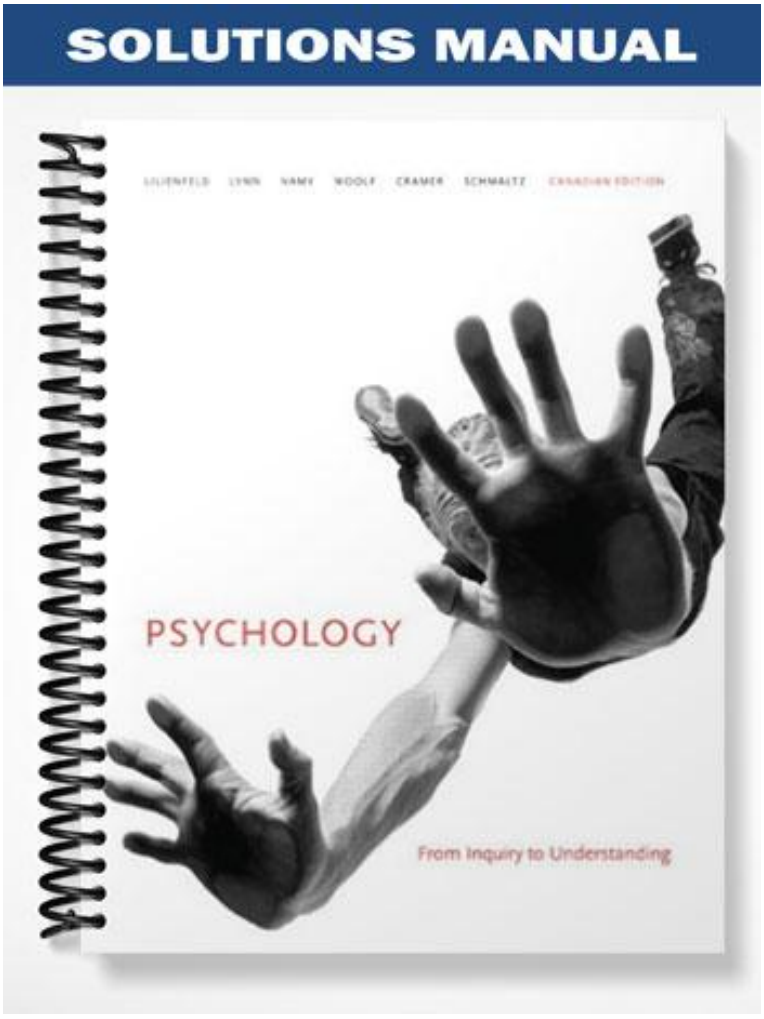
SOLUTIONS MANUAL



2/ RESEARCH METHODS: SAFEGUARDS AGAINST ERROR

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LECTURE GUIDE

THE BEAUTY AND NECESSITY OF GOOD RESEARCH DESIGN (TEXT P. 65)

2.1 Why we need good research designs (text p. 65)

- Reliance on common sense is prone to errors such as confirmation bias.
- Historically subjective impressions have led to tragic misconceptions on the efficaciousness of techniques such as the prefrontal lobotomy.

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2.2 How heuristics and biases prevent us from thinking clearly about psychology (text p. 66).

- **Heuristics** are mental short-cuts or rules of thumb. Typically, heuristics are helpful in conserving mental energy when bombarded with an overwhelming amount of information. There are two types of heuristics: the representative heuristic and the availability heuristic.
  - **Representative heuristics** are when we judge the probability of an event by its superficial similarity to a prototype.
    - Often individuals commit base rate fallacies when judging whether someone is more likely to be in one group over another. That is, people often do not consider how common a behaviour or characteristic is for a particular group.
  - **Availability heuristics** are when we estimate the likelihood of an occurrence based upon how easily it comes to mind.
- Cognitive biases often lead us to draw misleading conclusions. Two biases in particular are hindsight bias and overconfidence bias.
  - **Hindsight bias** is the tendency to overestimate how well we could have successfully forecast known outcomes. Known as the "I-knew-it-all-along-effect."
  - **Overconfidence bias** is the tendency to overestimate our ability to make correct predictions.

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THE SCIENTIFIC METHOD: TOOLBOX OF SKILLS (TEXT P. 70)

Lecture Launchers/Discussion Topics

- Case studies of Vietnam war experiences
- Correlations and Causal Relationships
- Independent and Dependent Variables
- The Placebo Effect
- The Road from Hypothesis to Conclusion
- An Experimental Example
- Applied Experimental Psychology in the Real World

Activities, Demonstrations, and Exercises:

- Can Science Answer This Question?
- Experimental Design
- Understanding Correlations

- Correlational and Experimental Research
- Testing Random Assignment
- Small Samples
- Which Method Would You Use?
- Name That Research Method
- Using Memory to Demonstrate Methodology
- Assignment: Observational Research in the Dining Hall
- Assignment: Naturalistic Observation

Web Resources:

- Research Methods and Statistics

2.3 – 2.4 Different Types of Scientific Designs: Advantages and Disadvantages (text p. 71)

- **Naturalistic Observation:** Watching behaviour in real world settings (text p. 71)
  - An advantage to this design includes high external validity (extent to which we can generalize our findings to real-world settings).
  - A disadvantage to this design is that it tends to be low on internal validity (the extent to which we can draw cause and effect inferences).
- **Case Study Designs:** A design that examines one person, or a small number of people in depth often over an extended period of time (text p. 71)
  - Advantages include the existence of proofs (the demonstration that a given psychological phenomenon can occur). Also, it allows for the opportunity to study rare or unusual phenomena that are too difficult, or impossible, to recreate in a laboratory. Additionally, this design is useful for offering insights that researchers can later test systematically.
  - A chief disadvantage is that this design cannot determine a cause and effect relationship or answer the question as to why a phenomenon occurred. It is also difficult to generalize results to broader populations from an individual or small sample.
- **Correlational Designs:** The extent to which two variables are associated (text p. 73)
  - Basic elements of a correlation
    - Direction: positive, negative, and zero correlations
    - Range: –1 to +1 and absolute value indicating the size of the correlation
    - Explained variance is found by squaring the correlation.
  - **Scatterplots** are two-dimensional graphs in which each dot represents a single person's data.
  - **Illusory correlations** are a misperception that there is a statistical association between two variables where none exists. We are especially prone to a fallacy of positive instances wherein we remember instances that are interesting and memorable and match these occurrences, which readily come to mind.
  - Correlations do not show causation and do not rule out third variable explanations for an association between variables.
- **Experimental Designs:** research characterized by random assignment of participants to conditions and manipulation of an independent variable (text p. 78)

- Experimental research designs are characterized by (1) random assignment of participants to conditions and (2) manipulation of an independent variable.
    - **Random assignment** is the random sorting of participants into two groups. One of these groups is called **the experimental group** (the group of participants that receives the manipulation) and the other group is called the **control group** (the group of participants that does not receive the manipulation).
    - An **independent variable** is any variable that an experimenter manipulates. A **dependent variable** is the variable that an experimenter measures to see whether the manipulation has an effect.
- A **confounding variable** or **confound** is any difference between the experimental and control groups other than the independent variable.
- The two aforementioned major features of an experimental design allow us to infer cause and effect relations. To make this inference we only need to ask (1) if this study is an experiment and, (2) if it is not an experiment, we should not draw causal inferences.
- Pitfalls in Experimental Designs:
    - **Placebo effect:** improvement resulting from the mere expectation of improvement
    - **Nocebo effect:** harm resulting from the mere expectation of harm
    - **Experimenter expectancy effect**: the phenomenon in which researchers' hypotheses lead them to unintentionally bias the outcome of a study. Because of this effect it is essential for researchers, whenever possible, to conduct their study in a double blind fashion. **A double-blind study** is when neither the researcher nor the participants are aware of who's in the experimental or control group.
    - **Hawthorne effect:** the phenomenon in which participants' knowledge that they are being studied can affect their behaviour. An especially widespread type of Hawthorne effect is demand characteristics. **Demand characteristics** are cues that participants pick up from a study that allow them to generate guesses regarding the researcher's hypotheses. Two ways of minimizing the Hawthorne effects are by covert observation (researchers conceal themselves) and participant observation (investigators become members of a group and then observe the behaviour of other group members.

- Sample selection and Evaluation
    - **Random selection** is the procedure that ensures every participant in a population has an equal chance of being chosen to participate. Random selection deals with how we assign our participants whereas random assignment deals with how we assign our participants to groups after they have been selected.
    - Evaluating measures

- **Reliability:** consistency of measurement. Test-retest reliability is when a questionnaire yields similar scores over time. Inter-rater reliability is the extent to which different people make similar behavioural observations.
- **Validity:** extent to which a measure assesses what it purports to measure
- **Self-report measures** and surveys are used to assess personality traits, mental illnesses, and interests. Surveys are closely related and are typically used to measure people's opinions and attitudes.
    - Advantages include ease of administration and also the direct questioning regarding personal information that only the respondent would have access to.
    - Disadvantages include the assumptions that people have insight into their own personality characteristics, and that they are honest in their responding. Some participants engage in response sets, which are tendencies to distort their answers to questionnaire items. Two types of problematic response sets are:
        - **Positive impression management:** the tendency to make ourselves look better than we actually are
        - **Malingering:** the tendency to make ourselves appear psychologically disturbed with the aim of achieving a clear-cut personal goal
- **Rating Data:** involves asking people who know others well to provide ratings on them. The advantage is having an objective opinion of someone who may be unlikely to give accurate information. The drawbacks of this approach include:
    - **Halo effect:** the tendency to have ratings of one positive characteristic "spill over" to influence the ratings of other positive characteristics. The converse of this is the **'horn effect'** wherein negative characteristics influence subsequent ratings.
    - **Leniency effect:** the tendency of raters to provide ratings that are overly generous
    - **Error of Central tendency:** an unwillingness to provide extreme (either very low or very high) ratings

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ETHICAL ISSUES IN RESEARCH DESIGN (TEXT P. 90)

Lecture Launchers/Discussion Topics:

- Animals in Psychological Research
- A Historical Perspective on Research Ethics

Classroom Activities, Demonstrations, and Exercises:

- Give the Doctor Some Advice

Web Resources:

- Ethics

2.5 Ethical Guidelines for Human Research (text p. 91)

- Every major North American university has at least one research ethics board (REB). The board reviews all research carefully with an eye toward protecting participant against abuses.
- REBs insist on a procedure called informed consent. **Informed consent** requires researchers to tell subjects what they are getting into before asking them to participate.
- Some research involves deception wherein a participant is deliberately misled about the nature of the study. In some experiments a confederate (a research assistant who plays the part of a participant) assists in deceiving a participant.
- Following the completion of a study the REB requires researchers to fully **debrief,** inform, participants about the nature of the study.

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2.6 Ethical Issues in Animal Research (text p. 92)

- Animal research is still a highly controversial topic.
- Few people are aware, though, of the rigorous, rigid guidelines that are in place to insure that animals used in research are treated humanely.

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STATISTICS: THE LANGUAGE OF PSYCHOLOGICAL RESEARCH (TEXT P. 93)

Statistics: The application of mathematics to describe and analyze data

2.7 **Descriptive Statistics:** numerical characterizations that describe data (text p. 94). The two main types of descriptive statistics are central tendency and dispersion.

- **Central tendency:** a measure of the "central" scores in a data set, or where the group tends to cluster. There are three measures of central tendency:
  - **Mean:** average, total score divided by the number of people
  - **Median:** middle score in a data set
  - **Mode:** the most frequent score in a data set
- **Dispersion:** a measure of how loosely or tightly bunched scores are. There are several different measures of dispersion.
  - **Range:** difference between the highest and lowest scores
  - **Standard deviation:** measure of dispersion that takes into account how far each data pint is from the mean

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2.8 **Inferential Statistics:** mathematical methods that allow us to determine whether we can generalize findings from our sample to the full population (text p. 95)

- **Statistical significance:** Typically, researchers do not accept a finding as believable unless it would have occurred by chance less than 1 out of every 20 times. The expression "$p<.05$" seen in psychology journals means that a finding is statistically significant if the probability of the finding occurring by chance alone is less than 1 in 20.

