

BA (Hons) Business Studies with Specialisms

Quantitative Analysis / Research Methods



Discuss the characteristics of the scientific method which makes it superior over other methods as a means of obtaining new and reliable knowledge

Introduction

Marketing research has borrowed liberally from other disciplines; this is not surprising because research methodologies and techniques have application over many fields of study. Like other emerging disciplines, marketing research theory has been developed by creative adaptation rather than blind adoption. The extent to which marketing theory has been built on borrowed concepts was noted some years ago by the Marketing Science Institute of America. Historically, most sciences started by borrowing their conceptual approach and general theoretical ideas from other sciences.

Joyce¹ has observed that:

Market research is not a practice or study isolated from other practices or studies. It has drawn freely from certain expert academic fields and will no doubt continue to do so. Further, market research organisations make use of people with expert, specialist training – especially from those fields known broadly as ‘the social sciences’ – both as staff members and consultants.

It took a long while to determine how the world is better investigated. One way is to talk about it. For example: Aristotle, the Greek philosopher, stated that males and females have different numbers of teeth, without bothering to check; he then provided long arguments as to why this is the way things ought to be. This method is unreliable: to determine whether a statement is correct it requires evidence. Debating over a subject or putting an argument forward does not qualify as proof. Consideration of the history of research methods requires a look at the history of science.

What is Science?

A basic question asked by many and answered in almost as many ways. Early roots of science begin with Plato (427-347 B.C.) and his search for everlasting truth and reality.

James Randi² defines science as:

‘a careful, disciplined, logical search for knowledge about any and all aspects of the universe, obtained by examination of the best available evidence. *What’s left is magic. And it doesn’t work.*’

We can define science as a methodical approach to the acquisition of knowledge. This important word distinguishes how a scientist works from how people learn about the world.

Ross Koning³ has some personal observations:

‘Creation must have occurred because life was not always here. Science is merely saying creation was not sudden and is still on-going. Science does not deny existence of God, God just cannot be tested scientifically. Scientists are commonly very religious. Science is the acquisition of truth.’

Modern science is an amazing phenomenon, and curiosity of how it works will continue to occupy people’s minds.

The Scientific Method

On a broad level, science is a methodology for attaining knowledge, where knowledge is a form of belief distinct from mere opinion or uninformed guesswork. Science is not the knowledge gained through the approach; hence, knowledge can be gained through a variety of ways. Science seeks out better ways of representing our experiences. The experiences and their representation in a system of beliefs are termed, respectively, observation and theory.

Recognizing that personal and cultural beliefs influence both our perceptions and our interpretations of natural phenomena, the aim is through the use of standard procedures and criteria to minimize those influences when developing a theory.

A better approach is to do experiments and perform careful observations. The results of this approach are universal in the sense that they can be reproduced by any skeptic. It is from these ideas that the scientific method was developed.

What is the “scientific method”?

The scientific method is the best way yet discovered for scrutinizing the truth from lies and delusion. It is based upon evidence rather than belief. This distinguishes science from faith.

The scientific method revolves around the following key steps:

1. Observe some aspect of the universe
2. Invent a tentative description, called a hypothesis, that is consistent with what you have observed
3. Use the hypothesis to predict the existence of other phenomena, or to predict quantitatively the results of new observations
4. Perform experimental tests of the predictions and modify hypothesis
5. Return to step 3 to ensure of no discrepancies between theory and experiment.

The scientific method is founded upon direct observation of the world around us. A scientist looks critically and attempts to avoid all sources of bias in this observation. But more than looking, a scientist measures to quantify the observations; this helps in avoiding bias.

Which of these lines is longer?



The both lines are the same length, though human bias might generate belief that one is longer than the other. The scientific method attempts to minimize the influence of bias or prejudice in the experiment when testing a hypothesis or a theory.

The next part of the scientific method is to form a hypothesis. This is merely an educated guess. You examine the literature on the subject and gather as much knowledge from books as possible to begin to arrive at an answer. This tentative answer...this best educated guess...is your hypothesis.

There is one important aspect to the hypothesis. It must be rejectable. There must be a way to test the possible answer to try to make it fail. If you design an untestable hypothesis, then science cannot be used to help you decide if it is right or not. For example: you hypothesis that 'God is awake'. There is no way to test your hypothesis scientifically; therefore, there is no way to make it fail.

If the experiments bear out the hypothesis it may come to be regarded as a theory, which then provides rational statements that explain a phenomena. This theory produces explanations to observations and predictions are made. To a scientist a theory is a conceptual framework that explains existing observations and predicts new ones.

On the other hand, if the experiments do not bear out the hypothesis, it must be rejected or modified. Prediction is a way to put the hypothesis to a test. The prediction has three parts:

1. If my hypothesis is true...
2. Then_____ should happen
3. When_____ is manipulated

The manipulation is what you knew would likely falsify your hypothesis. If this prediction holds then you will not be able to reject your hypothesis. If this prediction does not hold then you will reject your hypothesis. The scientific method requires that an hypothesis be ruled out or modified if its predictions are clearly and repeatedly incompatible with experiment tests. In every experimental science, 'experiment is supreme' and experimental verification of hypothetical predictions is absolutely necessary.

