# Chapter 1
# Understanding Scientific Research

Learning Objectives

- Explain what knowledge is and how it is obtained.
- Describe the current conception of science and describe its history.
- Understand the basic assumptions underlying scientific research.
- Describe the characteristics of scientific research and understand why each of these is necessary.
- Explain the difference between logic of discovery and logic of justification.
- Describe the characteristics that typify the person who is adept at pursuing scientific research.
- Describe the objectives of scientific research.
- Differentiate pseudoscience from scientific research.
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Chapter Outline

Why learn about the scientific research process?

- To learn the research process
- Provides a foundation for other courses
- To become a critical consumer of information
- To develop critical and analytic thinking
- Learn to critically read a research article
- Necessary for most graduate programs

Methods of Acquiring Knowledge

- Intuition – knowing without reasoning
  - used in forming some hypotheses (hunches)
  - problem – no mechanism for separating accurate from inaccurate knowledge
- Authority – facts stated from a respected source
  - can be used in the design phase of a study
  - can be used when interpreting the data
  - problem – authority can be wrong
- Rationalism – knowledge from reasoning
  - used to derive hypotheses
  - used to identify outcomes that would indicate the truth or falsity of the hypotheses
  - Rene Descartes (1596-1650)
  - potential problem – relying solely on rationalism can lead two people to reach different conclusions
  - Insufficient by itself
- Empiricism – knowledge from experience
  - observation used to collect data in science

- facts that concur with experience are accepted and those that do not are rejected
- John Locke (1632-1704) tabula rasa
- David Hume (1711-1776)
- potential problem is researcher bias
- must be conducted under controlled conditions
- systematic strategies must be used to reduce researcher bias and maximize objectivity

Science

- Designed to systematically produce reliable and valid knowledge about the natural world
- From the Latin verb scire which means "to know"
- The English term was coined in the 19th century by William Whewell (1794-1866)
- Different scientific methods have been popular historically

Scientific Methods

- Induction – specific to general reasoning
  - Aristotle (384-322 BCE)
  - still used today when generalizing from specific experiments to general hypotheses or theory
  - Latané (1981)
    - observed people do not exert as much effort in a group as they do working alone.
    - inferred that this represents the more general construct of Social Loafing
  - researchers relying on a sample to represent a population
- Deduction – general to specific reasoning
  - involved in forming hypotheses from theory
  - Levine (2000)
    - used the idea of social loafing to deduce a specific set of events that would reduce social loafing
      - a person who views the group's task as important and does not expect others to contribute adequately to the group's performance will work harder
- Hypothesis testing
  - formulating a hypothesis to explain some phenomenon that has been observed and then comparing the hypothesis with the facts
  - prominent from mid-19th century to about 1960, but still used extensively today
  - associated with logical positivists
    - philosophical position started by scholars at University of Vienna
    - believed that statements meaningful only when verifiable by observation
- Criticism of Hypothesis Testing
  - Popper and his falsification position
  - Duhem-Quine principle
- Naturalism – science should be studied and evaluated empirically
  - rejects foundational epistemology
  - we should continually evaluate our theories based on empirical adequacy
  - Thomas Kuhn (1922-1996)
    - paradigm – framework, thought, or belief by which you interpret reality
    - science governed by types of activities
      - normal science-shared paradigm

– revolutionary science – replace one paradigm with another

- Paul Feyerabend (1924-1994)
  - Feyerabend's Anarchists Theory of Science
    - argued there is no such thing as a method of science, but science has many methods
    - advocated that science does not give knowledge superior to other forms of knowledge
    - his position – the unchanging principle of scientific method is that "anything goes"
    - scientific knowledge is not better than other forms of knowledge

What Is Science?