- Statistical significance should not be confused with practical significance. A finding can be statistically significant an yet have no importance or real-world predictions.

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2.9 How People Lie with Statistics (text p. 96)

- Reporting measures of central tendency that are nonrepresentativeof most participants
- Creating visual representations that exaggerate effects
- Failing to take base rates into account

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BECOMING A PEER REVIEWER OF PSYCHOLOGICAL RESEARCH (TEXT P. 99)

Lecture Launchers/Discussion Topics:

- Pseudopsychology and the Mozart Effect

Classroom Activities, Demonstrations, and Exercises:

- Wonder Horse Dials 911 to Save Boy's Life
- Softens Hands While You Do Dishes
- Assignment: Critical Thinking (with sample syllabus and grading rubric)

2.10 Most Reporters aren't Scientists: Evaluating Psychology in the Media

- Few psychology reporters have formal psychological training. When considering media claims, the source should be questioned. We should wonder whether the story was sharpened (the tendency to exaggerate the central message) or levelled (minimize less central details), and consider if the story presents a balance between two sides of a controversy. An example of the latter is **pseudosymmetry** when there is the appearance of scientific controversy where none exists.

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2.11 Applying the Experimental Method: Extrasensory Perception (ESP) and Psychic Abilities

- Extrasensory perception (ESP) is the perception of events outside the known channels of sensation. It has been disproved. People may believe in ESP due to the general tendency to underestimate the likelihood of coincidences and thereafter attribute them incorrectly to psychic phenomena.

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CHAPTER 2
Learning Objectives

2.1 Explain what research designs accomplish that we can't discover by intuition alone
2.2 Identify heuristics and biases that prevent us from thinking clearly about psychology
2.3 Distinguish the types of designs and the conclusions that we can draw from each
2.4 Identify the potential pitfalls of each design that can lead to faulty conclusions
2.5 Explain the ethical obligations of researchers toward their research participants
2.6 Describe both sides of the debate on the use of animals as research subjects
2.7 Explain how to calculate measures of central tendency
2.8 Identify uses of various measures of central tendency and dispersion
2.9 Show how statistics can be misused for purposes of persuasion
2.10 Identify flaws in research designs
2.11 Identify skills for evaluating psychological claims in the popular media

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Chapter 2: Rapid Review

Heuristics are mental short-cuts or rules of thumb and typically are helpful in conserving mental energy when bombarded by information. Two types of heuristics are the **representative heuristic** and the **availability heuristic.** Often cognitive biases lead us to draw erroneous conclusions. Two biases in particular are **hindsight bias** and **overconfidence bias.**

There are several types of scientific designs, each with advantages and disadvantages. Naturalistic observation (watching behaviour in real world settings) has the advantage of high external validity but the disadvantage that it tends to be low on internal validity. The **case study design** examines one person, or a small number of people in depth often over an extended period of time. The advantages include the existence of proofs, the opportunity to study rare or unusual phenomena, and insights that researchers can later test systematically. A chief disadvantage is that it cannot determine a cause and effect relationship and results are difficult to generalize. **Correlational designs** assess the extent to which two variables are associated and can be positive, negative or zero and range from –1 to +1. Correlations can be plotted on **scatterplots,** which are two-dimensional graphs in which each dot represents a single person's data. Disadvantages to this design are **illusory correlations,** a misperception that there is a statistical association between two variables where none exists. Correlations do not show causation and do not rule out third variable explanations for an association between variables.

Experimental design research is characterized by random assignment of participants to conditions (experimental or control group) and manipulation of an independent variable to determine the effect on a dependent variable. Experimenters try to account for any **confounding variables** or **confound.** The disadvantages in experimental designs include placebo and nocebo effects, experimental expectancy effects, and the Hawthorne effect.

Participant sample selection is based upon **random selection,** the procedure that ensures every participant in a population has an equal chance of being chosen to participate. Measures are evaluated base upon r**eliability,** consistency of measurement, such as **test-retest reliability** and **inter-rater reliability** and **validity,** the extent to which a measure assesses what it purports to measure.

Self-report measures and surveys are used to assess personality traits, mental illnesses, and interests. Surveys are typically used to measure people's opinions and attitudes. Advantages include ease of administration and also the direct questioning regarding personal information that only the respondent would have access to. Disadvantages include the assumptions that people have insight into their own personality characteristics, and that they are honest in their responding. Some participants engage in **response sets,** which are tendencies to distort their answers to questionnaire items. Two types of problematic response sets are **positive impression management** and **malingering.**

Rating data involves asking people who know others well to provide ratings on them. The advantage is having an objective opinion of someone who may be unlikely to give accurate information. The drawbacks of this approach include the **halo effect** and **'horn effect,' leniency effect,** and the **error of central tendency.**

For researchers to conduct studies they must follow the ethical guidelines established by their universities' **research ethics board (REB).** The board reviews all research carefully with an eye toward protecting participant against abuses. REBs insist researchers use **informed consent,** requiring them to tell subjects what they are getting into before asking them to

participate, and then **debriefing them,** that is inform, participants about the true nature of the study.

Statistics is the application of mathematics to describing and analyzing data. There are two types of statistics, **descriptive statistics** that describe data and inferential statistics that allow us to determine whether we can generalize findings from our sample to the full population. The two main types of descriptive statistics are central tendency (i.e., the mean, median, and mode) and dispersion (i.e., range, standard deviation). In **inferential statistics** the mathematical method tests for **statistical significance,** a finding is statistically significant if the probability of the finding occurring by chance alone is less than 1 in 20. Statistical significance should not be confused with practical significance. A finding can be statistically significant and yet have no importance or real-world predictions. Statistics can be manipulated in several ways; such as, reporting measures of central tendency that are nonrepresentative of most participants, creating visual representations that exaggerate effects and failing to take base rates into account.

In the media few psychology reporters have formal psychological training. When considering media claims, the source should be questioned. We should consider whether the story was sharpened (the tendency to exaggerate the central message) or levelled (minimize less central details), and if the story presents a balance between two sides of a controversy.

When the experimental method is applied to rigorously test claims such as Extrasensory perception (ESP), the results often disprove these claims. People may believe in ESP due to the general tendency to underestimate the likelihood of coincidences and thereafter attribute them incorrectly to psychic phenomena.

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▼LECTURE LAUNCHERS AND DISCUSSION TOPICS

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Lecture/Discussion: Case studies of Vietnam war experiences

An excellent example of how the case study works in psychological research is the work of Lambright (2003), who studied the responses of six Vietnamese volunteers (varying in age from 24 to 68) to the disruption in their daily lives, occupations, and the cultural adjustments brought about by the war in Vietnam. She conducted the interviews individually, in different locations throughout Vietnam during June and July of 2002. The six volunteers, from whom she obtained written consent, answered seven questions. While the standard seven questions might suggest that this face-to-face interview was a highly structured one, Lambright was in fact free to follow up any interesting answers with more questions as the need arose, making the interview an unstructured one. Here are two brief excerpts from those interviews, answers to the question "What about your culture explains its resilience during sustained disruption (such as war, famine, social and political crises)?"

(Nguyen Ban, 24) "A happy stable family takes care of each other…we all overcome together. We have a solid base to stand on…. The Vietnamese are very flexible, adaptable to the situation. They are resilient; in the hard time they are unified and come together in a community to fight against the enemy…."

(Le Minh Viet, 68): Resilience, without the ability to adapt under circumstances, we wouldn't have survived the Chinese domination, the French, and all the wars over the centuries. Circumstances shape the attitudes, the emotions, and the behaviours. All of us are used to war situation and became acclimated so it minimizes trauma."

Notice that while both interviewees stress the adaptability of the Vietnamese, the younger Nguyen seems focused on how Vietnamese people might react in some future conflict—Nguyen did not live through wartime. The older Minh did experience the war, and talks more about how the past affects his culture now. This kind of detailed information is only possible in a case study style of research. Mere observation would not provide the answers to Lambright's questions.

Interview Questions:

1. What about your culture explains its resilience during sustained disruption (such as war, famine, social and political crises)?
2. What lessons have been learned as a result?
3. How have these lessons been integrated into the current society?
4. Can you share some examples of adjustment to the turmoil, examples known within your area of expertise or with which you are personally familiar?
5. Can you give examples of maladjustment known within your area of expertise or with which you are personally familiar?
6. In thinking about your answers, what do you see as being particular to the Vietnamese culture that explains your response to the above questions?
7. Is there anything else you would like to add to this interview?

Lambright, L.L. (2003). Paper presented at International Conference, Midwest Institute for International/Intercultural Education, Cleveland, Ohio, April.

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Lecture/Discussion: Correlations and Causal Relationships

There seems to be a general human tendency to attribute causality to correlated events. The lay person, like the psychologist, often imposes patterns of (apparently) lawful regularity on observed events. Given what is perceived as an "effect," we search for causes. Events are more likely to be singled out for attention and analysis when they are unusual, anomalous, and discontinuous with our prior experience. When such events are natural phenomena, they are typically relegated to the status of "cause" and then the search is directed toward their after-effects.

One of the most persistent instances in which pseudo-correlations of behaviour consequences are reported to flow from salient natural and human events is the "baby boom" syndrome. For example, the allegation of increased births nine months after a major power blackout in New York is well known. So too, is the baby boom in Israel nine months after their war with Egypt.

Invariably, when base rate data are used to compare the assumed "increase in births," the effect vanishes. That is, when seasonal fluctuations in births are taken into account, there is no unusual effect left to relate to the nine-months-earlier unusual event. But that does not deter the correlation seekers. Three University of North Carolina sociologists attributed a 1955 drop in Southern birth rates to the Supreme Court's 1954 school desegregation decision (Rindfuss, Reed, & St. John, 1978). They theorized that uncertain prospects for the future "demoralize"' prospective parents (both whites and, to a lesser extent, blacks), causing them to postpone any children they might otherwise have conceived in the three- or four-month period immediately following the decision. The subsequent recovery in the birth rate is attributed to the realization that desegregation would in fact proceed slowly.

And on it goes. Less than a week after Chicago's "Blizzard of '79," at least one newspaper columnist was speculating on the possibility of a baby boom in the coming autumn (Kup's column, *Chicago Sun-Times*, January 17, 1979, p. 52).

Another example of the temptation to confuse correlation with a causal connection is in the area of extramarital sexual affairs. Biracree (1984) found that, for men, there was an almost perfect positive correlation between annual income and the percentage of men who had been unfaithful to their wives. This relationship was not true for married women. If this finding is valid, what are the possible explanations for these relationships? Is there any strong evidence to support any of these explanations, or are they, at the moment, speculations?

References:

Biracree, T. (1984). *How you rate: Men* and *How you rate: Women*. New York: Dell.

Rindfuss, R. R., Reed, J. S., & St. John, C. A. (1978). A fertility reaction to a historical event: Southern white birthrates and the 1954 desegregation ruling. *Science, 201,* 178–180.

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Lecture/Discussion: Independent and Dependent Variables

In the cereal and fruit example, the cereal and the fruit are independent variables and the rash is the dependent variable. One useful way of thinking about and identifying independent and dependent variables is to remember that the basic hypothesis underlying any experiment is "X causes Y" (colouring a movie [X] changes the way people respond to it [Y]; a cereal [X] caused a rash [Y]; a fruit [X] caused a rash [Y]). To test such hypotheses, X is manipulated in order to determine its effect on Y. Thus, X is the independent variable and Y is the dependent variable. Advise students that, when trying to identify independent and dependent variables (as might happen in the context of an exam question), they should put the variables in the scenario into an "X causes Y" statement.

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Lecture/Discussion: The Placebo Effect

The power of suggestion is powerful indeed. Consider the example of the placebo effect. During the 1950s, surgeons routinely performed a simple operation to relieve chest pain suffered by patients with angina pectoris. An amazing number of the patients—nearly 90 percent—reported relief from pain. An experimental study divided angina patients into two groups and informed them that they were going to have an operation that had a very high success rate in relieving angina pain. The actual surgery was performed on only half the patients. What was done with the other half would no longer be allowed according to ethical medical standards. The surgeons took the remaining half of the patients, put them under anesthesia, made the surgical incision in their chests, and then simply sewed them up again. When the patients awakened in the recovery room, they were told that the operation had been performed (Cherry, 1981). The patients who had the sham surgery did even better than the patients who had undergone the actual operation! Their pain had been relieved simply by the power of suggestion. Remind students of the aspirin study and ask why the researcher included a placebo.

