



**FRANKLIN UNIVERSITY PROFICIENCY EXAM (FUPE)
STUDY GUIDE**

Course Title: Science 211	<i>Name: Introduction to Scientific Analysis and Reasoning</i>
Recommended Textbook(s):	Battersby, M. (2016). <i>Is that a fact?: A field guide to statistical and scientific information</i> (2nd ed.). Ontario, Canada: Broadview Press. ISBN: 9781554812448 (print), 978-1-77048-598-3 (e-text)
Number & Type of Questions:	75 Multiple Choice Questions 15 Short Answer/Essay Questions
Permitted Materials:	None
Time Limit:	2 Hours
Minimum Passing Score:	70%

Format varies

This course is an introduction to critical thinking on statistical and scientific claims. The student will develop the critical thinking skills necessary to analyze and evaluate popular sources of (mis)information and to better understand and evaluate all sorts of scientific claims and arguments. The focus of the course is on students developing thoughtful and critical use of scientific information and research to be able to separate truth from deception and make decisions that affect their personal lives and roles as informed and engaged citizens.

Upon completion of this course, students should be able to:

- Identify what is being claimed when presented with popular sources of information or science.
- Analyze and evaluate how good the evidence and the reasoning is for supporting a given claim.
- Determine what other information is relevant to the context of the argument.
- Identify common arguments that seem persuasive but fail to meet the criteria of scientific analysis and reasoning.

Outline of the Topics Covered:

1. Introduction to Critical Thinking and Questioning
 - Define what critical thinking is and why it is important.
 - Explain what a fallacy is and give an example.
 - Explain the problem of the blind men and the elephant.
 - Explain how we gain scientific knowledge.
 - Explain how critical thinking facilitates the acquisition of scientific knowledge.
 - Analyze and evaluate arguments using four basic CRITICAL QUESTIONS.
2. Statistics, Polling, and Critical Thinking
 - Explain the benefits and importance of the study of statistics.
 - Explain what opinion polls are and some of the problems with polling.
 - Discuss what statistical sampling is and its difficulties.
 - Explain how critical thinking may be applied to the most common type of statistical information: polls.
3. Sampling Woes and Other Biases
 - Explain the problems that influence the quality and reliability of polling information.
 - Analyze and evaluate a poll report using the four basic CRITICAL QUESTIONS.
4. Getting Good Data and Making Sense of Data
 - Explain and illustrate some of the fallacies of data quality and characterization.
 - Use the critical questions to explain the meaning of collected data.
5. Thinking Critically About Data Presented in Graphs
 - Identify the basic types of graphs.
 - Analyze and evaluate graphs.
6. Correlation versus Causation
 - Describe what a correlation is and how it is established.
 - Explain the meaning of “correlation does not imply causation.”
 - Critically evaluate correlational claims.
 - Explain the danger of confusing correlation with causation.
 - Identify extraneous or confounding variables.
7. Mainstream Research: Observational Studies
 - Define an observational study.
 - Explain the main types of observational studies.

- Explain the advantages and disadvantages of these observational studies.
- Give examples of which statistics are useful to look at and which statistics mislead people in these observational studies.
- Explain how to interpret mainstream research.
- Explain why people shouldn't trust observational studies.

8. Determining and Testing Causation

- Explain how we determine support for causation.
- Explain the role of experimental methods in testing cause and effect relationships.
- Evaluate thinking in regard to causal claims about issues in science.
- Test causal claims about autism.
- Critically evaluate whether vaccines cause viral infections, developmental disability, crippling and potentially deadly medical disorders, or diseases.

9. Possible Problems with Experimental Studies

- Identify and explain possible problems with experimental studies.
- Explain the importance of reproducible experiments and the peer review process to help overcome the problems of experimental studies.
- Describe the role of rationalism in science.

10. How to Critically Analyze and Evaluate a Research Article

- Identify the key parts of a research article.
- Critically analyze and evaluate a research article.

Sample Questions:

1. Define what critical thinking is and why it is important.
2. Explain what a fallacy is and give an example.
3. Explain how we gain scientific knowledge.
4. Explain how critical thinking facilitates the acquisition of scientific knowledge.
5. Explain the benefit and importance of the study of statistics.
6. Explain what opinion polls are and some of the problems with polling.
7. Describe what a correlation is and how it is established.
8. Discuss what "correlation does not imply causation" means.
9. Explain the main types of observational studies.
10. Give examples of how statistics are there to mislead people in these observational studies.
11. Explain why people shouldn't trust observational studies.
12. Explain possible problems with experimental studies.
13. Explain the importance of reproducible experiments and the peer review process to help overcome the problems of experimental studies.
14. What are the basic parts of a research article?