- Multiple methods and practices used to develop secure scientific knowledge
- Scientists must
  - be skeptical, creative, and systematic
  - identify problems
  - question current solutions that are not working
  - creatively and systematically come up with new solutions
  - subject these new solutions to empirical testing
- To be successful, science must
  - conduct research ethically
  - critically self-examine its practices to determine what is working and what is not
  - engage in ongoing learning and improvement

Basic Assumptions Underlying Scientific Research

- Uniformity or regularity in nature
  - determinism – the belief that mental process are fully caused by prior natural factors
  - probabilistic causes – a weaker form of determinism that indicates regularities that usually, but not always, occur
- Reality in nature
  - the assumption that the things we see, hear, feel, smell, and taste are real
- Discoverability
  - the assumption it is possible to discover the regularities that exist in nature
  - task may not be simple – e.g., cure for cancer or AIDS
  - two components
    - discovering the pieces of the puzzle
    - putting them together

Characteristics of Scientific Research

- Control
  - holding constant or eliminating the influence of extraneous variables
  - allows for unambiguous claims about cause and effect
  - placebo effect
    - improvement due to participants' expectations for improvement rather than the actual treatment
- Operationism
  - representing constructs by a specific set of operations

- operational definition
  - defining a concept by the operations used to represent or measure it

- Objections to operational definition
  - demands too strict
  - a single operational definition could not completely specify the meaning of a term
  - example
    - aggression
      - honking of horns, hitting a BoBo doll, delivering electric shocks to another, and the force with which a pad is hit

- Multiple operationalism
- Replication
  - reproduction of results in a new study
  - reasons for failure to replicate
    - effect doesn't exist
    - replication study is not an exact replication
    - effect may depend on context
  - meta-analysis
    - a quantitative technique for describing the relationship between variables across multiple studies

Role of Theory in Science

- To summarize and integrate existing data
- To guide new research
- Continuous interaction between theory and empirical observation
  - logic or context of discovery
    - the inductive part of science
  - logic or context of justification
    - the deductive part of science

Role of Scientist in Psychological Research

- Curiosity
  - goal is the pursuit of knowledge and the uncovering of regularities in nature
- Patience
  - gaining knowledge from nature can be a slow, tedious process
- Objectivity
  - the scientist's personal wishes and attitudes should not affect his or her observations
- Change
  - devising new methods and techniques for investigating nature

Objectives of Psychological Research

- Description
  - portraying the phenomenon accurately
  - focusing on characteristics and degree to which they exist
  - e.g., Piaget's theory of child development arose from detailed observations of his own

children

- Explanation
  - identifying the cause(s) of the phenomenon
  - e.g., social media and extroversion
- Prediction
  - anticipating the outcome the occurrence of an event
  - identifying risk factors of a phenomenon can help you to predict when it might happen
  - e.g., academic success
- Control
  - manipulation of the conditions that determine a phenomenon
  - different meanings of the word control
    - controlling antecedents to produce a desired outcome
    - eliminating influence of extraneous variables

Pseudoscience

- An approach that claims to be scientific, but in fact violates many tenets of science
- Attempted association with science made in an attempt to gain legitimacy
- Examples
  - commercials that claim "scientifically proven"
  - ESP, fortune telling, superstitions

Strategies Used in Pseudoscience

- Creating new (ad hoc) hypotheses in order to explain away negative findings
  - characterized by statements that can't be falsified or ad hoc hypotheses to explain problems with the claim
- Exclusive use of confirmation and reinterpretation of negative findings as supporting the claim
  - science tries to prove hypotheses wrong
- Absence of self-correction through continual and rigorous testing of the claim
  - does not try to verify or refute claims
- Reversed burden of proof
  - asks critics to prove that their claims are wrong
- Overreliance on testimonials and anecdotal evidence supporting a claim
- Use of ambiguous or confusing language to make a claim sound as if it has survived scientific scrutiny
  - language that confuses versus clarifies
  - uses scientific terms to sound respectable
- Absence of any connection to other disciplines that study issues related to the claim

Multiple-choice questions

1. Which of the following is NOT a good reason for psychology students to take a research methods course?

a. It will allow you to become a better consumer of the scientific literature
* b. It requires more rigorous thinking than is typically found in other psychology courses
c. The content of psychology courses is typically based on scientific findings
d. You need to be able to evaluate the adequacy of the many claims you encounter daily

2. Which of the following is a reason for taking a Research Methods course?

a. To develop critical and analytic thinking skills.
b. To learn how to conduct psychological research.
c. To become an informed and critical consumer of information.
* d. All of the above

3. Being an informed and critical consumer of information will help you to critically read which of the following?

a. popular magazines
b. newspaper
c. scientific journal
* d. all of the above

4. Which of the following is a disadvantage of the intuitive approach to acquiring knowledge?

a. Intuition is takes a long time to understand and is difficult to use.
* b. Intuition does not provide a mechanism to help you to separate accurate from inaccurate knowledge.
c. Intuition can lead you to two equally accurate conclusions.
d. Intuition relies entirely on memory when in use and memory can be inaccurate.