Cherry, L. (1981, September). Power of the empty pill. *Science Digest, 116*, 60–67.

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Lecture/Discussion: The Road from Hypothesis to Conclusion

How do we know that cigarette smoking is dangerous to your health?

Cigarette smoking became common in Europe after French and British soldiers picked up the habit from Turkish soldiers in the Crimean War of 1854 to 1856. The habit was adopted by a few Americans in the next 30 or 40 years. The tobacco was strong and they rolled their own. More American males began to smoke after the automatic cigarette-making machine was perfected in North Carolina in the 1880s. Very few women smoked, at least in public, until after World War I when U.S. tobacco companies began to target women with their advertising.

People must have suspected that cigarettes are dangerous to health long before any research was done. The slang term for cigarettes, "coffin nails," was used during the first half of the century.

The conjecture became a hypothesis when doctors noticed that many people who died of lung cancer had been heavy smokers, and it was also suspected that nicotine affects the circulatory system. Early studies produced high negative correlations between cigarette smoking and age at death: the more people smoked, the younger they were when they died.

This correlational data resulted in the first warning labels on cigarettes in the 1960s: "Caution: The Surgeon General has determined that cigarette smoking may be hazardous to your health." Notice that the warning reads "may be hazardous," rather than "is hazardous." The conservative warning is all that is justified by correlational data. A relationship between variables does not imply that the variables are causally related. The earlier death of smokers could be for reasons other than cigarette smoking. Perhaps smokers live more stressful lives, and both the smoking and their illness are the result of stress. Also, it is possible that smokers are not as careful of their health in other ways as non-smokers; maybe they don't exercise or have nutritious diets. Or perhaps both the smoking and the mortality have a genetic basis.

To do a definitive experiment on the effects of smoking, one would need to get a sample of 100 or so young people who have never smoked and assign them randomly to a smoking group and nonsmoking group. The smokers would smoke at least one package of cigarettes a day for life, beginning at age 16 or 18, and the non-smokers would not smoke at all. The dependent variable is age at death, and the successors of the original researchers could not analyze the data until all the subjects died. If the non-smokers lived significantly longer, the researchers would be justified in concluding that cigarette smoking <u>is</u> hazardous to health.

An experiment like this has not been done, and probably never will be done. In the 1970s the label on cigarette packages was changed to read, "Cigarette smoking is dangerous to your health." The evidence that prompted this change came from several sources. One source was studies that tried to match smokers and non-smokers on various alternative causes, such as stress, and thus to control for its effects on health. Another source of evidence came from animal studies. The conclusions that cigarettes are truly "coffin nails" is based on large amounts of data and a

multitude of studies.

Many studies were required to get from a hypothesis to a firm conclusion in the establishment of a causal link between smoking and disease and death. The reason is that there are humane and ethical constraints that rule out certain types of research. Because humans are the primary focus in psychology, it is often difficult for us to get answers to important questions. As just one example of this, we would like to know if child abuse has permanent effects on personality, and if so, what these effects are. But we cannot assign infants at birth to be abused or not abused, so to study this question we must try to tease out these effects from the mass of environmental variables that affect the development of human personality.

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Lecture/Discussion: An Experimental Example

Can vitamins increase IQ?

Suppose you hear about a retarded boy who did better schoolwork after being given a dose of a vitamin-mineral supplement, and you decide to conduct an experiment to see if intellectual functioning of retarded children can really be improved by such a diet supplement. You start with the hypothesis, "A vitamin-mineral supplement (independent variable) added to the diet of mentally retarded children will improve their intellectual functioning (dependent variable)."

Your first task is to define your variables more precisely. What vitamins and minerals will you use, and at what strength? How many times a day and for how many months? You may decide to use an IQ test score as a numerical measure of your dependent variable; you may also decide that you will require a minimum increase in the number of points as acceptable evidence of improvement, because many chance factors can influence test scores.

You draw your subjects from a group of children who have all been tested and diagnosed as mentally retarded, and you randomly assign them to either the experimental group, who will get the supplement, or the control group, who will be given a placebo (some inert substance) instead of the supplement.

There are several precautions you will need to take to avoid bias in your results. Besides controlling for similarity of your two groups at the start, you will want to be sure that the subjects in both groups are exposed to all the same conditions during the experiment except for the exposure to the independent variable, the nutritional supplement. Temperature, timing, instructions, conditions of testing, and other events during the time of the experiment should be as similar as possible for the two groups.

Your own desires to prove or disprove the idea that vitamins may increase school performance may be a possible source of bias. To reduce this bias, would you conduct a single-blind or double-blind experiment?

For a fixed period of time, say four months, the children in the experimental group receive the supplements in tablets at each meal. The control-group children also receive tablets, but they contain nothing of biological value (a placebo). Neither the children nor those working with them or testing them know which child is getting which kind of tablet. At the end of the four months, intelligence tests are given again to see if the groups now differ.

You may find that both groups have higher scores than originally, perhaps from all the extra attention they have been receiving or from some natural development over this period. So you use the control group's scores as a baseline and compare the experimental group's scores with that baseline.

If you find no difference, the study may end there, or you may try variations, perhaps a stronger supplement or a longer time period or subjects who are less retarded.

If you do find a difference in your original study, you will evaluate the probability that your obtained difference could have occurred by chance alone, even without the independent variable. If it is unlikely that it is a chance finding, your confidence in the hypothesis is increased.

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Lecture/Discussion: Applied Experimental Psychology in the Real World

Students often have difficulty wondering how general research results can be applied to the real world. In other words, "How does this relate to me?" The following example provides connections between basic research in sensation and perception and possible military or medical errors.

A number of devices use sound (beeps, clicks, etc) to provide feedback regarding bodies, structures, or machines. These sounds are designed to provide people with information about changes in the current situation. For example, in medicine, drops in heart rate or blood pressure are signalled with beeps. Jet pilots receive information regarding positioning in the form of sounds as well. The purpose of these devices is to provide immediate auditory feedback that signals potential problems. The auditory nature allows the surgeon or pilot to be visually focused on something else at the time.

Unfortunately, results of recent research (Neuhoff, Kramer, and Wayand, 2002) suggest that people often misperceive how sounds change when both their pitch and loudness change. Rather than noticing the changes immediately and accurately noting the meaning of the changes, individuals may miss the changes entirely or misinterpret them. Because of this misperception, people can't accurately judge the intended meanings of the sounds. Real-world complications that could arise from this problem range from medical mistakes to serious pilot errors. For example, if a pilot does not accurately identify the sounds of the flight system that are designed to alert him/her of possible mechanical issues, the chances of mechanical failure or crashes may be increased. This result is contrary to the purposes of those feedback systems which are designed to enhance safety. It appears that the initial assumptions of inventors/creators of these systems regarding the accuracy of human interpretations of the sounds may have been incorrect.

http://www.apa.org/releases/auditory.html
Neuhoff, J. G., Kramer, G., & Wayand, J. (2002). Pitch and Loudness Interact in Auditory Displays: Can the Data Get Lost in the Map? *Journal of Experimental Psychology—Applied*, Vol. 8. No.1

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Lecture/Discussion: Animals in Psychological Research

Should animals be used in psychological research?

A controversial issue in psychology, and in many other fields of study, involves the use of animals in research. Is it ethical to subject animals to unnatural and/or painful situations in the pursuit of knowledge about the human condition? You might present students with some additional information about the use of animals in psychological research and the nature of the debate.

Psychologists who study animals are sometimes interested in comparing different species or hope to learn more about a particular species. Their work generally falls into the area of basic science, but often it produces practical benefits. For example, using behavioural principles, farmers have been able to reduce crop destruction by birds and deer without resorting to their traditional method—shooting the animals. Other psychologists are primarily interested in principles that apply to both animals and people. Because many animals have biological systems or behavioural patterns similar to those of human beings, using animals often allows more control over variables than would otherwise be possible. In some cases, practical or ethical considerations prevent the use of human beings as subjects. By studying animals, we can also clarify important theoretical issues. For example, we might not attribute the greater life expectancy of women solely to "lifestyle" factors and health practices if we find that a male-female difference exists in other mammals as well.

As the text points out, those who support the use of animals in research argue that animal studies have led to many improvements in human health and well-being. In recent years, however, animal research has provoked angry disputes over the welfare of animals and even over whether to do any animal research at all. Much of the criticism has centred on the medical and commercial use of animals, but psychologists have also come under fire. Critics of animal research have pointed to studies that produce no benefits for human beings but involve substantial harm to the animals being studied. A few years ago, for instance, a Maryland psychologist studying the nervous system was convicted of cruelty to animals after he cut the nerve fibres controlling limb sensation in 17 monkeys. The purpose of his research was to find ways to restore the use of crippled limbs in stroke victims. The charges alleged abusive treatment of the animals. The psychologist's conviction was eventually reversed on appeal, but by then the government had withdrawn its funding of the project.

People have staked out extreme positions on both sides of this debate. The controversy has often degenerated into vicious name-calling by extremists on both sides. Some animal rights activists have vandalized laboratories, and threatened and harassed researchers and their families; some scientists have unfairly branded all animal welfare activists as terrorists (Blum, 1994). A more positive result of the debate has been the close examination of the American Psychological Association ethical code for the humane treatment of animals and the passage of stricter federal animal welfare regulations governing the housing and care of research animals. Most psychological organizations, however, oppose proposals to ban or greatly reduce animal research. The APA and other organizations feel that protective legislation for animals is desirable but must not jeopardize productive research that increases scientific understanding and improves human welfare.

http://www.rgs.uky.edu/ori/univet/resources/Handbook/hb-ethics-history.htm
http://www.the-aps.org/publications/tphys/legacy/1983/issue5/271.pdf

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Lecture /Discussion: A Historical Perspective on Research Ethics

When discussing the ethical treatment of human research participants several "classic" studies, which would be ethically questionable by today's standards, serve as examples. For instance, many instructors discuss Stanley Milgram's studies of obedience, Philip Zimbardo's prison simulation, or Stanley Schachter's studies of autonomic arousal and attribution. Students often have mixed reactions to these examples. Some find them relatively innocuous, whereas others have strong reactions to the treatments participants were asked to endure. The fact that such studies took place within relatively recent times compounds the issue. Some students see these 1960s experiments as "long ago and of a different time," whereas others see them as examples of the "unethical treatment psychologists still foist on people to this day."

To provide a context for these types of issues, your students might be interested in hearing about older examples of ethically questionable research. For example, Carney Landis, a noted psychologist of the 1920s and 1930s, conducted a series of studies dealing with the experience and expression of emotion. In one set of studies he was particularly interested in capturing facial expressions of emotion, and used strong elicitors of emotion to produce them. For example, one situation involved dropping a lit firecracker underneath an unsuspecting subject's chair, whereas another involved showing participants pornographic (for their day) photographs and photos of horribly disfiguring skin diseases.

Although these manipulations may seem harsh, Landis used stronger ones as well. For example, participants were instructed in one situation to plunge their hand into a pail of shallow water that, unbeknownst to them, contained three live frogs. (This manipulation was presumably used to evoke disgust.) To quote Landis, however, "After the subject had reacted to the frogs the experimenter said, 'Yes, but you have not felt everything yet, feel around again.' While the subject was doing so he received a strong ... shock from an induction coil, attached to the pail by concealed wiring."

And for the *coup de grâce:*

> "The table in front of the subject was covered with a cloth. A flat tray and a butcher's knife were placed on the cloth. A live white rat was given to the subject. He (sic) was instructed, 'Hold this rat with your left hand and then cut off its head with the knife.'...In five cases where the subjects could not be persuaded to follow directions the experimenter cut off the head while the subject looked on."

Mention is also made of a final experiment involving shock which "...varied from a just noticeable intensity to a strength which caused the subject to jump from the chair," as well as other studies. Landis' participants, in passing, included graduate students, a stenographer, a school teacher, and a thirteen-year-old boy with high blood pressure.

