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Week#2:Model of ScientificInquiry

RESEARCH METHODOLOGY &SCIENTIFIC WRITING

STUDY PROGRAM: INFORMATION SYSTEM

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Session Objectives

- To understand the steps in Scientific Inquiry (Bertanya secara Ilmiah)
- To understand the characteristics of Scientific Methods
- To understand the logical thinking in Research using inductive and deductive approaches
- To understand how to draw conclusion using logical reasoning

Session Agenda

- I. What is Scientific Inquiry?
- II. Characteristics of Scientific Inquiry
- III. Model of Scientific Inquiry and Its Delivery
- IV. Basic Skills Needed in Scientific Inquiry
- V. Logical Thinking in Scientific Inquiry
- VI. Inductive and Deductive Logical Thinking
- VII. Logical Fallacies

I. What is Scientific Inquiry?

- Scientific inquiry is a term that encompasses a variety of techniques that scientists use to explore the natural world and propose explanations based on the evidence they find.
- The objective of scientific inquiry is to find and to characterize the patterns as resulted from the exploration.
- Scientific inquiry is founded on experiment and observations as opposed to purely rational or isolated logical thought.
- Scientific Inquiry can enrich our understanding of science

Why Scientific Inquiry ?

- It will make you more knowledgeable about something.
- You will be able to explain about something more thorough
- It will make you a more literate and cultured person.
- It will provide you more ideas

Hence, scientific inquiry is implemented
in a research methodology

II.Characteristics of Scientific Inquiry

- Based on factsas opposed to “imagination”
- Objectiveconsiderationas opposed to subjective consideration
- Analyticalas opposed to “trivial”
- Quantitative in Nature(can be measured)
- Deductive Logic-Hypothesis(general to specific approach)
- Inductive Logic-Generalization(specific to general approach)

Activities in Scientific Inquiry

- Making observations instead of “wondering around”
- Posting questions to all possible problems or issues
- Finding out what is already known in order to avoid from re-inventing wheel
- Planning investigations as part of steps in methodology
- Reviewing past knowledge in light of experimental evidence in order continuity
- Using tools to gather, analyze, and interpret data so that data can be justified (dapat dipertanggung jawabkan)
- Proposing analysis, interpretation and explanation to the problems of interest
- Communicating the results through research report.