5. Jackie's friend tells her what to do in her personal life based on her "gut instincts." A more formal name for this source of knowledge is

a. rationalism.
b. hypothesis testing.
c. appeal to authority.
* d. intuition.

6. If you accept your physician's explanation for your illness without researching your condition or asking how she came to her conclusion, you are relying on _____ as a source of knowledge.

* a. authority
b. reason
c. intuition
d. science

7. Consulting the expertise of an Authority can be useful when

a. designing a study.
b. forming a hypothesis
c. interpreting data
* d. All of the above

8. Which of the following methods is NOT useful when forming a hypothesis?

a. Intuition
* b. Hoaxing
c. Rationalism
d. Authority

9. After every trip Pete takes to the automatic carwash he finds a new ding in his car. He concludes that this automatic carwash damages cars. He is relying on what source of knowledge?

a. Intuition
b. Rationalism
* c. Empiricism
d. Science

10. One approach to gaining knowledge is known as _____ and involves using reasoning to acquire knowledge.

a. determinism
b. logic of discovery
* c. rationalism
d. naturalism

11. _____ is an important part of the scientific approach that is based on the notion that the origin of all knowledge is from our senses.

a. Rationalism
b. Intuition
* c. Empiricism
d. Authority

12. Whewell believed that _____ should be designed to systematically produce reliable and valid knowledge about the national world.

a. Psychology
* b. Science
c. Induction
d. Rationalism

13. Latané and Darnley (1969) were one of the first to conduct experiments on the now well known "bystander effect". They were prompted to conduct theses experiments by the famous case of the murder of Kitty Genovese. When a specific situation leads to a general understanding of behavior, this is called?

a. empiricism
b. deduction
c. naturalism
* d. induction

14. Tom was experiencing dizziness just before he ate his lunch and noted that after he started eating his dizziness disappeared. From this he inferred that dizziness was due to a lack of nutrition and whenever someone complained of dizziness he encouraged them to eat. His inference that dizziness is due to lack of nutrition demonstrates what reasoning process?

a. deduction
b. hypothesis testing
* c. induction
d. naturalism

15. Which of the following is the best example of using inductive reasoning?

a. Developing a hypothesis based on an established theory
b. Developing a theory of aggression based on your observation of children
* c. Deducing that video games will contribute to a specific child's aggression
d. Developing a theory based on intuition

16. Suzy was working on her doctoral dissertation and in her social psychology class she learned that social facilitation, or the presence of others, influences performance. Based on this information she hypothesized that a person would run faster when running in a group of people than when running alone. In forming this hypothesis, Suzy used what type of reasoning process?

* a. Deduction
b. Naturalism
c. Social rationalism
d. Induction

17. Social Learning theory states that “we learn from others.” This broad theory has lead to the testing of many specific hypotheses such as “Children learn manners from their parents.” This is an example of what type of reasoning?

a. empiricism
* b. deduction
c. naturalism
d. induction

18. _____ was a philosophical approach that influenced the development of the scientific method because of its emphasis on verifying scientific information through experience or observation.

* a. Logical positivism
b. Falsificationism
c. Rationalism
d. Revolutionary science

19. Karl Popper advocated a deductive approach to science that focused on attempting to disprove hypotheses. His approach is known as

a. logical positivism
* b. falsificationism
c. determinability
d. naturalism

20. Logical positivists advocated _____ as an important scientific method.

a. induction
b. deduction
* c. hypothesis testing
d. naturalism

21. Dr. Stokley has derived a hypothesis from Skinner’s Theory of Operant Conditioning. Dr. Stokley wants to collect factual information and evidence to test his hypothesis. Which of the following refers to the process he will use?

a. Rationalism
* b. Hypothesis Testing
c. Induction
d. Normal Science

22. Today many scientists rely on a hybrid approach to hypothesis testing that includes both _____ and _____.

a. naturalism: rationalism
b. intuition: empiricism
* c. logical positivism: falsification
d. induction: deduction

23. If, in your attempt to study science, you took an empirical approach you would take the approach which has come to be known as

a. revolutionary science.
b. logical positivism.
c. falsificationism.
* d. naturalism.