Although Landis has been singled out for examination here, there certainly are no lack of experiments from the 1920s through the 1960s work mentioned above that can provide examples of ethically dubious research. Discussing such studies, especially in light of current APA standards, should produce spirited discussion among your students.

Landis, C. (1924). Studies of emotional reactions II: General behavior and facial expression. *Comparative Psychology, 4,* 447-509.

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Lecture/Discussion: Pseudopsychology and the Mozart Effect

Before discussing pseudoscience, ask students about their impression of the so-called Mozart effect. Most students have heard of the general phenomenon and have seen advertisements and CDs of music "designed to increase your children's IQ." Bring in a magazine advertisement and read from it, touting the merits of the product. Ask students if they believe it, and if they would buy the product. Probe them by asking what "proof" they would need that the product actually works. Usually, students will begin to question the merits of the product, at which point you can discuss the actual psychological findings of this moneymaking gimmick by summarizing the work of Steele, Bass, and Crook (1999).

Pseudoscience quite literally means "false science." Its "claims [are] presented so that they appear scientific even though they lack the supporting evidence and plausibility" (Shermer, 1997, p. 33). Furthermore, pseudoscience appears to use scientific methods and tries to give that "science-y" impression. Some characteristics of Pseudoscience include the following: (http://www.pseudoscience.org)

1. associates itself with true science
2. relies on and accepts anectdotal evidence
3. sidesteps disproof
   - any possible outcome is explained away
   - a theory is not a good theory if it can explain everything because it can never make specific predictions
4. dangerously reduces complexity to simplicity (to a consumer society)

Ask students why the Mozart effect would be considered pseudoscience based on the four aforementioned characteristics. Have students give other examples of possible pseudoscience such as graphology, palmistry, aromatherapy, and quite arguable Eye-Movement Desensitization and Reprocessing (EMDR).

There is an excellent video clip entitled "Paper Personality" by *Scientific American Frontiers* that shows the downfalls of graphology, and a companion website for teaching activities related to graphology:

http://www.pbs.org/safarchive/4_class/45_pguides/pguide_802/4482_paper.html

"Paper Personality" (Running time: 8:46). Chedd-Angier Productions (1997). *Scientific American Frontiers: Season VIII: Beyond Science?* Episode 2 of 5. [Television series episode].
Available to purchase: http://www.shop.pbs.org
View online: http://www.pbs.org/saf/archive.htm (Keyword: paper personality)

Steele, K.M., & Bass, K. E., & Crook, M. D. (1999). The mystery of the Mozart effect: Failure to replicate. *Psychological Science, 10,* 366–369.

Shermer, M. (1997). *Why people believe weird things: Pseudoscience, superstition, and other confusions of our time.* New York: W. H. Freeman & Co.

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CLASSROOM ACTIVITIES, DEMONSTRATIONS, AND EXERCISES:

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Activity: Can Science Answer This Question?

Students are asked to identify whether specific questions can be addressed using the methods of science. The student handout is included as **Handout Master 2. 1** This is a good exercise to follow-up to the **Lecture Topic** in this chapter **How Do We Know What We Know?** Suggested answers and explanations are listed below.

1. No. The question as stated is vague and the terms are not defined. What does "bad" mean? (Good and bad are value judgments.) Who or what is "society"? Bad for whom? However, specific correlates and consequences of abortion can be studied.
2. Yes. The independent variable would be "before or after eating" and the dependent variable would be talkativeness, which could be operationally defined (e.g., as the length of replies to questions).
3. Yes, so long as the variables are operationally defined. The independent variable would be jogging versus not jogging (or perhaps the frequency or duration of jogging); the dependent variable would be some measure of mental attitude, such as scores on a psychological test.
4. Yes. This question requires only the computation of a correlation between doctors' GPAs in medical school and their subsequent incomes. Such variables as "years in practice" would have to be controlled and a representative sample would have to be selected.
5. No, probably not; it would be a little like comparing apples and oranges. Physiological measures of emotional strength would not be useful because there is not always a relationship between physiological arousal and subjective experience, and because love tends to be a more enduring emotion than anger.
6. Yes. The independent variable would be "bottle-fed versus breast-fed." The dependent variable would be alertness, which would have to be operationally defined in behavioural terms. If babies were randomly assigned to the two groups, the study would be an experiment. If the researcher used babies whose mothers had already made the decision about feeding method, the study would be correlational, and inferences about cause and effect could not be made.
7. No. "Moral" is a broad, vague term that means different things to different people. Moreover, many unanticipated economic, political, and social developments could affect the outcome. Even if "moral" could be defined adequately, and projections from current trends and conditions could be made, the results might turn out to be meaningless because definitions of morality change over time. What is "moral" in the 1990s might not be moral in 2020, and vice versa.
8. No. The subjects would be very uncooperative!

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Activity: Experimental Design

The overarching goals of the following exercise are to demonstrate how psychology and the scientific method can be used to address issues that interest your students, to teach them how the concepts they are learning influence experimental design, and to give them an appreciation for the challenges faced by experimental psychologists. Lead your class through the process of designing an experiment. Start with a hypothesis generated through brainstorming by the class. Allowing your students to provide the hypothesis ensures that it will interest them and that they will stay engaged. Students may start with topics such as alien abduction, crop circles, and the Loch Ness monster. Welcome this, as it gives you a terrific opportunity to talk about alternative explanations, existence proofs, and the fact that some topics, such as the proof of the existence of God, remain firmly outside the boundaries of science. The scientific method is not a panacea; it is a highly structured method for testing measurable factors and relationships. After your class has agreed on an issue to test, lead them toward a consensus and a testable hypothesis about the issue. Once your class has clearly defined a hypothesis, lead them through a discussion of possible alternative explanations. Challenge their hypothesis and their beliefs. Are there other possible explanations that are simpler and more likely? What assumptions and possible biases underlie their hypothesis? How would the hypothesis (and their assumptions and biases) generated by your class be different from explanations put forward by people from different cultures and different times? You might want to mention that spirit possession was a widely held explanation for mental illness until relatively recently. After listing a number of possible alternative explanations, allow your class to suggest a very basic methodology for testing the hypothesis and eliminating the alternative explanations. You might want to give them a head start by suggesting the kind of data that they would need to collect to measure the variables of interest. Depending on the hypothesis chosen and the sophistication of your class, outlining a reasonable experiment may be a difficult process. If the class begins to show signs of overload, you can quickly switch gears and use the exercise to demonstrate the difficulty in designing and executing well-controlled experiments.

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Activity: Understanding Correlations

This exercise on correlations can be used as a classroom demonstration or as a take-home assignment following a lecture on the nature and uses of correlations. The student handout for this exercise is included as **Handout Master 2.4.** Suggested answers are provided below; however, there are other reasonable explanations.

1. *Positive*. Mutual influence. Similar life experiences.
2. *Negative*. Orphanage environment has an adverse effect on cognitive development. Intelligent children are more likely to be adopted.
3. *Positive*. Violent pornography stimulates violent behaviour. Both the violent crime and the number of stores are related to the size of cities. Violent criminals are attracted to violent pornography.
4. *Negative*. Absent students miss pearls of wisdom from the mouth of the instructor. Students with jobs or other responsibilities find it difficult both to get to class and to find time to study.
5. *Positive*. The money appropriated to control crime was poorly spent. The city grew during the eight years, resulting in more crime and more tax revenues.
6. *Positive*. Both variables are related to socio-economic factors; children from affluent homes have both intellectual and physical advantages over children from substandard home environments. Age is the third variable that accounts for scores on both variables; older children have bigger vocabularies and are also stronger and better coordinated.

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Activity: Correlational and Experimental Research

Many students have difficulty understanding the difference between correlational research and experimental research. It might be useful to walk the class through an example where both kinds of research are illustrated with the same variables. Two examples that could be used this way are the relationship between violent television

viewing and aggression, and the relationship between similarity and liking. In both examples either variable could plausibly be caused by the other (or by some third factor); so the step up from correlational to experimental research, where causality can be determined, can be seen as useful. Spend some time discussing how psychologists must be ingenious to turn concepts such as "liking" into measurable variables (this will help students appreciate the scientific process). As examples, you can present actual studies that have been done in these two areas. Byrne (1971) discusses extensive research on the influence of similarity on attraction, and Liebert and Sprafkin (1988) discuss the effects of television on children.

Byrne, D. (1971). *The attraction paradigm.* New York: Academic Press.

Liebert, R., & Sprafkin, J. (1988). *The early window: Effects of television on children and youth.* New York: Pergamon Press.

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Activity: Testing Random Assignment (Group activity)

Students are often distrustful of random assignment, thinking that the people with the best memory or the worst sense of smell will all end up in the same group and make the results of research undependable. This demonstration is designed to show that random assignment does produce equivalent groups.

Provide students with small cards and have them record their height in inches on the card. If the class is small, ask them to record the height of their best friend on a second card. Collect the cards and then randomly assign them to several groups of 20. Have students calculate means for the groups.

The means should be quite close, illustrating that random assignment has produced equivalent groups. You might also explain that random assignment is not infallible and can be a source of experimental error.

This activity can be extended by using groups of different sizes, such as 2, 5, 10, 20, and 50, to show that the probability of getting groups that are not equivalent decreases as group size increases.

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Activity: Small Samples

Objective: To discover if small samples can really be representative
Materials: A coin, copies of the chart in Handout Master 2.5
Procedure: Sometimes students have a hard time believing that 1,000 people or so can represent the entire population of the United States. This activity will help them see that small samples can be representative. Divide students into small groups and instruct them as follows:

Point out to students that, as *n* gets bigger, the more balanced the percentage of heads and tails becomes. However, they should notice too that *n*=20 isn't much better than *n*=15. And it took a lot longer to collect 5 samples of 20 coin tosses each. In other words, there wasn't much gain in representativeness for the extra cost in time and energy. So, small samples can be representative, and increasing the size of a sample doesn't always pay off when costs are balanced against benefits.

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Activity: Which Method Would You Use?

The following examples can be used to generate a class discussion on the research methods used by psychologists. Write the methods on the board: case histories, naturalistic observation, laboratory observation, surveys, tests,

correlational studies, and experiments. Then, for each situation, ask students to decide which method is appropriate and briefly describe why.

1. Determining the favourite food of adolescents.
   Method: Survey
   Explanation: Adolescents constitute a large population and the information sought should be accessible through questionnaires or interviews. Care will be needed to construct a sample that is representative of the population under consideration.
2. Determining whether a person is introverted or extroverted.
   Method: Psychological test
   Explanation: The goal is to measure psychological qualities within an individual. Other methods (e.g., case history, naturalistic observation) might be employed, but they are more time-consuming and do not offer the degree of standardization, reliability, and validity found in a well-constructed test.
3. Determining if frustration causes aggression.
   Method: Experiment
   Explanation: Cause-and-effect information is being sought. In science this information is obtained through experimentation in which the proposed causal variable is manipulated under controlled conditions.
4. Determining if level of education is associated with crime.
   Method: Correlation
   Explanation: This technique is used to determine if and how strongly two variables are related. Establishing that a correlation exists, however, does not address the problem of why two things are related.
5. Determining how teenagers behave on their first date.
   Method: Naturalistic observation
   Explanation: A description of behaviour as it occurs in a real-life situation is being sought. Making the observations without arousing suspicion in subjects could be problematic, and the investigator will need to be careful to prevent "guinea-pig" reaction.
6. Determining the behaviour of subjects who are anxious about participating in research.
   Method: Laboratory observation
   Explanation: The goal here can be readily achieved within an environment artificially set up by the experimenter. The advantage of this approach is that the investigator has greater control over the situation being studied.
7. Determining why a housewife gave up a flourishing career.
   Method: Case history
   Explanation: Making this determination requires in-depth information about the way a variety of psychological factors, expectations, values, motives, past experiences, and so forth, blend together within the person. This kind of information is unique to the person and could not be assessed through standardized tests.

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Activity: Name That Research Method

In this exercise, students are asked to match brief descriptions of research with the name of the method being used. Copy **Handout Master 2.2** and distribute to students as a basis for this exercise.

Answers: 1-c, 2-a, 3-e, 4-f, 5-d, 6-b.