III. Models of Scientific Inquiry

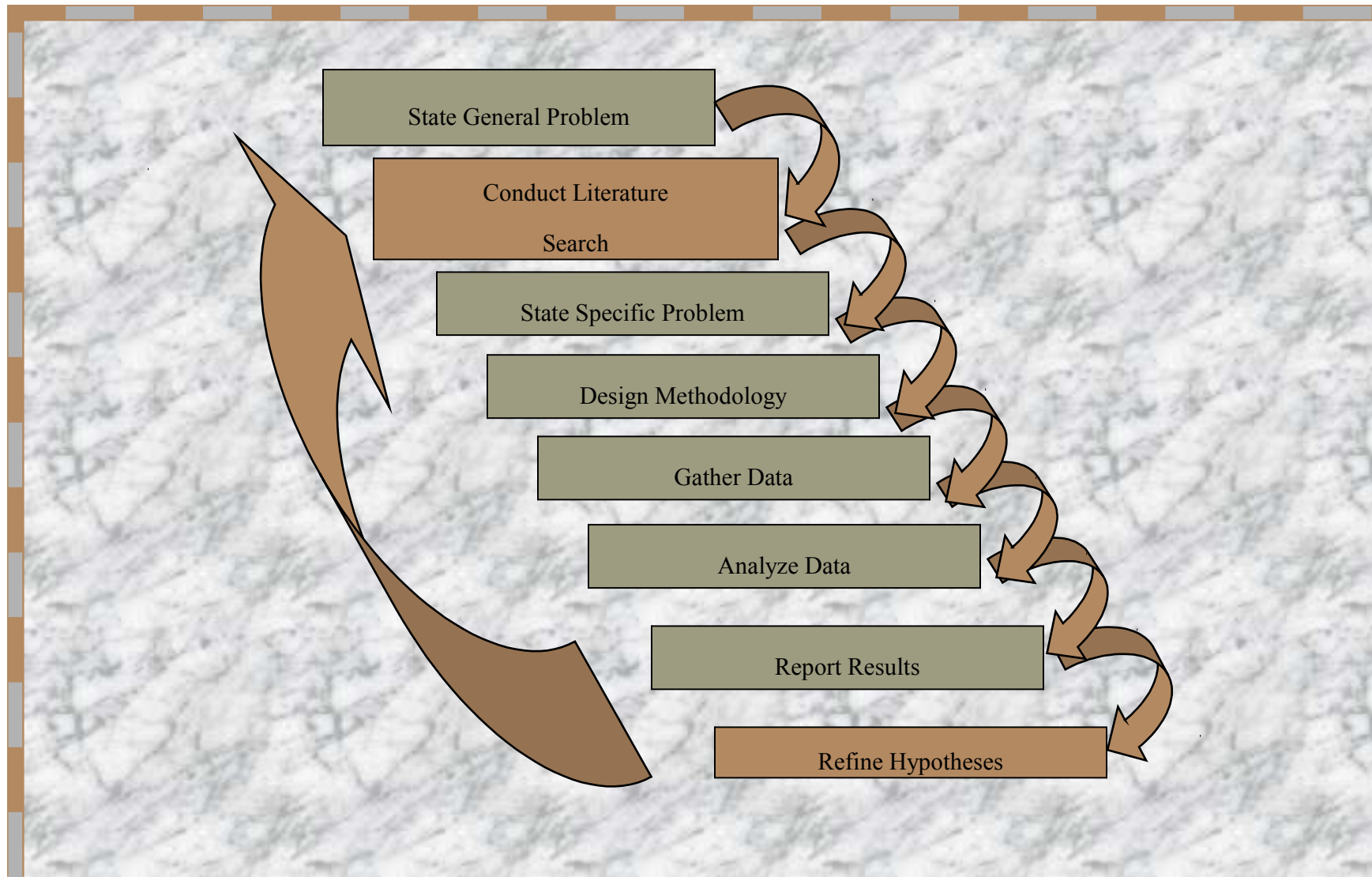
Classical model

- Originated from Aristotle
- Distinguished the forms of approximate and exact reasoning
- Set out the threefold scheme of abductive, deductive, and inductive inference
- Treated the compound forms such as reasoning by analogy.


Pragmatic model

- Originated from Charles Peirce
- Considered scientific inquiry to be a species of the genus *inquiry*
- He defined as any means of fixing belief
- Any means of arriving at a settled opinion on a matter in question.
- Begins with a state of uncertainty and moves toward a state of certainty
- Sufficient at least to terminate the inquiry for the time being.

General Model of Scientific of Inquiry



Another Model.....

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- Problem Statement
 - Organize Critical Thinking Framework
 - Organize Premises
 - Hypothesis Formulation
 - Testing Hypothesis
 - Draw Conclusion

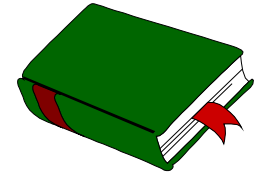
Deliverables of Each Step

State General Problem

- Statement that stated general problems
- Example: Will the universe expand forever?
 - Exercise: State at least three general problems on your own.

Conduct Literature Search

- List all related literatures to the problems stated
- Underline all theories, techniques, methods, findings and so forth that others have found
- Critically analyze all the weaknesses, strengths, similarities, dissimilarities among those theories, techniques, findings above.
- Summarize all those literatures (make annotated bibliographies)



Deliverables of Each Step

State Specific Problem

- Statement of general problem to specific problem
- Example: What are the factors that cause the universe expanded?
 - Exercise: State at least two specific problems that derived from the above exercise