Experiments may test the theory directly or may test for consequences derived from the theory using mathematics and logic. The necessity of experiment also implies that a theory must be testable. Theories which cannot be tested, because, for instance, they have no observable ramifications, do not qualify as scientific theories. One of the key factors of scientific method is that the theory must be falsifiable.

Sir Karl Popper (1902-1994): Falsificationism

(1993) Demarcation Criteria: Science is divided from psuedo-science or "myth" by making statements which are potentially falsifiable.

When a hypothesis passes the test it is adopted as a theory it correctly explains a range of phenomena it can, at any time, be falsified by new experimental evidence. When exploring a new set or phenomena scientists do use existing theories, however, it is always kept in mind that the old theories might fail to explain the new experiments and observations. In this case new hypotheses are devised and tested until a new theory emerges.

A theory is accepted not based on the prestige or convincing powers of the proponent, but on the results obtained through observations and experiments which anyone can reproduce. Most experiments and observations are repeated many times. If the original claims are not verified the process returns to the origin of such discrepancies.

Epistemology is the branch of philosophy that studies knowledge. It attempts to answer the basic question: what distinguishes true (adequate) knowledge from false (inadequate) knowledge? Practically, this question translates into issues of scientific methodology: how can one develop theories or models that are better than competing theories?

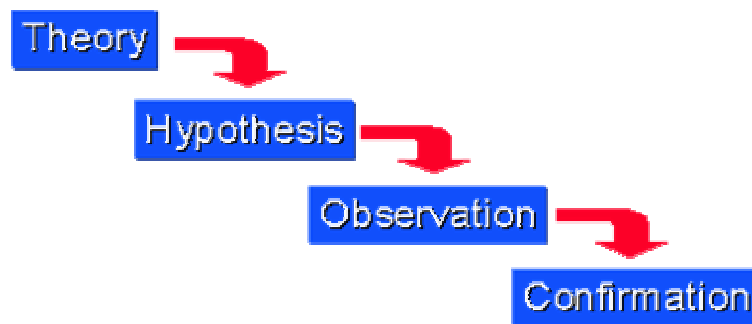
It is possible to construct a useful and reliable model for understanding scientific reasoning, known as the “Hypothetico-Deductive” model. The heart of the “Hypothetico-Deductive” model is deductive reasoning (induction plays a role primarily in generating laws about observations that are then deduced from theory, such as the law of multiple proportions).

According to the H-D model, hypotheses and theories are sets of general principles that are said to explain and predict observable results. A theory is successful insofar as observable consequences can be deduced from those general principles and statements. When a positive instance of a predicted observation occurs, it is said to confirm that theory.

Deductive and Inductive Thinking

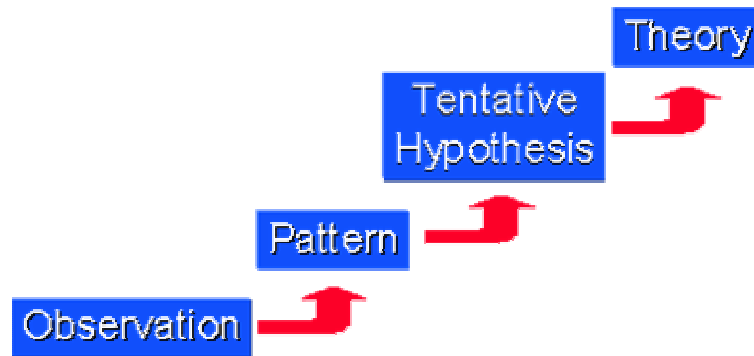
In logic, two broad methods of reasoning are referred to: the deductive and inductive approaches.

Deductive reasoning works from the more general to the more specific. Sometimes this is informally called a ‘top-down’ approach. The process may begin with thinking up a theory about our topic of interest. We then narrow that down into more specific hypotheses that we can test. We narrow down even further when we collect observations to address the hypotheses. This ultimately leads us to be able to test the hypotheses with specific data – a confirmation (or not) of our original theories.



Inductive reasoning works the other way, moving from specific observations to broader generalizations and theories. Informally, it is often known as a “bottom-up” approach. In inductive reasoning, the process begins with specific observations and measures, then patterns and regularities are detected, formulating some tentative hypotheses that we can

explore, and finally end up developing some general conclusions or theories.



Inductive reasoning, by its very nature, is more open-ended and exploratory, especially at the beginning. Deductive reasoning is narrower in nature and is concerned with testing or confirming hypotheses. Even though a particular study may look like it's purely deductive (e.g., an experiment designed to test the hypothesized effects of some treatment on some outcome), most social research involves both inductive and deductive reasoning processes at some time in the project. The two graphs above can be assembled into a single circular one that continually cycles from theories down to observations and back up to theories. Even in the most constrained experiment, the researchers may observe patterns in the data that lead them to develop new theories.