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Activity: Using Memory to Demonstrate Methodology

This demonstration introduces the concept of the experimental method; however, it is equally applicable to the

material in the memory chapter. Students are given the question “Can we improve memory by using a mnemonic technique?” and are asked to design an experiment to test the hypothesis. The experiment is then conducted using procedures summarized below. Through this procedure, students are guided through a typical psychological experiment and are introduced to the concepts of independent variable, dependent variable, experimental and control groups, and control procedures.

Prepare a mnemonic technique and write it on small slips of paper to hand to some of the students (half of the class). Construct a list of common words to use in conjunction with the mnemonic. Here is one of many mnemonic techniques:

PRESIDENTIAL

Word List: Pet, Road, Eagle, Screen, Ink, Dog, Envelope, Number, Target, Income, Alley, Library

Begin a discussion of the experimental method by asking for definitions of a hypothesis. After discussing the students' definitions, tell them that they are going to conduct an experiment in class and provide them with the question above as the hypothesis. After defining mnemonic techniques, inform the class that you have a mnemonic technique but need to know how to proceed from this point. Students are asked for input as to how to test the hypothesis. Usually someone proposes that the class be divided into two groups: one that receives the mnemonic and one that does not. Ask how the students should be assigned to each group. This leads us to a discussion of random assignment.

The experiment begins by passing out the slips of paper with the mnemonic to the "experimental" group. All students are then given the following instructions: “I am going to read a list of words; when I'm finished I want you to recall as many words as you can IN THE SAME ORDER AS THEY WERE READ.” Tell the experimental group how to use the mnemonic: “The letters of the word correspond to the first letter of each word in the list, so you can use the word to help you remember the order of the words in the list.”

Read the list of words, pausing about four seconds between words. Then tell the students to write down as many words as they can remember in the same sequence as they were read. Allow about three minutes of recall time, then ask the students to correct their own paper and tabulate the results on the board. This demonstration typically yields a large difference between the two groups. If desired, you can initiate a discussion of statistical inference and perhaps conduct some preliminary analyses. Discuss how the results pertain to the original hypothesis.

Adapted from Davis, S. F., & Palladino, J. J. (1994). *Interactions: A newsletter to accompany Psychology, 1(Win),* 1.

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Assignment: Observational Research in the Dining Hall

Koschmann and Wesp (2001) provide several research activities for observational research, correlational research, and experimental research. One way to introduce students to research methods is to allow them to become more cognizant of their everyday surroundings and fellow classmates’ behaviours. Koschmann and Wesp suggest that the college or university dining hall is an excellent “laboratory” to observe human behaviour. Merely ask students to observe others during meals in the cafeteria, such as seat selection or food choices. You might encourage student research teams to decide which behaviours they wish to observe. Ask students to record their observations, maintain confidentiality, and “debrief” anyone who asked them what they were doing. During the next scheduled class, ask students to share their findings and to generate discussion about potential hypotheses that may provide a better understanding of the behaviours they observed.

Koschmann, N. & Wesp, R. (2001). Using a dining facility as an introductory psychology research laboratory. *Teaching of Psychology, 28,* 105–108.

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Assignment: Naturalistic Observation

Objective: To collect data on spatial relationships
Materials: None
Procedure: Assign students to small groups of four or five individuals. Ask each to collect data on personal space in two distinct social situations, perhaps the student union building or other public areas on campus and a situation such as a party, a bar, or another area where individuals are talking. Ask the students to estimate the distance that individuals stand apart when they talk in this public area, noting any differences between same sex and opposite sex individuals. Encourage students to be creative in their data collection; for example, they could approach the participants with a yardstick, or they could count the number of tiles on the floor. Students will come up with their own ideas on the best methods of data collection. When students bring their data to class, summarize each group's findings in terms of the mean distances individuals stand apart while talking and put the results on the overhead or chalkboard. Break out the data by sex and situation. Discuss any problems the students encountered with this type of data collection.

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Activity: Give the Doctor Some Advice

This exercise describes research on the effects of drinking and driving. However, this study is flawed and students are asked to suggest ways to correct the errors. Copy **Handout Master 2.3** and distribute to students as a basis for this exercise.

Suggested answers:
1. e
2. Possible confounding variables:
   The vodka and the placebo should be mixed in equal amounts of orange juice.
   Subjects should be chosen randomly and also assigned randomly to the different groups. (The same amount of alcohol affects males and females differently.)
   The researcher should not select friends, colleagues, or his own students as the subjects for this research, or any research, because of possible experimenter expectancy and demand characteristics.
   The subjects should participate at the same time of day since their last meal can determine how potent the effects of alcohol can be.
   Informed consent should be obtained before the research, not after.

Given these many possible confounding variables, Dr. Moesteller should be more cautious in his conclusions.

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Activity: Wonder Horse Dials 911 to Save Boy's Life

Jane Halonen suggests a fun class exercise that tests students' understanding of experimental methodology principles. Once you have covered the basics of correlation, experimentation, and causal inference, challenge your students to apply these principles by examining the outrageous claims made in tabloid headlines, many of which imply a causal relationship (e.g., dreaming in black-and-white improves your sex life; garlic diet improves memory, but not breath; large gopher presence precedes volcano eruptions). For this exercise, bring in a variety of headlines from the *Star*, *National Enquirer*, *Weekly World News*, *Globe*, etc. that are psychology-related and causal-sounding (or ask students to bring in examples). Challenge students to design simple studies that will accurately test whether

or not the relationship claimed in the headline is a valid one. Halonen reports that students enjoy the opportunity to "think like scientists" in response to humorous and outrageous claims and that this exercise helps stimulate them to scrutinize causal claims from all sources and to design experiments more carefully and creatively (and, if that isn't enough, they can practise their newfound skills in line at the grocery store).

Halonen, J. S. (1986). *Teaching critical thinking in psychology*. Milwaukee: Alverno Productions.

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Activity: Softens Hands While You Do Dishes

A variation of the tabloid exercise suggested above encourages students to apply experimental principles to claims they are bombarded with on a daily basis—television and magazine advertising. For this exercise, bring in (or have your students bring in) samples of advertising and have students critique the product claims of success according to principles of experimental methodology. Ads can be critiques on several grounds, including the problem of personal testimony as unreliable, the absence of a control or comparison group, the presence of extraneous variables, the presence of plausible alternative explanations, unclear or undefined variables, and a lack of supporting statistics. Jane Halonen reports that students become enthusiastic about the usually dreaded topic of experimental methodology when they realize it has the potential to make them smarter consumers.

Halonen, J. S. (1986). *Teaching critical thinking in psychology*. Milwaukee: Alverno Productions.

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Assignment: Critical Thinking

Many instructors look for new ways to incorporate critical thinking into the classroom. The sample syllabus, addendum (see Handout Master 2.4) and rubric for grading (see Handout Master 2.4b) were produced by Dr. James Oliver at Henry Ford Community College. The materials provide a sample of how to incorporate a critical thinking assignment in an introductory psychology class.

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▼Handout Masters

Handout Master 2.1 Can Science Answer This Question?
Handout Master 2.2 Name That Research Method
Handout Master 2.3 Give that Doctor Some Advice
Handout Master 2.4 Critical Thinking Exercise: Sample Syllabi
Handout Master 2.4b Critical Thinking Exercise Rubric
Handout Master 2.5 Critical Thinking Exercise

Handout Master 2.1
Can Science Answer This Question?

Psychology is an empirical science; that is, its knowledge is obtained through observation, experimentation, and measurement. Some questions cannot be answered empirically and are, therefore, outside the realm of science.

Decide whether scientific research can answer the questions below and respond "yes" or "no" to each question. Do not try to answer the question itself. Just say whether or not scientific research can, in principle, address the question. Briefly explain why each question is, or is not, a good candidate for scientific inquiry.

For the questions that can be studied scientifically, identify what the independent and dependent variables would be in the experiment.

1. Is abortion on demand bad for society?

2. Do people talk more after they have eaten than they do when they are hungry?

3. Does jogging lead to a positive mental attitude?

4. Are the incomes of doctors related to the grades they make in medical school?

5. Which emotion is stronger, love or anger?

6. Are breast-fed babies more alert than bottle-fed babies?

7. Will people be more moral in the year 2020 than they are now?

8. Are people who commit suicide sorry after they have done it?

◄ Return to Activity: Can Science Answer this Question?
▼ Return to List of Chapter 2 Handout Masters
▲ Return to Chapter 2 Table of Contents

Handout Master 2.2
Name That Research Method

Here are the major research methods used by psychologists. Match each with one of the following examples of research.

a. case history
b. naturalistic observation
c. laboratory observation
d. survey
e. psychological tests
f. experiment

1. Frank is a full professor who is interested in the factors that affect the performance of rats who are learning to find their way through a complex maze. Every afternoon he gives each of his 50 rats ten trials in the maze, counting the number of wrong turns each rat makes on its way through the maze.

2. Ben is counselling with Fennimore Jones in a small room in the neuropsychiatric hospital. Ben is a graduate student in clinical psychology and Fennimore is his client. Fennimore was admitted to the neuropsychiatric hospital when he came to the student health clinic complaining that he hears voices shouting obscenities at him, and confiding that he thinks he is going through a spontaneous sex change. After each session with Fennimore, Ben writes a report describing Fennimore's verbal and nonverbal behaviour and his interpretations of the behaviour.

3. Carl is a graduate student who plans to become a psychometrician. He, like Ben, is working at the neuropsychiatric hospital. His job is to administer a battery of tests to new patients. He will send the test results, along with his summary and interpretation of them, to the patient's clinical psychologist or psychiatrist.

4. Ada is testing the hypothesis that colour preference can be influenced by associating a colour with a pleasant experience, such as eating. This afternoon she is delivering a supply of red, yellow, blue, green, and white nursing bottles to the mothers of newborns who have consented to let their infants be subjects in her research.

5. Dee is an assistant professor who will teach introductory psychology for the first time next term. She has chosen some films to show to her class of more than 200 students, and is now preparing a questionnaire to administer to her students after each film. She thinks getting student reactions to the films will be helpful next time she teaches the class.

6. Ed is an undergraduate psychology major. For his senior thesis he is investigating the nature of the audience for pornography. This afternoon he is sitting in his car across the street from one of the pornographic bookstores in the area. He is taking notes on the sex, approximate age, and ethnicity of the patrons as they enter and leave the store.

◄ Return to Class Activity: Name That Research Method
▼ Return to List of Chapter 2 Handout Masters
▲ Return to Chapter 2 Table of Contents

Handout Master 2.3
Give the Doctor Some Advice

Dr. Moesteller has long been interested in the effects of alcohol on human behaviour. His latest experiment involved giving college students one of three kinds of drinks:

3 oz. of 100 proof vodka mixed with a standard size glass of orange juice,
2 oz. of 100 proof vodka mixed with a small glass of orange juice, or
3 oz. of a nonalcoholic but vodka-flavoured substance mixed with a standard size glass of orange juice.

Dr. Moesteller recruited some of his subjects from the school's track team, which was easy because he is the assistant coach. He recruited the rest of his subjects from his introductory psychology class. Dr. Moesteller assigned the women on the track team to the 2 oz. vodka group, the men from his class to the 3 oz. vodka group, and the women from his class to the nonalcoholic group.

The women on the track team participated right after they finished practising, and students from his class participated at various times during the day. After each group had a chance to drink the beverage, he had them sit in an automobile simulator where their task was to step on the brake every time they saw a red light.

Much to his surprise, the 2 oz. group showed slower reaction times to the red light than the 3 oz. group. The nonalcoholic group was the quickest to react. As soon as the experiment was over, he explained to the subjects the true purpose of the experiment and had them sign an informed consent form. From his analysis of the results, Dr. Moesteller concluded that drinking alcoholic beverages can slow reaction time for braking in college students who drive after drinking.

1. Based on his experiment, was Dr. Moesteller's conclusion correct?
   a. No, because he did not randomly select his subjects.
   b. No, because he knew some of his subjects better than others.
   c. Yes, because subjects in both experimental groups had slower reaction times than the control group.
   d. Yes, because his results agree with what we all know from our experience with those who drink and drive.
   e. No, because there were too many confounding variables in his experiment, including both a and b.