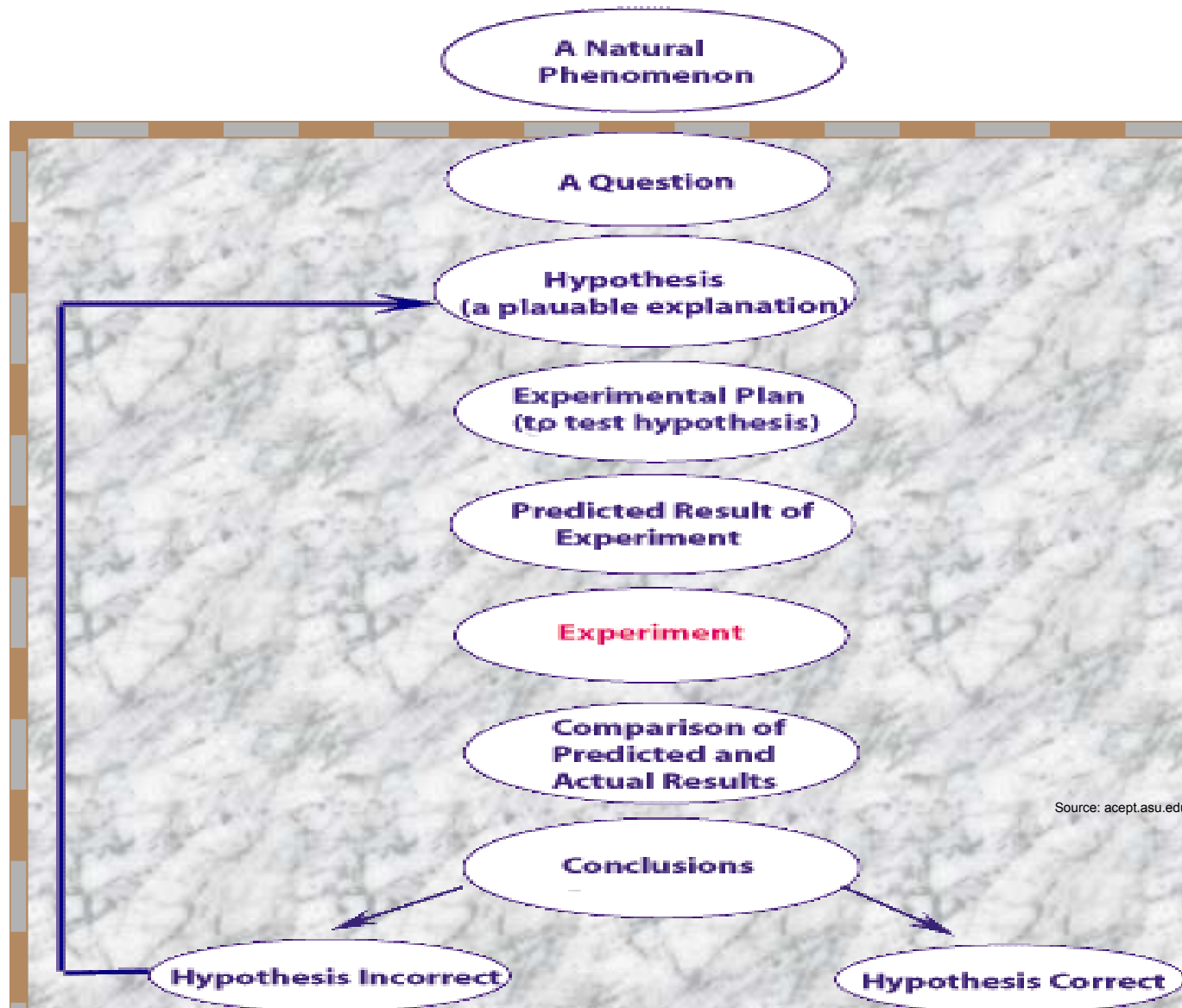
Design Methodology

- List all steps to be taken in order to answer those stated problems
- Establish the setting of experiment
- Provide all necessary means, tools, instruments
- Define the object, variables, etc