Comparison of Properties

Deduction

1. In a valid deductive argument, all of the content of the conclusion is present, at least implicitly, in the premises. Deduction is *nonampliative*.
2. If the premises are true, the conclusion must be true. Valid deduction is *necessarily truth preserving*.
3. If new premises are added to a valid deductive argument (and none of its premises are changed or deleted) the argument remains valid. Deduction is *erosion-proof*.
4. Deductive validity is an *all-or-nothing* matter; validity does not come in degrees. An argument is totally valid, or it is invalid.

Induction

1. Induction is *ampliative*. The conclusion of an inductive argument has content that goes beyond the content of its premises.

2. A correct inductive argument may have true premises and a false conclusion. Induction is *not necessarily truth preserving*.
3. New premises may completely undermine a strong inductive argument. Induction is *not erosion-proof*.
4. Inductive arguments come in different *degrees of strength*. In some inductions the premises support the conclusions more strongly than in others.

Source: Introduction to the Philosophy of Science. Merilee H. Salmon, John Earman, Clark Glymour, James G. Lennox, Peter Machamer, J.E. McGuire, John D. Norton, Wesley C. Salmon, and Kenneth H. Schaffner. Englewood Cliffs: Prentice Hall, 1992.
Available: <http://dharma-haven.org/science/myth-of-scientific-method.htm>

Non-Scientific Sources

1. Common Sense

People often refer to their knowledge and skills as common sense. It is good sense in everyday affairs. For example: The old farmer didn't have much education but had always gotten along on a lot of common sense. He is hopeful that in the event of another war the world powers may summon enough common sense to avoid mass atomic destruction.

Having a practical intelligence in different situations can derive knowledge that is of immense value. This practical intelligence has been gained naturally from the individual's experience throughout their life and cannot be applied to any education or training.

The experiences that an individual has been through during their life may affect their ability to produce unbiased knowledge.

2. Trial and Error

Trial and Error is a method of learning by trying out different responses to a new situation until one response is successful.

The desired result is then played on for future use and noted by the researcher. It can be quite a time consuming activity, however, similar problems in the future may benefit from the experiment.

3. Tenacity

Tenacity is the determination to continue what you are doing. It means that the knowledge derived from previous studies must be recognised as it holds true value for a long period of time.

4. Intuition

Intuition is a psychological and philosophical term which designates the process of immediate apprehension or perception of an actual fact, being or relation between two terms and its results. As an element of educational method intuition means the grasp of knowledge by concrete, experimental or intellectual, ways of apprehension.

The importance of intuition as a process and element of knowledge is easily seen if we observe that it is intuition which furnishes us with the first experimental data as well as with the primary concepts and the fundamental judgements or principles which are the primitive elements and the foundation of every speculation.

5. Authority

An expert provides knowledge on a particular subject, whereby subordinates accept the idea or concept as a respected source of knowledge.

6. Rationalism

Rationalism is a philosophical movement which attempts to study the universe using reason, in the form of deductive and mathematical methods, rather than sense experience. Descartes, for example, tried to deduce what God's world is like from the axioms of divine existence and goodness. When sourcing knowledge rationalism can be misleading when it is used alone, however, improving the accuracy of the principles associated with the subject will result in better sourcing.

7. Empiricism

Any view which bases our knowledge, or the materials from which it is constructed, on experience through the traditional five senses. It is opposed to rationalism and denies that we have any *a priori knowledge* or innate ideas: we owe all our concepts to experience of the world. A priori knowledge is any kind of knowledge that is in no way derived from sense experience, observation or experiment.

What might be called the classical empiricist view is associated especially with Locke, the first of the so-called British Empiricists, and his successors Berkeley and Hume.

Empiricism has its roots in the idea that all we can know about the world is what the world cares to tell us; we must observe it neutrally and dispassionately, and any attempt on our part to mould or interfere with the process of receiving this information can only lead to distortion and arbitrary imaging.

Conclusion

The scientific method is intricately associated with science, the process of human inquiry that pervades the modern era on many levels. While the method appears simple and logical in description, there is perhaps no more complex question than that of knowing how we come to know things.

In comparison with the non-scientific sources the emphasis here is that the scientific method distinguishes science from other forms of explanation because of its requirements of systematic experimentation.

We use specific methods because they are objective, public and can give repeatable results. The question of how science is so successful at improving understanding is hardly ever presented as a question at all. No matter what happens, you will learn something. Science is not only about getting 'the answer'. Scientists who study extremely complex problems can spend a lifetime and not find 'the answer'. Even so, their results may eventually play a part in completing the full picture of understanding.

Animal and children may learn about whatever they pay attention to, and so do scientists.