2. On the other side of this page, give Dr. Moesteller some advice on how he might improve his research on drinking.

◄ Return to Class Activity: Give the Doctor Some Advice
▼ Return to List of Chapter 2 Handout Masters
▲ Return to Chapter 2 Table of Contents

Handout Master 2.4
Sample Syllabus for Inclusion of Critical Thinking Component

Introductory Psychology

Syllabus and Course Calendar, Winter Semester, 2006

INSTRUCTOR: James E. Oliver, Ph.D.; **OFFICE:** xxxx **PHONE:** xxxxxx
OFFICE HOURS: MWF xxxxxxx; TR 9xxxx
email: xxxxxxx

COURSE DESCRIPTION

The course description is presented in the current catalog as follows: "Introduces elementary concepts and principles related to the scientific study of behaviour and the mental processes of cognition and affective states. Variables examined include the history of psychology, the scientific method, theory, biological foundations, psychological processes related to cognition and affective states, developmental changes over time, and applications related to healthy and unhealthy personalities." There is no course prerequisite.

TEXT AND MATERIALS

Text: Ciccarelli, Saundra., *Psychology*. Prentice Hall, Upper Saddle River, NJ (current ISBN 0-13-6004288)

Paul, R. and Elder, Linda (2003). *The Thinker's Guide for Students on How to Study and Learn a Discipline using Critical Thinking Concepts and Tools*. The Foundation for Critical Thinking, Dillon Beach, CA.

Paul, R. and Elder, Linda (2003). *A Miniature Guide to the Foundations of Analytic Thinking.* The Foundation for Critical Thinking, Dillion Beach, CA.

Materials: Scripts, exercises, or topics will be used as content for essay papers or class assignments. Video will be used to supplement the text. In this regard, a few students indicate a desire to view more video related material than can be presented in class. Two excellent series—one of eight one-hour tapes entitled "The Brain," and another of nine one-hour tapes entitled "The Mind," may be viewed in the Listening Centre in the Library.

The major core course objectives are behaviour/performance demonstrations of knowledge in the cognitive and affective domains requiring each student to identify and/or think critically about a representative sample of the facts, concepts, theories, and applications of the text content presented in the course calendar below. The specific learning and assessment objectives for each chapter are presented in the text.

Students will write a critical thinking essay following the model presented by Paul and Elder in their many publications. The essay will be based on an exercise requiring each student to make a self-analysis of their three psychological domains in each of five variables related to academic achievement.

ASSESSMENT OF ACADEMIC ACHIEVEMENT

A combination of grades on writing assignments, tests, critical thinking, and the final examination will be used to assess your total class performance.

A. Chapter Tests--(Maximum Value = 350 points): A multiple choice test will be given the last day devoted to the study of each of the chapters. Each test will include 15 questions representing the major learning objectives for the current chapter and 12 additional questions from previous chapters. **Your low test score will be dropped. If you miss a test, that will be your low grade dropped. The maximum value of each test is 25 points. You must provide a scantron answer sheet and a number 2 pencil.**

A "Makeup" test will be given on the first day of return to class and then only if the reason for absence is excusable. Questions for a makeup test will be computer generated by random selection from the total pool of items in the test bank and will generally be different from those given on the scheduled test date.

B. Critical Thinking Essay: (Total Maximum Value = 80 points): As described in the addendum to this syllabus, critical thinking and its expression in writing has become a very specific educational objective demanded by those who support our educational institutions by allocation of tax dollars and by those who provide accreditation required for Henry Ford Community College to function as an educational institution.

The critical thinking essay is due XXXXX but may be submitted early. If submitted late, five points will be deducted for each class day of late submission.

C. Final Examination: (TOTAL MAXIMUM VALUE = 100 POINTS): The final examination will be comprehensive and the same for all students taking this course. One hundred multiple-choice questions will be presented with a maximum value of 100 points. Grades will be curved so the average score of my three classes will be 80.

D. *Final Grade Determination: The final grade will be calculated as a percent of the total available points achieved as follows:*

90% or more = A

80 – 89% = B

70 – 79% = C
60 – 69 % = D
59% or less = E

COURSE CALENDAR

Deviation from the calendar presented below is not anticipated in the absence of extenuating circumstances requiring the cancellation of class:

DATES	CHAPTERS AND ASSIGNMENTS
January 9	**Orientation**
11, 13, 18, 20	**1. The Science of Psychology:** **1. Read article, "Why Should We Redefine Instruction." Read from text, "Introduction" and chapter major concepts, "What is Psychology?" and "Psychology Then: The History of Psychology." 2. Read major concepts, "Psychology Now: Modern Perspectives," "Types of Psychological Professionals." 3. Read major concepts, "Psychology: The Science." 4. Read balance of chapter and begin Paul and Elder "Analytic Thinking."** **Complete parallel portions of the Study Guide for the text.**
23	**Critical Thinking: See handout providing specific instructions.**
25, 27, 30	**2. The Biological Perspective:** **1. Read text major concepts: "An Overview of the Nervous System;" "The Central Nervous System—The Central Processing Unit;"** **2. "The Peripheral Nervous System—Nerves On the Edge;" "Peeking Inside the Brain;"**

3. Read balance of chapter and continue with Paul and Elder's books.

February	**1**	**Critical Thinking: See handout providing specific instructions.**
February	**3, 6, 8**	**3. Sensation and Perception**
	10, 13, 15	**4. Consciousness, Sleep, Dreams, Hypnosis, and Drugs**
	17, 20, 22	**5. Learning**
	24, 27, & March 1	**6. Memory**
March	**3, 13,15**	**8. Development Across the Life Span**
	17, 20, 22	**7. Cognition, Thinking, Intelligence, and Language**
	24, 27, 29	**9. Motivation and Emotion**
	31 & April 3, 5	**11. Stress and Health**
April	**7, 10, 12**	**13. Theories of Personality**
	14, 17, 19	**14. Psychological Disorders**
	21, 24, 26	**15. Psychological Therapies**
	28 & May 1	**12. Social Psychology**

OTHER POLICIES:

A. Attendance: Attendance policy is presented in the College Catalog. It states, in part, as follows:

"No system of "cuts" operates at Henry Ford Community College. Students are expected to attend all the sessions of the classes for which they are enrolled. Penalties may be imposed, at the discretion of the individual instructor, whenever absence or tardiness has affected the quality of the student's work. Students, as a matter of courtesy, should explain the reason for an absence to their instructor. Lack of attendance may affect the student's final grade."

B. Withdrawal/Drop: Policy related to Changes in Schedule is presented in the College Catalog. It states, in part,

"...A student may officially drop a class without penalty until the end of the tenth week during the fall and

winter semesters and the fifth week during the spring and summer semesters. A DR will be recorded on the student's transcript. If a student stops attending a class without officially withdrawing from the class, the instructor may record either an E or DR grade." (Underline added). In accordance with this policy, I will give withdrawals after the tenth week a DRop grade providing the student's cumulative grade is passing at the time of withdrawal; a grade of E if the cumulative grade is failing.

C. Dishonesty: A policy relating specifically to academic dishonesty is presented in the College Catalog. Become familiar with the behaviours that may result in course failure.

ADDENDUM TO THE SYLLABUS: CRITICAL THINKING

INTRODUCTION

Historically, educators have emphasized the importance of critical thinking and have assumed with substantial certitude such thinking was a "natural outcome" of higher education. Today we not only question the validity of this assumption but also believe teaching and learning can accelerate the frequency and quality of this assumed natural outcome. For this reason, emphasis on critical thinking as a specific learning objective is quite new, and efforts are being made nationally to incorporate it into essentially all formal educational curriculums.

Teaching and learning about critical thinking is a required learning objective in this course. The design for the achievement of this learning objective incorporates three related purposes.

The first purpose is learning how to think critically by analyzing and assessing any content, subject, or domain.

- The second purpose is to enable each student to generate and quantify information about the three psychological domains associated with five achievement-related variables. The resource for this purpose is attached as Exhibit A.

- The third purpose is to apply the learning acquired in fulfilling the first purpose and to acquire personal insight by writing a critical thinking essay as an eight-part assessment of the content generated in fulfilling the second purpose.

Exhibit A is attached as a format for generating the total information or content to be used in writing the critical thinking essay. Part I is designed to enable you to generate observations about your three psychological domains—behaviour, cognition, and affective states—as they operate in five variables associated with achievement in the academic setting—study, motivation to complete college, selection of a college major and career goal, family responsibility and support, and support from instructors and counselors. Part I is to be summarized quantitatively in Part II enabling you to assess the relative strengths of the three domains and the five variables.

Psychological Domains: Most introductory texts present the definition of psychology as the "…scientific study of behaviour and mental processes." Behaviour is observable in what people do or say. Mental processes include cognition and affective states and can only be inferred by observations of behaviour.

- Behaviour occurs as a result of interaction of the mind and body and is observable in the threshold actions people take and in the sounds they make.
- Mental processes are divided into two broad categories—cognition and affect.

- Cognition occurs when the brain and body interact to acquire, store, retrieve, and use information acquired from experience with the world. While the mental processes of cognition are not directly observable, they may be inferred from observable behaviour.
- Affective states occur when the brain and body interact to produce feelings, moods, and emotions. Affect is also not directly observable, but inferred from behaviour.
    - Feeling is activated as a sensation only by the sense of touch. Other feelings are experienced as a broad range of psychological perceptions such as satisfaction, fear, anger, love, joy, guilt, suspicion, uncertainty, or sympathy.
    - Mood is used in the study of abnormal behaviour to refer to disordered thought of either a depressive or euphoric nature. In our daily lives, we think of mood as atypical of our usual overall feeling tone, such as, "I am having a great/bad day."
    - Emotion is produced when feelings activate involuntary changes in the body enabling it to become more responsive to demands placed on it by a threat to life, or by other physiological or psychological stressors.

It is important to understand the three psychological domains do not operate in isolation. Each is part of a larger system and function both individually and interactively to provide motivation. For example, someone was motivated to generate this assignment. As it was typed the principal domain was psychomotor (behaviour.) Yet, it was completed with feeling (affect) about the content and the rationale for developing it. Further, there was a necessity for knowledge (cognition) related to the subject of critical thinking, to sentence structure, spelling, and punctuation. We infrequently, if ever, function from a single domain. The three interact in some way.

Observations: As you complete Part I, Exhibit A, you are required to think like a researcher. You are to generate information introspectively and describe your most typical behaviour, cognition, and affective states related to each of the five achievement-related variables. You will be using the case study method with a sample of one for whom you are the world's expert observer. The following are examples of observations related to each of these domains for the variable "study."

\+ - Behaviour
(x) ( ) 1. For each hour of class, I allocate two hours of time for study.
( ) (x) 2. I do not study. I just review summaries before exams.
Cognition
( ) (x) 1. I often think attending college is a waste of time.
(x) ( ) 2. I remember best when I focus total attention on my study.
Affect
( ) (x) 1. I become depressed when there is too much studying to do.
(x) ( ) 2. I am enthusiastic about the new ideas presented in my book.

These three sets of observations provide one effective (+) and one ineffective (–) statement as specified by the "x" in the parenthesis. As you record your introspective observations, use an "x" to indicate your assessment of each as either effective of ineffective. Both may be effective, both ineffective, or one of each.

Note: If you consistently present one "effective" and one "ineffective" statement, it will be assumed you are not generating valid information. For example, if you should say, "I enjoy studying," and follow with the statement, "I hate studying," it will be clear you are completing the assignment with meaningless simplicity. To assure domain clarity, underline the verb causing each observation to fall into the domain of behaviour, cognition, or affective state.

Quantitative Summary: Part II of Exhibit A enables you to enter a quantitative summary of the effectiveness or ineffectiveness of your observations. Each cell in the table provides space for entering the number of effective and ineffective statements you have made. Space is provided for totals to facilitate your comparative assessment of the relative effectiveness in each of your three psychological domains and the five variables associated with academic achievement.

BACKGROUND INFORMATION

Paul and Elder (2003) have provided brief historical background for critical thinking and a current dictionary definition.