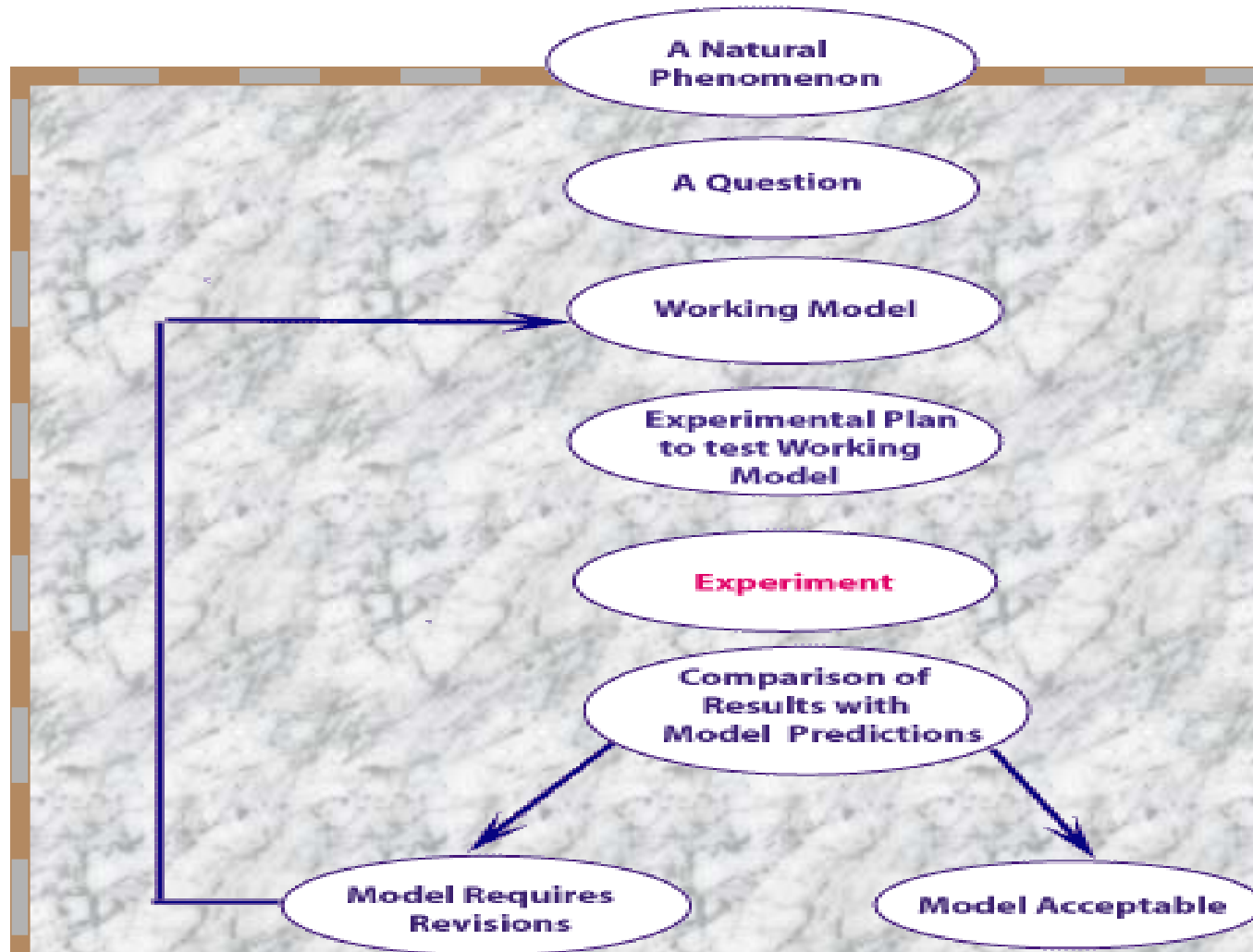
Deliverables of Each Step

- Gather Data
 - Organize data in tables, graphics
- Analyze Data
 - Interpret the organized, and processed data
- Report the Results