24. Naturalism rejects _____ which assumes that knowledge is a matter of deductive reasoning and that knowledge is fully certain.

a. genetic epistemology
b. the Duhem-Quine principle
* c. foundational epistemology
d. empirical adequacy

25. In the past there were a group of psychologists that were known as behaviorists because the approach they advocated was bound by a set of beliefs regarding the way behavior or responses are acquired and changed. These psychologists took the position that the responses we learn are a function of the consequences of our behavior. This position or set of beliefs would represent

a. a rigid approach to science.
* b. a paradigm.
c. the period of time in which intuition was the dominant mode of thought.
d. reliance on authority

26. One general approach to studying abnormal behavior involves focusing on the biological causes of disorders. This conceptual framework, or _____, includes a set of assumptions (e.g., that mental illness has a physical basis) that enable psychologists to interpret different mental disorders.

* a. paradigm
b. dogmatism
c. logic
d. theory

27. According to Kuhn, science reflects two types of activities, normal science and _____ science.

a. cautionary
b. paradigmatic
* c. revolutionary
d. proactive

28. Sometimes science seems to go through a period of chaos where the current beliefs, concepts and practices, or fundamental beliefs that are typically shared by scientists are questioned and start being replaced by another set of fundamental beliefs. This period is referred to by Kuhn as _____ science.

a. cautionary
b. paradigmatic
* c. revolutionary
d. proactive

29. _____ science is governed by a single paradigm, while _____ science may be a time of shifting from one paradigm to another.

* a. Normal: revolutionary
b. Mechanistic: organismic
c. Revolutionary: normal
d. Bad; good

30. According to the textbook, a scientist must be

a. creative
b. systematic
c. skeptical
* d. all of the above

31. _____ argued there is no such thing as the method of science.

a. Popper
b. Kuhn
c. Duhem-Quine
* d. Feyerabend

32. If we have identified a set of specific aims to arrive at knowledge of a specific kind, and methods for achieving those aims along with a set of standards for judging the extent to which they have been met, then we have probably represented

a. philosophical speculation
* b. science
c. paradigmatic science
d. revolutionary science

33. In order to have a science of behavior, we have to accept the basic assumption that

a. psychology focuses in perceptions, images, and other phenomena that have no real basis in nature.
b. the underlying causes of behavior are usually irrational or illogical.
* c. there are lawful, deterministic relations between behavior and its causes.
d. there are no lawful relations between behavior and its causes

34. Psychologists use the concept of determinism to mean

* a. behaviors and mental processes are caused by prior natural factors.
b. behaviors and mental processes are predetermined from birth.
c. humans can freely choose their destiny.
d. behavior can be understood through reasoning.

35. Which of the following refers to the belief that all forms of behavior have causes that are potentially knowable?

a. determinism
b. falsifiability
* c. discoverability
d. empiricism

36. Which of the following is NOT a basic assumption underlying scientific research?

a. regularity in nature
b. reality in nature
c. discoverability
* d. controllability

37. Developing theories, laws, and generalizations to help our understanding of human behavior supports which basic assumption of scientific research?

a. determinism in nature
* b. uniformity in nature
c. reality in nature
d. control in nature

38. The fact that researchers have found that the bystander effect can be seen across different emergency situations supports which basic assumption of scientific research?

a. reality in nature
b. determinism in nature
* c. uniformity in nature
d. control in nature

39. The fact that researcher have found that changes in serotonin levels cause changes in mood supports _____ which is the belief that there are causes of mental process.

a. control
b. discoverability
* c. determinism
d. operationalism

40. Which of the following is the basic assumption of science that states when researchers interact with the natural world this has a primary say in truth?

a. discoverability in nature
b. control in nature
c. uniformity in nature
* d. reality in nature

41. Finding a cure for cancer or Autism are being investigated by science. The assumption of science that these cures are potentially knowable is called

a. control
b. operationalism
* c. discoverability
d. determinism

42. In order to isolate the cause of a behavior, research psychologists rely primarily on being able to

a. get authoritative advice.
b. do statistical testing.
* c. control the environment.
d. communicate their findings.

43. Control in an experimental situation involves

a. attempting to change an individual's behavior for their own good.
b. having a clear and precise definition of the variables that will be tested.
* c. eliminating the influence of extraneous variables so that a cause and effect relationship can be established.
d. an attempt to falsify or verify a stated hypothesis.

