4. Test the hypothesis. Once you have formed a hypothesis, you need to test that it works. This might involve calling vendors for price checks, interviewing people who have done a similar project or procedure, reading about the subject, creating a spreadsheet to run the numbers, etc. If you have access to library services, you might enlist the librarian's help to research the literature for similar problems and solutions that did or did not work. You may encounter impartial evidence that disproves your hypothesis. You have three choices if this happens.

- Disregard the evidence and continue.
- Change your hypothesis to allow for the new evidence.
- Discard your hypothesis and choose another.

It is not uncommon to revise your hypothesis several times as new information becomes available. This flexibility benefits you as an individual in addition to your company by allowing you to adapt to change more quickly and respond to changing market conditions. If you aren't locked into a certain solution, you can modify it to meet the needs of the company or the client.

5. Select the final hypothesis (draw conclusions). Eventually, you will come to a hypothesis that is proven correct or, at the very least, you are unable to disprove. After running the tests, you will be

able to draw conclusions, which are definitive statements. You should not come up with a conclusion first and then create research that proves your conclusion. Approach all problems with an open mind and don't pre-judge what the solution should be.

Applying the Scientific Method

Using the five steps of the Scientific Method is easier than you think, and it will help you to resolve many of the problems you face daily. By defining the problem clearly, researching the options, developing and testing hypotheses, and drawing conclusions, you will be able to proactively approach any problem you encounter. The key elements to consider are having a thorough understanding of the problem, involving appropriate people in the process, and recognizing that sometimes the best answer is a melding of more than one option. Keep an open mind. Approach all problems without pre-judging what the solution should be.

The following sample case studies demonstrate the theories and principles of the Scientific Method being applied to everyday problems.

● *How can you save the company money while choosing a new travel provider?*

Problem: Your boss and colleagues have been complaining about your company's travel agent's price increase. Your working hypothesis is that this company charges too much and there are less-expensive competitors.

Research: Look through old files to see when the agent last increased prices and, if possible, any pattern or percentage of

increases; have your librarian search trade literature on the topic of travel agent fees; and call some other area travel agents to get prices.

Develop a hypothesis: Your research will either support or disprove your hypothesis that the current company charges too much. If you discover the company is one of the least expensive, your next step is to inform your boss and provide backup data. Then you're done. If it does appear the company's services are overpriced, you should continue further exploration.

Test the hypothesis: Gather more data on alternative travel agents. Investigate the possibility of the employees doing their own travel arrangements online. Review your travel purchases to see if some of the trips could have been planned better to reduce costs (Saturday stopovers, advance-ticket purchases, alternative airports, etc.).

Draw conclusions: Identify several agents that appear to provide less-expensive but equally good or better services. Inform your boss that you have information on some options for changing travel agents. Provide all the data and then allow your boss to decide if a change is necessary. Your scientific approach to this issue may well end up saving your employer significant money.

● *How can you organize your files to save time and energy?*

Problem: You are always running around to file your department's materials. Working hypothesis: There must be a better way!

Research: Examine all the files to see if you can discover categories or, if you already have them categorized, additional categories. Also examine the placement of your file drawers. Points to look for include: What files are accessed most often? What files least often? What file has your boss been known to need at odd hours? You may need to write down file and file location categories and play with them on paper or on the computer.

Form a hypothesis: For example, open job files may be in the lowest drawers, and closed files may be in the drawer closest to your desk. These can be rearranged to improve your efficiency.

Test the hypothesis: Move some of

each of these type files and test out the arrangement for at least two days or for a week if you can manage it. (Inform your boss of the new locations.)

Draw conclusions: Either it is worth doing the move or not. You may, of course, also have come up with some other hypotheses, such as investing in a different-style filing cabinet that would better fit the space and make the files more reachable. You would need to do research on this, perhaps talk with vendors, even have a representative come in to demonstrate, etc. One big plus to the Scientific Method approach is that the data you are collecting is well-suited for proving a case to your boss. Well thought-out and compiled research always makes an argument more convincing.

● *How can you get your boss from New York to Miami by tomorrow at 9 a.m. when a hurricane is on the way?*

Problem: Your boss needs to get from New York to Miami by tomorrow at 9 a.m., but a hurricane is headed for the area and the airport is closed.

Research: Examine all the available choices. Don't assume there is only one right answer. In many cases, you are looking for the choice with the fewest negative consequences. Sometimes the first/best choice is not an option. Additional alternatives to consider in this scenario include:

- Take the bus or train.
- Drive.
- Change the day of the meeting.
- See if the Miami participants can get to New York or an alternative city.
- Cancel the meeting.
- Fly into a nearby airport that isn't closed.
- Take a chance that the airport will miraculously open.

Hypothesis: Taking the train would be the best alternative.

Test the hypothesis: Verify the train is running. Investigate the bus and a rental car as alternatives.

Draw conclusions: The solution to this problem may not be your decision to make. However, you can approach your boss with several alternatives to consider, and together you can come up with a strategy that will address the problem constructively.

● *How can you learn a new computer program when you don't have time during the day?*

Problem: You want to learn a new software program but you just don't have the time.

Research: Review your available options.

- Read a book on the program.
- Take a class.
- Try a tutorial.
- Ask a knowledgeable friend or coworker to show you the highlights.
- Set aside five minutes each day to learn a new feature in the software.

The best option will depend on you and your personality. If this is an unusual software, you may not know anyone else who already is familiar with the program. You may not have the financial resources to take a class. You may have difficulty finding the time to read a book.

Hypothesis: A tutorial is your best option for learning this software.

Test the hypothesis: Take the tutorial. Afterwards, make an evaluation of the necessity for further research to master the program.

Draw conclusions: You may determine that while the tutorial was helpful, it didn't go far enough to show you the details of the program. You may decide to add a reminder to your daily calendar to read one help topic every day.



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