> The concept of critical thinking is embedded not only in a core body of research over the last 30 to 50 years but is also derived from ancient Greek. The word 'critical' derives etymologically from two Greek roots: 'kriticos' (meaning discerning judgment) and 'kriterion' (meaning standards). Etymologically, then, critical thinking implies development of "discerning judgment based on standards."
>
> In Webster's New World Dictionary, the relevant entry reads, "characterized by careful analysis and judgment" and is followed by the gloss: "*critical, in its strictest sense, implies an attempt at objective judgment so as to determine both merits and faults."* Applied to thinking, then, we might provisionally define critical thinking as thinking explicitly aimed at well-founded judgment and hence utilizing appropriate evaluative standards in the attempt to determine the true worth, merit, or value of something.

It should be clear criticism embraces meritorious as well as adverse assessment. In their miniature guide, "How to Study and Learn," they provide their own definition of critical thinking:

> Critical thinking is the kind of thinking—about any subject, content, or domain—that improves itself through disciplined analysis and assessment. Analysis requires knowledge of the elements of thought; assessment requires knowledge of the standards for thought.

- Knowledge for disciplined analysis requires understanding and use of eight different elements of thought—purpose, question or issue, concept, information, assumption, inference, implication, and point of view. We do analysis by the separate assessment of each of these elements.

- Knowledge for disciplined standards requires understanding and use of the nine standards of thought—clarity, accuracy, precision, relevance, depth, breadth, logic, significance, and fairness. We use standards to present intellectually responsible and clearly understandable assessments of the true worth, merit, or value of each element.

- Knowledge requiring understanding represents the highest level of knowledge—and such understanding causes an effect. When we truly understand, we can express thinking in a way enabling others to re-create our meaning; to understand what we meant to communicate.

The greatest limit placed on thinking is ignorance. However, knowledge may be minimal or maximal as described by the words—know, comprehend, and understand.

- To know is to be aware of something as a fact or truth—minimal knowledge.

- To comprehend is to know something thoroughly and to perceive its relationships to certain other ideas, facts, or information.

- To understand is to be fully aware not only of the meaning of something and its relationship to other ideas, facts, or information, but also its total implications and significance.

THINKING AND REASONING IN ASSESSMENT

Much of our thinking is extemporaneous and does not require reasoning and well-founded judgment to assess the true worth, merit, or value of a subject, content or domain. Critical thinking does. Reasoning is the glue of critical thought; it is an independent or causative variable having the effect of shaping the

rationale of assessment. A reason is a statement supporting the cause, the effect, or the motivation for any element of critical thinking. Descriptions of cause, effect, or motivation enable the reader or listener to place information into context, to re-create with greater precision the meaning intended by the speaker or author. It can often be enhanced by an example.

- Causative reasoning requires disclosure of thought underlying assessment of any content, subject or domain as having merit or the lack of merit. It responds to the questions of what and why? This is true whether we are assessing our own, or someone else's behaviour, cognition, or affective state. Remember, the three psychological domains are highly interactive; each may contribute to cause and description of it. "The reason I think this is…," "An example of this occurred last year when…."

- Effect reasoning requires disclosure of the result or consequence, the power of ideation to produce anticipated or unanticipated results. For example, were your purposes(s) fulfilled by this assignment? If not, explain why.

- Motivational reasoning requires disclosure of change or anticipated change in thinking, feeling or behaviour associated with analysis of new information.

Consider the first two Elements: Purpose and Question or Issue:

- As you address the first Element—purpose—any comment you make about your purpose for writing this essay must be supported by a reason if it is to have meaning to the reader.

    - The reason may be associated with cause (how or why it caused you to think about critical thinking, per se, about your psychological domains, or your achievement related variables;
    - with effect (how it caused you to think new or different thoughts regarding these issues),
    - or motivation (how it changed your feeling of "need" to think differently about critical thinking or the issues associated with this assignment).

- Without question, the major issues in critical thinking are "analysis" and "standards." Therefore, as you address Element 2, "Question or Issue," you must present your assessment of the following:

    - What causes us to feel a "need" for analysis (to break into separate parts) of any subject, content or domain?
    - Why should we adhere to standards when we assess?
    - How does compliance with analysis and standards impact your motivation to speak or write in a way enabling others to better re-create your thought?

The description of cause, effect, and/or motivation places any element of critical thinking into context. The standards of thought about each of the eight elements will be met only when placed in context; when the listeners or readers are able to re-create the meaning intended by the speaker or author.

SOME MISCELLANEOUS THOUGHTS ABOUT THINKING

What Is, and What Limits Thinking? Thinking is not a novel idea. Although we do it all the time when we are awake, we probably think about thinking with low frequency. Thinking is an automatic biological activity of the brain providing us with consciousness or awareness. Our consciousness or awareness structures what we consider our personal reality. We think when we behave—what we do or say; we think when we engage in cognition—when we learn and when we use our learning; and we think when we engage in affective states—feelings, moods, and emotions. When we think about the analysis and assessment of thinking, it is like cutting a knife with a knife. Each of us uses our brain to decide and communicate what is happening in our brain.

What Causes Thinking? The automatic biological activity we have named "thinking" is a response caused by either, or both, external or internal stimuli. The external cause of thinking is stimulation of the brain by the basic senses of sight, sound, touch, taste, and smell. The senses translate physical and chemical energy from the environment into a form the brain can translate as a representation of our reality.

The internal causes of thinking are both sensory and self-stimulated. For example, some sensations are internal in nature—such as pain, our sense of orientation and our sense of balance. Self-stimulated or automatic thinking is produced by mental manipulation focused on memories of the past, awareness of the present, or thought about the future. We think about not only what was, is, or could be, but also what could have been, may be now, or what might be in the future. The late Carl Sagan estimated the average adult possessed long-term memory equivalent to about 10 billion pages of encyclopedic information. Therefore, we have a profound resource for thinking about our life history; the activity, situation, or context of the moment; or about the immediate or distant future.

What Makes Thinking Critical? By their definition, Paul and Elder emphasize we may think critically about anything—any subject, content, or domain—provided our thinking is improved by disciplined analysis and assessment.

How Do We Discipline Analysis and Assessment? The concept of analysis requires the separation of any subject, content or domain into its constituent building blocks or elements with an understanding of the relationships and differences between them. For example, the science of chemistry has allowed us to identify some 120 elements constituting the "matter" of our world. Few chemical elements exist in isolation. They are mixed or synthesized with other elements and called compounds. But we know how to separate compounds. For example, we know two parts of hydrogen and one part of oxygen (H2O) synthesize to become water. We synthesize chemical elements in thousands of ways to make equally thousands of products.

The thinking inherent in the language constituting a subject, content, or domain is like a chemical compound. We must identify and assess each element of the compound if we are to fully re-create the meaning of the author or speaker. Elemental assessments are the component parts of critical thinking. Their integration not only explains the cause and effect relationship; they also influence the behavioural dynamic called motivation.

Unlike chemists, Paul and Elder have not used science, but have used creative thinking to identify a "family" of eight elements whose sequential assessment of any subject, content, or domain is the spoken or written articulation of thought. We discipline thinking by analyzing the subject, content, or domain in a way revealing the full intentionality of the communication of the speaker or writer. The concept of assessment has the general meaning of officially estimating the value of property for purposes of sale or taxation. Assessments are arbitrary and of limited value in the absence of standards for evaluation or judging the meaning and the merit, or lack of merit, of content in any subject or domain. Paul and Elder have identified nine standards for excellence in the assessment of critical thinking. These standards include clarity, accuracy, precision, relevance, depth, breadth, logic, significance, and fairness. Use of these standards allow us to communicate meaning in such an effective way as to enable others to re-create our meaning when they hear what we have said or read what we have written.

So What? Critical thinking is not a global judgment; it is an assessment of multiple elements of the total communication of the speaker, writer, listener, or reader.

The concept of applying discipline to analysis and assessment for improvement requires the sequential use of the elements and continuous use of the standards of thought. Improvement is inherent in the way we utilize these elements and standards to guide us in examining in multiple ways (cause, effect, and motivation) the content of our own or someone else's written or oral articulation. The omission of any one of the elements infers the author of the critical thought has presented an incomplete analysis of the information. The omission of any standard implies limitation in the quality of analysis or presentation.

When Should We Think Critically? It is most important to know there is a time to think and a time not to think in accord with the concepts of critical thinking. We say this because there is a spontaneity to life easily extinguished by the disciplined sequence of thought identified as elements and the quality of thought identified as standards. Fortunately, as we learn to think critically, we also learn what subject, content and domains are appropriate for such discipline.

In summary, thinking defines our life as a person, as a student, as a member of a family or a community, and as a citizen. The noble purpose of education is to improve the quality of life by modifying thinking. Thinking not only allows us to learn the 3R's, it also allows us to make career decisions and acquire the knowledge required to become a doctor, a skilled-trade member, a teacher, a lawyer, a nurse, an auto mechanic, etc. So we think about everything in our lives and if we think our lives are important, we need to learn how to use "disciplined analysis and assessment" for thinking in the acquisition and use of knowledge.

WRITING THE CRITICAL THINKING ESSAY

Writing the critical thinking essay requires the full use of your ability to communicate with elaboration your assessment of the information you have generated in Exhibit A. The following is an abbreviated list of the basic requirements for writing the essay.

- You must understand the concepts of three psychological domains and five achievement-related variables to complete Exhibit A.
- You must understand the concepts of elements and standards prior to beginning the essay.
- Do not waste time or space in your essay defining or redefining each element you are assessing. Your instructor understands the elements and the criteria for adequate assessment of them. Please review the attached rubric.

- Write in the first person singular. This is an "I, me, my" essay.

    - "My purpose(s) for completing this assignment is/are…."
    - "The question(s) or issue(s) I have about the concept of critical thinking (or the observations I have made are….")
    - "I think the concept of three psychological domains…," "I think the concept of five achievement related variables…," etc. for the concepts of Elements and Standards.
    - Use subheads generously. As you assess the information you generated in Exhibit A insert a subhead for each of the five achievement-related variables. Assess each variable by elaboration on your observations in the psychological domains. Make meaning clear by describing:
        - What caused you to evaluate it as "effective" or "ineffective?"
        - How is it working for you? Is it producing the results you anticipated, or not?
        - Does your assessment of your observations motivate you to change in any of your psychological domains? If so, state those implications as a separate paragraph. Combining "Implications" with "Information" about each of the five variables will contribute to understanding for both you and the reader; it will also attenuate the assessment you make under the Element, "Implications."

The following headings must be used and serve as a constant reminder of the element you are assessing:

⇒ Assessment of Element #1—Purpose: All thinking and reasoning about content has or generates purpose(s).

Assess your purpose(s) for completing this assignment. To assess, you must not only state each purpose but also explain the reasons why it has caused you to think as you do about the subject of "critical thinking," the effect it has had on your thoughts about the advantages or disadvantages of critical thinking, or the way you have or have not been motivated to think differently about critical thinking in the future. Use a separate paragraph to describe each purpose.

- In addition to a good understanding of the total content of the miniature guides, it is suggested you reread pages 2, 3, 10, and 37 of the "Analytic Thinking" guide. Evaluate everything you write in terms of the nine intellectual standards presented in pages 6 and 7.
- From "How to Study and Learn" guide, reread the page inside the front cover and pages 4, 5, 22, 28, and 29.

⇒ Assessment of Element #2—Questions or Issues: All thinking and reasoning about content is an attempt to figure something out, to settle some question(s) or issue(s).

Assess whether or not you believe this assignment enables you to fulfill the issue of critical thinking as it is presented in the definition given by Paul and Elder. Describe the reasoning underlying your questions or issues. Cause—why do you have the question; effect—what would be the advantage of having the answer to this question or issue; motivation—how might the answer to this question or issue motivate you to behave, think or feel differently in the future.

- State any questions you may have about the content of the Paul and Elder miniature guides as an educational source for learning about the requirements for critical thinking and for optimal utilization of your intelligence in the educational process.
- Also, present any questions you may have about this addendum as a learning and instructional document.
- The second purpose of this assignment is related to your observations about yourself. Having made these observations, present any questions you have about the domains, the achievement-related variables or questions emerging as a result of observations you have made of yourself in Exhibit A.
- Reread pages 11 and 38 of the "Analytic Thinking" guide. Though much larger in scope, you may get an idea by rereading pages 36 and 37 of the "How to Study and Learn" guide.

⇒ Assessment of Element 3—Concepts: All thinking and reasoning about content utilizes concepts and ideas.