44. Which of the following are important characteristics of scientific research in psychology?

a. operationalism
b. control
c. replication
* d. all of the above

45. Holding factors such as temperature, lighting, and seating arrangement constant during experimental testing supports which of the following characteristics of scientific research?

a. operationalism
* b. control
c. discoverability
d. replication

46. Matching participants on factors such as age, gender, and IQ during experimental testing supports which of the following characteristics of scientific research?
*

a. control
b. operationalism
c. replication
d. discoverability

47. Which of the following is the best example of an operationalization of the construct of "hunger"?

a. feeling of emptiness or growling in the stomach
b. a desire to eat brought about by an intense image of the taste and smell of a favorite food
c. realizing it's been a long time since one has eaten anything
* d. a child asking his mother whether supper is ready more than 5 times in a 15 minute period

48. Suppose that a student taking research methods proposes to test the hypothesis that “playing violent video games leads men to have negative attitudes toward women.” After being asked to operationalize her variables the student proposes the following hypotheses. Which one provides the best operational definitions of her variables?

a. Playing video games that advocate violence leads men to have bad feelings toward women.
b. Playing video games does not lead men to have negative feelings toward women.
* c. Playing the violent video game Battle Warrior for 2 hours a day for one week will cause men to have negative attitudes toward women as measured by the Hostility Toward Women scale.
d. Playing Nintendo for more than 3 hours a day leads college-aged men to have negative feelings toward women.

49. Operationalism

a. is a hindrance in scientific research because it limits researchers ability to define constructs in multiple ways.
b. is needed so that all researchers will use the same precise definition of a construct.
* c. is necessary so that researchers will be clear about defining the terms of their studies.
d. is not necessary because recent advances in technology make collection of behavioral data much more precise.

50. Why do scientists favor operationalizing terms used in their research?

a. they reduce research questions to manageable, albeit ambiguous, levels
* b. they minimize ambiguity by requiring empirical referents
c. it allows them to avoid less "scientific" concepts like emotions
d. they lead to multiple definitions of the same concept

51. Some scientists have criticized the concept of operational definitions as being too strict stating that a single operational definition could not completely define the meaning of a term. What has been proposed to overcome this criticism?

a. eliminating operational definitions
b. replication
* c. multiple operationalism
d. meta-analysis

52. Which of the following is NOT an operational definition of “memory”?

a. the score on a reading comprehension test
* b. information that is stored in the brain
c. the number of words that a participant recalls from a list of previously studied words
d. the number of words a child can read from a list of words

53. If scientific studies are to be of general use, they should be readily reproducible by others in a procedure known as

* a. replication.
b. empiricism.
c. generalization.
d. operationalism.

54. Dr. Haynes finds that in her laboratory, bacterium X can be killed with antibiotic Y. However, Dr. Swensson does not observe this same result in her laboratory. What is the most plausible explanation for why this happened?

a. Dr. Haynes made up the results to survive in a publish-or-perish academic setting.
b. The results of biomedical experiments are often random, so this is not unusual.
c. Dr. Swensson made mistakes analyzing the data.
* d. Dr. Swensson did not use the exact same procedure as Dr. Haynes.

55. Even though replication is accepted as an important aspect of the scientific method, few scientists actually do studies that use the exact same procedure of past experiments. Why not?

* a. Replications are rarely published.
b. In reality, replication studies rarely reproduce previous results, and scientists don't want to have to deal with conflicting data.
c. Scientists do not believe that replications are important
d. Replications are typically very expensive.

56. Which of the characteristics of scientific research indicates the reliability of operational definitions?

a. meta-analysis
b. control
c. placebo
* d. replication

57. Dr. Smarsh is investigating the effect of room temperature on memory while Dr. McArdle is investigating the effect of study time on memory. Both researchers use a reading comprehension test to operationalize memory in their studies. By using the same reading comprehension test as the measure of the dependant variable, they are achieving _____ replication of research.
*

a. partial
b. exact
c. incomplete
d. dependant

58. Although we should be cautious when drawing conclusions from a single study, we can be more confident in the findings of _____ research which involves combining information from multiple studies.