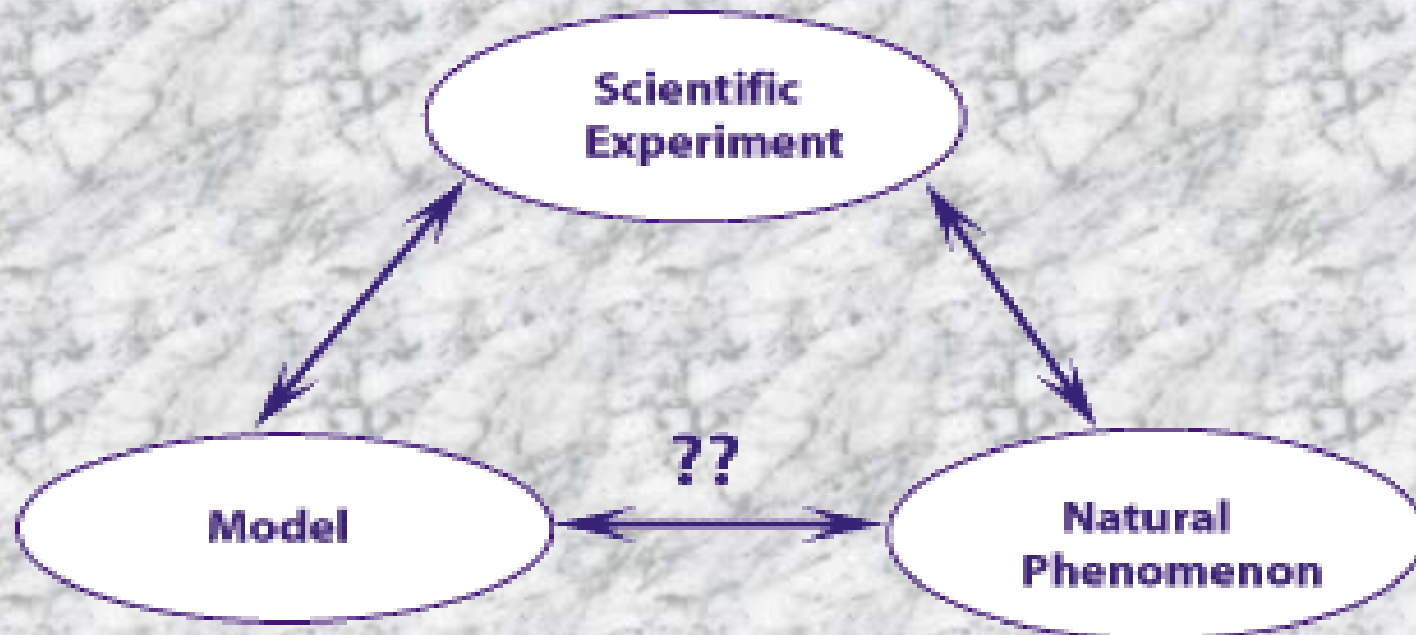
Simplist Form of Scientific Inquiry



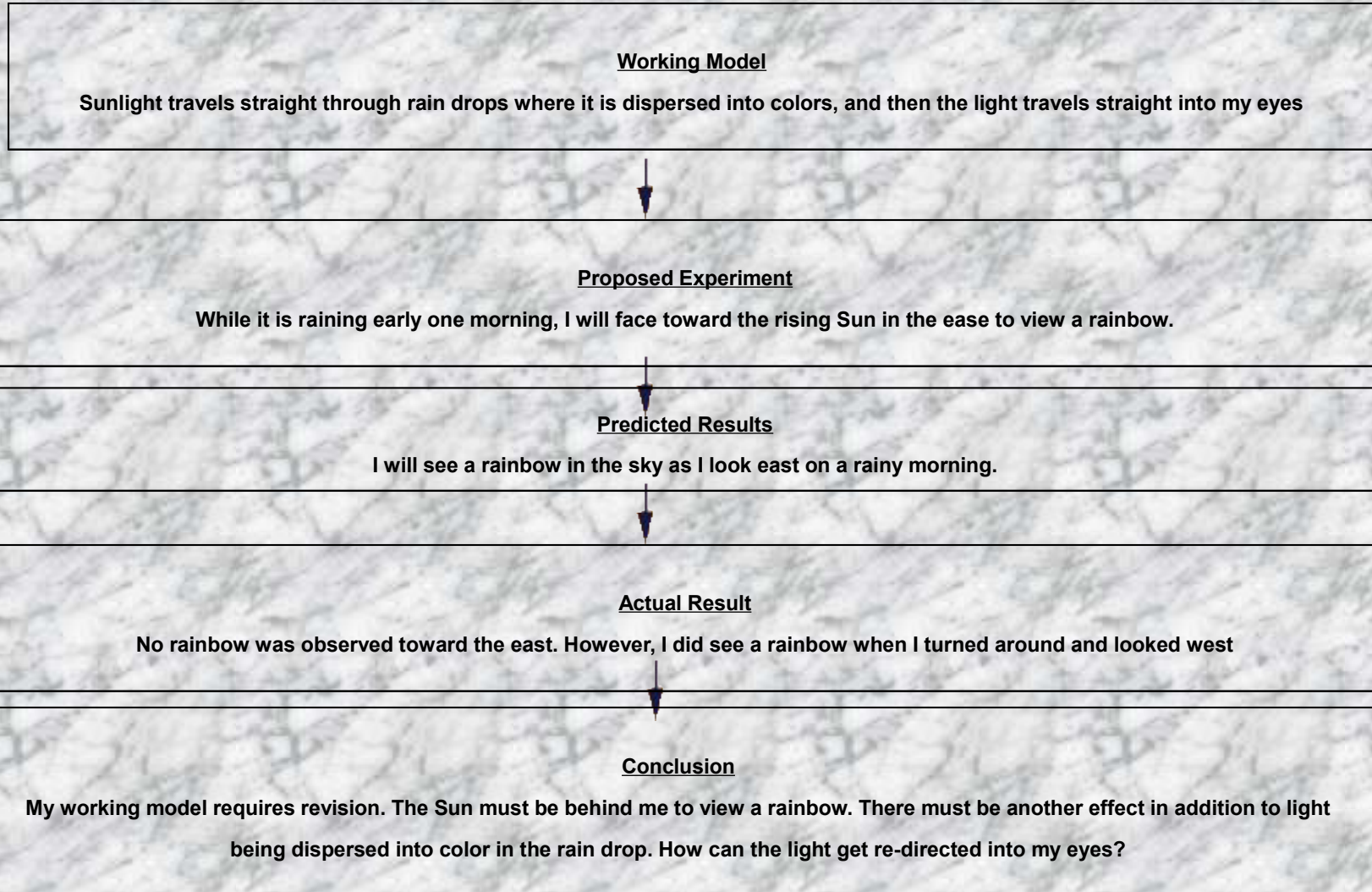
Model Development in the Physical Science



Key Components of Scientific Inquiry



Example of Model Development: What Factors Determine the Visibility of a Rainbow?



IV. Basic Skills Needed in Scientific Inquiry

- Observing. Able to observe.
- Classifying and sequencing. Able to classify and sequence
- Communicating. Able to communicate
- Measuring. Able to measure
- Predicting. Able in making prediction
- Hypothesizing.
- Inferring. Able to draw conclusion
- Defining, controlling, and manipulating variable in experimentation
- Designing, constructing and interpreting models
- Interpreting, analyzing and evaluating data

Uses of Basic Skills in Scientific Inquiry

- To make connections with world situations
- To encourage more active problem solving approach to learning and thinking
- To apply math skills
- To review what is already known in light of experimental evidence
- To propose answers, explanations and predictions
- To use tools to gather, analyze and interpret data

Exercises Your Thought

- Develop a scientific model of your own

- Post deliverables of each step of the model

- Categorized the scientific model into a research method.

- How do you develop basic skills needed in Scientific Inquiry?