- Assess the cause, effect, or motivation supporting the merit or lack of merit of the concept of elements and nine standards as the generic guidance for engaging in critical thinking.
- Assess the cause, effect, or motivation supporting the merit or lack of merit of examining the three psychological domains and the five achievement related variables for students in this psychology course.
- Reread pages 46 and 47 of the miniature guide on "How to Study and Learn" and use "activated knowledge" as you complete assessment of this element.
- Review again the pages suggested for rereading in element 1 above.

⇒ Assessment of Element #4—Information: All thinking and reasoning about content is based on information, data, and evidence.

Assess the observations in Exhibit A by sequential review of each of the academic achievement-related variables. (You must place a subhead indicating each variable you are addressing, e.g., Study, Completion of College, etc.)

- First, consider the variable "study." Elaborate generously on the observations you have made. Communicate the deeper meaning of the abbreviated statements presented in Part I by mental

manipulation of the information you have drawn from your own private cognitive domain. Mentally manipulate by addressing your reasoning in terms of cause, effect, and/or motivation. For example:

- If you state "I spend about one hour studying each chapter," describe the cause—why you do not spend more time studying; the effect—how well this is working for you; and your motivation for investing so little of yourself in the process we call "higher education."
- Your analysis will be most effective when written to "standards" allowing your intended meaning of each word, sentence, or idea to be readily re-created by the reader.
- Conclude the assessment of each achievement-related variable with a statement of the "Implications" it has for your future.
- Incorporate in your assessment the similarities and differences revealed by the totals in Part II, i.e., assess the relative strength and/or weakness of the three domains and five variables. Use a subhead, "Quantitative Analysis."

- Reread pages 12 and 39 of the "Analytic Thinking" guide.

⇒ Assessment of Element #5—Assumptions: All thinking and reasoning about content is based on assumption(s).

Since you will have written Part I of this assignment hours or days before addressing this element of critical thinking, reexamine what you have written for your integrity and honesty with yourself. Essentially all you have written is based on the assumption you are a valid observer of your own psychological domains. Can you now find consistency between the behavioural, cognitive, and affective domains, or do you now consider any of your observations as unreasonable, questionable, misleading, or contradictory?

- Reread pages 13, 40, and 41 of the "Analytic Thinking" guide.

⇒ Assessment of Element # 6—Inferences: All thinking and reasoning about content requires/ makes inferences.

Note: Paul and Elder state in the "Analytic Thinking" guide, (p 45) that inferences follow from assumptions. They also state, "An inference is a step in the mind, by which one concludes that something is true based on something else being true, or appearing true." Since only behaviour can be observed directly, we make inferences about what is being thought (cognition) and felt (affect). We observe behaviour as "true evidence" and then make inferences about what is true in the thinking and feeling accompanying the behaviour.

Like assumptions, inferences must be made by reexamination of the information or data presented in Parts I and II. If you have identified any assumptions as unreasonable, questionable, misleading, or contradictory, take the next step and identify the new assumption(s) you would make based on the revised inference.
Reread pages 13 and 40 of the "Analytic Thinking" guide.

⇒ Assessment of Element # 7--Implications: All thinking and reasoning about content leads somewhere and has implications and consequences.

Assuming you have stated "Implications" in assessing each achievement-related variable, now assess any additional behavioural, cognitive, or affective changes you consider desirable and describe the anticipated consequence of each change.

Assessment of Element 8--Point of View: All thinking and reasoning about content embodies a point of view.

This final element of critical thinking could be placed anywhere in the series of eight elements. Each of us has a past, a present, and a future. The past is history and has largely shaped us as the person we are. The present is an ever-fleeting moment. The future is a time period characterized by the pursuit of purposes, goals, or objectives. We use our encyclopedic memories and "what if" questions to metacognitively create meaning for our current and future behaviour, cognition, and affect. We are always trying to get from where

we are to where we want to be. Change designed to improve the future must always be bridged from the past and to the future.

A point of view is somewhat akin to the concept of feeling in the affective domain. We have a feeling about almost everything. We also have a point of view about almost everything. Anyone who reads your paper will have an appreciation of your point of view toward many issues related to life, personal competence, relationships, and education. Perhaps you can best utilize this element as the final paragraph(s) of your essay to assess the assignment, and your reaction to the assignment as an initial approach to formal teaching and learning about critical thinking.

References:

Paul, R. and Elder, Linda (2003). *The thinker's guide for students on how to study and learn a discipline using critical thinking concepts and tools.* Foundation for Critical Thinking, Dillon Beach, CA.

Paul, R. and Elder, Linda (2003). *A miniature guide for students and faculty in the foundations of analytic thinking.* Foundation for Critical Thinking, Dillon Beach, CA

Paul, R., Elder, Linda and Bartell, T. (1997). *California teacher preparation for instructions in critical thinking: research findings and policy recommendations.* Foundation for Critical Thinking, Dillon Beach, Ca.

Sagan, C. Untitled and undated video.

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Handout Master 2.4b

PSYCHOLOGY

Rubric for Grading Critical Thinking Assignment

A rubric is a scoring guide associating numerical values with verbal descriptions of the worthiness of any performance. Through analysis, the total performance is subdivided into component parts with both a numerical and verbal scale for evaluating or assessing each.

- Students find a rubric helpful since it provides advance knowledge of how their performance will be evaluated.

- Instructors find a rubric helpful as an instrument for increasing both intrapersonal and interpersonal reliability and uniformity of grading.

The rubric for the critical thinking assignment is modelled with substantial similarity to that used in grading the International Critical Thinking Essay Test (IAT), published by the International Center For the Assessment of Thinking.

Part I, Observation and Part II, Summary

In grading Parts I and II of the assignment, instructors will focus on the extent to which the student has followed directions, made rational, thoughtful observations, and summarized data. A maximum holistic value of eight points will be used with grade equivalents as follows:

8 points for excellent performance with a grade equivalent of "A"
6 points for above average performance with a grade equivalent of "B"
4 points for average performance with a grade equivalent of "C"
2 points for poor performance with a grade equivalent of "D"
0 points for nonperformance or exceedingly poor performance, grade equivalent of "E"

If less than all points are awarded, comments will be made to explain the rationale for grading.

Part III, Essay

Part III will be graded with a maximum value of "4" on each of the eight elements of critical thinking referenced in the publications of Paul and Elder and in the Addendum to the syllabus.

4 points will be assigned as an excellent evaluation (highly skilled)
3 points will be assigned as a commendable evaluation (good skill)
2 points will be assigned as a mid-level evaluation (average skill)
1 point will be assigned as a poor evaluation (almost total absence of skill)
0 points will be assigned as a total loss (total absence of skill)

A grading format is presented below. A copy will be attached to each student's returned paper. Instructors may allocate less than maximum points for any of the eight structures of thought without greater rationale than is provided in the rubric. However, if you have question regarding your grade, please contact the instructor.

Rubric For Grading Critical Thinking Assignment

STUDENT'S NAME:_____
TOTAL POINTS:_____

PART I: Observations, and PART II, Summary of Observations—(Maximum grade = 8 points)

_____ A holistic assessment of pursuit of directions and clarity in describing and summarizing observations

PART III: Essay—(Maximum Score = 32 points)

Purpose(s): 4 points: Excellent. Identifies two or more (personally valuable) purposes for completing the assignment.
3 points: Commendable. Identifies one (personally valuable) purpose for completing the assignment.
2 points: Mid-level. Lacks clarity in statement of the personal value for completing the assignment.
1 point: Poor. States purpose(s) unrelated to instructions.

Questions: 4 points: Excellent. Distinct questions about each predefined purpose and each personal purpose.
3.points: Commendable. Distinct questions about either predefined or personal purposes, but not both.
2 points: Mid-level: Has few questions about purpose.
1 Point: Questions lack clear relationship to any purpose.

Concepts: 4 points: Excellent. Assess merit or lack of merit of "elements & standards:" "domains & variables."
3 points: Commendable. Provides less than full insight into the rationale for each of the four major concepts.
2 points: Mid-level. Limited description of relationships between major and subordinate concepts.
1 point: Poor. Assessment of the four major concepts has very limited meaning.

Information: 4 points: Excellent. Assesses the deeper meaning of observations in each achievement-related variable and totals.
3 points: Commendable. Assesses well for achievement-related variables, but not for quantitative totals.
2 points: Mid-level: Elaborations provide modest insight into the rationale for observations and totals.
1 point: Poor: Description is limited; does little to expand meaning of observations.

Assumptions: 4 points: Excellent. Identifies in Part I two or more observations with less than complete "evidence."
3 points: Commendable. Identifies in Part I one observation with less than adequate "evidence."
2 points: Mid-level. Describes "assumptions" but does not identify any in Part I.
1 point: Poor. Non-specific comments identifying or explaining assumptions.

Inferences 4 points: Excellent. Identifies two or more specific inconsistencies between behaviour, cognitive, and affect statements in Part I.
3 points: Commendable. Identifies one inconsistency between statements of behaviour, cognition, and affect. .
2 points: Mid-level. Identifies one or more inferences in the "Information Element" presented (above).
1 point: Poor. Very limited identification of inference in Part I or previously presented information.

Implications: 4 points: Excellent. Identifies two or more behaviour changes needed for more effectiveness in achievement-related variables.
3 points: Commendable. Identifies the one most needed behaviour change needed for improvement.
2 points: Mid-level. Lacks clarity on specific need or advantage of change.
1 point: Poor. Limited recognition of implications, per se.

Point of View: 4 points: Excellent. Articulates the advantages or disadvantages of critical thinking and of this assignment.
3 points: Commendable. Articulates the specific advantages or disadvantages of this assignment only.
2 points: Mid-level. Description indicates a limited understanding of the "system" and the "assignment."
1 point: Poor. Acknowledges critical thinking as a learning objective, but does not indicate why.

Total possible points is 40. A grade of 36 or more is equivalent to a grade of "A"; 32-35 a "B"; 28-31 a "C"; and 24-27 a "D."

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Handout Master 2.5

You probably know that when you flip a coin, the chances of getting a head or a tail is 50 percent. This probability is based on an infinite number of coin tosses. But how well does tossing the coin twice represent the whole population of tosses, or the infinite number of tosses? If a sample of two tosses, or n=2 as a statistician would express it, doesn't represent the population, what about a sample of 5 or 10 or 15 or 20? To answer these questions, you have to take repeated samples of the same size. Toss a coin twice (n=2), and then write the number of heads and tails in the column labelled #1. Repeat the process four more times, recording your results the second time under #2, the third time under #3, and so on until you have a total of five samples each of which consists of two coin tosses. When the n=2 row is completely filled in, calculate the overall percentage of heads and tails. Now use the same process to collect data on samples of n=5, n=10, n=15, and n=20.

Sample size	Toss #1		Toss #2		Toss #3		Toss #4		Toss #5		Overall %	
	H	T	H	T	H	T	H	T	H	T	H	T
n=2												
n=5												
n=10												
n=15												
n=20												

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WEB RESOURCES

Research Methods and Statistics
Ethics

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Research/Statistics

Rice Virtual Lab in Statistics: http://onlinestatbook.com/rvls.html
Includes links to an online statistics textbook, simulations and demonstrations, case studies, and basic statistical analysis tools.

VassarStats: http://faculty.vassar.edu/lowry/VassarStats.html
Richard Lowry from Vassar College maintains this excellent site for statistical calculations.

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Ethics

APA Code of Ethics: http://www.apa.org/ethics/code.html
American Psychological Association's Ethical Principles of Psychologists and Code of Conduct. Your students may be required to participate in experiments as part of their introductory course. Introduce them to this website either at the start of the semester (to allay their fears about participating in studies) or at the end (as a "wrap-up" paper comparing their research experiences with the ethical guidelines stated by APA).

Cloning (msnbc.com): http://www.msnbc.com/news/CLONING_front.asp
Articles on the pros and cons of cloning are available.

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General/comprehensive

Science & Pseudoscience Review in Mental Health: http://www.pseudoscience.org
"The Review" is an online resource for questioning "scientific" claims in mental health research and publishing. This is a great resource for student projects to explore various scientific claims related to EMDR, touch therapies, and hidden memories, just to name a few.