a. theoretical
b. inductive
c. deductive
* d. meta-analysis

59. Dr. Nettles conducts a literature review in the area of cognitive behavioral therapy and then decided to quantitatively combine and integrate multiple research studies on this topic. This technique is called

a. replication
* b. meta-analysis
c. operationalism
d. multiple operationalism

60. Theory plays an important role in science. Which of the following is NOT generally seen as a function of theory?

* a. stating a scientist's philosophy about the world
b. summarizing a group of related facts into a coherent statement
c. integrating groups of facts into a whole
d. generating new hypotheses for experiments

61. Many people mistake "theory" for "guess" or for "unfounded assumption." This is an incorrect portrayal because theories

* a. are actually integrated summaries of facts and findings from empirical research.
b. are widely accepted by many authorities in the relevant field.
c. have been derived by a painstaking process of operationalizing.
d. have been proved to be true.

62. Which of the following best describes the relationship between empirical observation and theory?

a. empirical observation guides theory (logic of discovery)
b. theory guides future research which is empirically tested (logic of justification)
* c. both ‘a’ and ‘b’ are true – that is, there is constant interaction between theory and empirical observation
d. theory and empirical observation are independent of one another

63. Jean Piaget's theory of the cognitive development was initially based on his observation of children. This is an illustration of the idea that empirical observations generate theories and has been referred to as

* a. logic of discovery.
b. logic of justification.
c. logic of theory development.
d. logic of empirical observation.

64. "Good" candidates for becoming scientists are those who have all of the following characteristics EXCEPT

a. curiosity.
* b. obstinacy.
c. patience.
d. objectivity.

65. After research shows that anxiety can be reduced through a new type of cognitive therapy, therapists begin using the technique more frequently. This illustrates which of the following objectives of psychological research?

a. explanation
* b. control or influence
c. description
d. prediction

66. Which of the following is not an objective of scientific research?

a. description
b. prediction
c. explanation
* d. power

67. Which of the following is not an objective of science?

a. Explanation of how a phenomenon works.
b. Prediction of what will happen in the future, under certain conditions.
* c. Proving a theory is true.
d. Controlling conditions that determine a phenomenon

68. A psychology professor surveyed college students on his campus to determine their attitudes toward binge drinking. His work fulfilled which objective of science?

* a. description
b. explanation
c. prediction
d. control

69. Roberta is interested in whether people communicate differently when utilizing technology (e.g., online chatting or e-mail) than in face-to-face conversations. She begins by simply observing conversations that occur in the two environments to get a better sense of the variables that should be investigated. This initial step of simply observing behavior would correspond to which of the following objectives of psychological research:

a. prediction
b. explanation
* c. description
d. replication

70. Put the objectives of science in the correct logical order:

a. control, describe, predict, explain
* b. describe, explain, predict, control
c. explain, control, predict, describe
d. predict, describe, control, explain

71. Which of the following is <u>NOT</u> an example of control in an experiment?

a. making sure the room temperature, lighting, and noise are the same for all participants in an experiment on study techniques
* b. arranging to be the only person with access to all data files once the data have been collected
c. making sure all the rats in a maze-running experiment have equal access to food in their cages
d. arranging to test all the participants in an alertness study at the same time of day

72. If extraneous variables are not controlled in an experiment, what major problem will the researcher face?

a. not having enough data to allow for valid statistical analysis
b. the results will be stated in subjective, and possibly biased terms
* c. it cannot be known which variable(s) produced the observed results
d. not having enough participants

73. Control is an objective of psychological science. In this context, control refers to

* a. our ability to manipulate conditions that affect behavior in order to change behavior.
b. our ability to override peoples' free will and make them do what we want them to do.
c. our ability to explain the effects of extraneous factors on behavior.
d. our ability to give a complete description of what a certain behavior looks like.

74. In a classic study by Jellinek (1946) research participants who thought they were drinking alcohol (but were not) behaved in a drunken manner very similar to participants that did in fact drink alcohol. This finding is a good illustration of

a. multiple operationalism.
* b. the placebo effect.
c. meta-anlysis.
d. the impact of an extraneous variable.

75. Many people make use of hand-writing analysis or astrology to assess personality. Others believe that extrasensory phenomenon exist and that they may even possess such ability. Such beliefs and the knowledge imparted by individuals possessing such beliefs represent

a. historical facts.
b. ritualistic knowledge.
* c. pseudoscientific beliefs.
d. empirical beliefs.

76. Pseudoscientific beliefs are characterized by all of the following EXCEPT

a. making statements that can not be refuted.
b. failing to attempt to verify or refute claims and beliefs.
c. supporting claims with testimonials.
* d. having a set of claims and beliefs that have accumulated over time and that changes over time.
e. making use of scientific sounding language to lend respectability to the claims and beliefs.

<u>Vocabulary</u>

Define the following in psychological terms:

| | | |
|---|---|---|
| Intuition | Authority | Rationalism |
| Empiricism | Science | Induction |
| Deduction | Hypothesis testing | Logical positivism |
| Falsificationism | Duhem-Quine principle | Naturalism |
| Empirical adequacy | Normal science | Paradigm |
| Revolutionary science | Determinism | Probabilistic causes |
| Reality in nature | Discoverability | Control |
| Placebo effect | Operationalism | Operational definition |

| | | |
|---|---|---|
| Multiple operationalism | Replication | Meta-analysis |
| Theory | Logic of discovery | Logic of justification |
| Objectivity | Description | Explanation |
| Prediction | Control | Pseudoscience |

Essay questions

1) Compare and contrast empiricism and authority as methods of acquiring knowledge. What are the advantages and disadvantages of each?

2) Many people believe that in relationships "opposites attract." Provide an example of the type of evidence that would be used to support this statement for each of the four methods of acquiring knowledge.

3) Describe how the methods of science have changed over time.

4) Using examples not provided in your text, explain the difference between deductive and inductive reasoning.

5) Discuss the three working assumptions underlying scientific research.

6) One of the characteristics that sets science apart from other methods of acquiring knowledge is control. What is meant by control?

7) What is operationalism? Why is it an essential element of scientific research? Provide an example of how a psychologist might operationalize the concept of "love."

8) What is replication and why is it such an important aspect of scientific research? What might it mean if we fail to replicate a research finding?

9) What is a meta-analysis and what is the advantage of a meta-analytic study as compared to a single study?

10) Define and given an example of the four major goals of scientific research. How does each relate to a science of behavior?

11) What distinguishes pseudoscientific knowledge from scientific knowledge?

Classroom Exercise Suggestions

1) To create interest and to illustrate that completing a research project is within their capabilities, you might have students read an article from the Psi Chi undergraduate research journal (http://www.psichi.org/pubs/journal/). The articles are generally easy for students to digest and they are sure to find topics that interest them. This could also serve as a nice springboard for many of the topics discussed in Chapter 1 (e.g., control, replication, operationalization, etc.).

2) Ask students to write something they “know” to be true about (human) behavior (try having them list well-established superstitions like “Absence makes the heart grow fonder” or “A watched pot never boils”). Then after a discussion of the ways of knowing, ask them to identify the method that led to their knowledge or belief. Have them share their ideas with the class.

3) As a good introduction to the spirit of "doing science," have the class read and discuss the untitled article by W. Eric Keller in the November, 1988 issue of Smithsonian magazine. In the article, Keller – a non-scientist experiencing a summer internship at the Marine Biological Laboratories in Woods Hole, MA – manages to convey both the excitement and demands of scientific endeavor. Students should come to realize that science is not a dry, boring matter of rote memorization of facts, but a passionate search for knowledge full of interesting and unexpected twists and turns. The following are some suggestions for questions to spur discussion:

> a) Trace Keller's progression from a broad general interest to his development of a hypothesis, a simple testable idea. How does Keller's hypothesis relate to his original interest? What other hypotheses might he have tested?
>
> b) Why couldn't Keller have tested his hypothesis by simply observing diopatra in the wild?
>
> c) Did Keller prove anything definitively? Was this a failing of his particular project, or do you think it's indicative of most scientific experiments? Why? What does this imply about experimental evidence?
>
> d) Identify some instances in which Keller had to develop creative, imaginative solutions to practical problems that hindered his progress. How do these situations compare with the typical cultural stereotype of science and those who practice it?

4) Ask the students to write a paragraph or two about what they think being a scientist is all about, and how they see themselves relative to that role. Then assign each student to think of a question about human behavior ("Why do people do X?") that is personally interesting, and attempt to answer it through appropriate observation. At the next class meeting, have students share their attempts to answer their questions. Their successes and failures can become launch points for introducing critical aspects of scientific method, e.g., the need to frame questions (hypotheses) in concrete terms, the need for controlled conditions, the function of participant selection in producing generalizability, etc., which will be covered in greater detail throughout the course. It may be a useful follow-up exercise to pose the same question at the end of the semester, so students can observe their own growth in their understanding of science.

5) Students often have difficulty operationalizing variables and so you might extend the text discussion of this topic with several examples. Begin by pointing out that many of the topics psychologists are interested in may be vague or can be defined in multiple ways. In order to test these concepts we need to define them in precise, measurable, and concrete ways. Next, provide students with examples of hypotheses that a psychologist might be interested in testing. Ask

students to restate the hypotheses by defining the variables in ways that will allow them to be more easily tested. For example:

a. Using the Internet a lot makes people lonelier.
b. Drinking moderate amounts of alcohol lowers the risk of heart disease.
c. Religious people are happier than nonreligious people

6) One way to illustrate the value of science is to contrast it with pseudoscientific thinking. It may be worthwhile to extend the text discussion of pseudoscience by discussing and providing examples of several characteristics of pseudoscience including: having the outward appearance of science, an absence of skeptical peer review, a reliance on personal experience, making claims that cannot be falsified, and making appeals to authority. After discussing the distinction between science and pseudoscience, have students evaluate the claims for Thought Field Therapy (http://www.rogercallahan.com/). Ask students to identify as many instances of pseudoscience as possible. After students have completed their own analysis, you might want to point them to an article published by Gaudiano & Herbert (2000) in Skeptical Inquirer (Can we really tap our problems away? A critical analysis of thought field therapy) that can be found here: http://www.csicop.org/si/archive/category/volume_24.4 or by searching the archives of the Skeptical Inquirer site.

7) To further illustrate the ubiquity of pseudoscientific thinking, have students visit the Skeptics Dictionary (http://www.skepdic.com/). You might simply have them browse the site or alternatively, ask them to explore some of the topics on the "junk science" portion of the site and identify examples of pseudoscientific thinking. This can be an eye-opening exercise for students as they explore topics that previously seemed believable to them.

8) As a fun way to explore the topic of pseudoscience, you might consider showing the film Secrets of the Psychics (available from amazon.com) in which the magician James Randi exposes the tricks of psychics and other charlatans.

9) The Web site Clips for Class (www.clipsforclass.com) has an extensive list of videos for use in many different psychology classes. Under the Research tab there is a video entitled "Penn and Teller: Placebo Effect". Here is the description found on the Web site and suggested questions for students after watching this clip.

Comedians Penn and Teller expose medical scam artists by using outrageous fake medical equipment and a fictitious doctor in a shopping mall. People tried "magnet therapy," "chiropractic weighted coats," and a "snail mucus mask" and were asked whether they experienced any health benefits.

Why did magnet therapy, magno mitts, and the chiropractic coat seem to work for the people? Have you heard of other medical treatments that could be included in this video?

10) The book 50 Great Myths of Popular Psychology: Shattering Widespread Misconceptions about Human Behavior by Lillienfeld, Lynn, Ruscio, and Beyerstein is filled with many examples of pseudoscientific thinking that could be explored when reviewing this chapter.

11) Discuss the case of Kitty Genovese as the inductive inspiration for studies on what is now know as the bystander effect. The following is a reference for the first bystander effect study conducted by Darnley and Latané (1968).

Darnley, J. M., & Latané, B. (1968). Bystander intervention in emergencies: Diffusion of responsibility. Journal Of Personality and Social Psychology, 8(4, Pt.1), 377-383. doi:10.1037/h0025589

12) Discuss Social Learning Theory as a simple broad theory that can generate many specific hypotheses through deduction. Social Learning Theory in its broadest forms states "We learn from other." Have students find original references for demonstrating deduction through the example of social learning theory to specific examples.

13) The following link is to a talk by doctor and epidemiologist Ben Goldacre posted in TED Talk. Dr. Goldacre is discussing bad science through many avenues. Topics covered in this textbook that are touched on in this talk include authority as a source of information, the placebo effect, scientific vs. public media sources, drug trials, correlation and causation, and biased data reporting. The suggested demonstration for this textbook would be to show this to students after covering the first chapter and then again at the end of the semester to demonstrate to them their change in perspective on the listed topics. You could have them take notes on the video each time they watch and write a summary paper on the changes in their perspective and understanding of the information.

http://www.ted.com/talks/view/lang///id/1234