





















Design Pattern for Observational Investigation | Design Pattern 2167

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Title	Design Pattern for Observational Investigation
Overview	<p>This design pattern supports the writing of storyboards and items that address scientific reasoning and process skills in observational (non-experimental) investigations. Observational investigations differ from experimental investigations. In experimental investigations, it is necessary to control or manipulate one or more of the variables of interest to test a prediction or hypothesis; in observational investigations, variables typically cannot be altered at all (e.g., objects in space) or in a short time frame (e.g., a lake ecosystem). This design pattern may be used to generate groups of tasks for any science content strand.</p>
Use	<p> U1. This design pattern supports the construction of tasks that address observational investigations - that is, investigations where experimental methods are not appropriate (e.g., earth and space science, demography, paleoanthropology, physiology, ecology). In order for students to have a well-rounded understanding of the scientific method, they need to be familiar with the context and methods of observational investigations. details</p>
Focal knowledge, skills, and abilities	<p> Fk1. Ability to analyze why observational investigation methods are more appropriate than experimental methods for some phenomena/situations details</p> <p> Fk2. Ability to distinguish between observational and experimental methodology details</p> <p> Fk3. Ability to generate or evaluate predictions or hypotheses about scientific phenomena that are appropriate for observational investigation details</p> <p> Fk4. Ability to formulate conclusions, create models, and appropriately generalize results from observational investigations details</p> <p> Fk5. Ability to test predictions or hypotheses using observational methods details</p> <p> Fk6. Ability to plan a systematic collection of observational data based on a predicted relationship</p> <p> Fk7. Ability to collect, analyze, and interpret observational data with appropriate tools</p>
Additional knowledge, skills, and abilities	<p>  Ak1. Content knowledge (may be construct relevant) details</p> <p> Ak2. Prerequisite knowledge from earlier grades details</p> <p> Ak3. Data collection and analysis details</p> <p> Ak4. Representational forms (e.g., graphs, maps) details</p>
Potential observations	<p>  Po1. Appropriateness/strength of observational evidence to help confirm or disconfirm a prediction or hypothesis details</p> <p> Po2. Accuracy in identifying the effects of an observed active phenomenon and how these effects are consistent with a posited cause and effect relationship details</p> <p> Po3. Correctness of recognized pattern in data to support a prediction or hypothesis details</p> <p> Po4. Plausibility/correctness of explanation for observed findings details</p> <p> Po5. Accuracy in critiquing the observational investigation methods, evidence, and conclusions of others details</p> <p> Po6. Plausibility and systematicity of the data collection plan</p>

- ☞ Po7. Correctness of selected tools and procedures for data collection
- ☞ Po8. Systematicity and appropriateness of collected data
- ☞ Po9. Appropriateness of measurement precision

Potential work products ⓘ

- ☞ Pw1. Identification or generation of a prediction or hypothesis that is appropriate to an observational investigation situation [details](#)
- ☞ Pw2. Identification of observational settings where data could be collected to confirm or disconfirm a prediction or hypothesis [details](#)
- ☞ Pw3. Identification of additional source of data that could confirm or disconfirm a prediction or hypothesis supported by existing data [details](#)
- ☞ Pw4. Identification or generation of a replicable data collection process (e.g., repeated sampling over time or at several locations) [details](#)
- ☞ Pw5. Identification of potentially disconfirming observations
- ☞ Pw6. Filling in of a representational form (e.g., a graph, chart, or map) to show the relationship among variables relevant to a prediction or hypothesis [details](#)
- ☞ Pw7. Generation or selection of an explanation for observed findings [details](#)
- ☞ Pw8. Critique of flawed explanation based on observations
- ☞ Pw9. Peer critique (hypothetical in a standard assessment, real in classroom work) of the observational investigation methods, evidence, and conclusions [details](#)

Potential rubrics ⓘ

Characteristic features ⓘ

- ☞ Cf1. Focus on Nature of Science (Strand I) benchmarks relating to observational investigations at the appropriate grade level [details](#)
- ☞ Cf2. Presentation of a real-world situation with patterns suggesting the relationship between at least two variables that can be observed systematically (but are not amenable to experimental investigation). [details](#)

Variable features ⓘ

- ☞ Vf1. Content (strand) context [details](#)
- ☞ Vf2. Qualitative or quantitative investigations [details](#)
- ☞ Vf3. Number of variables and the complexity of their relationships [details](#)
- ☞ Vf4. Simple or complex investigations [details](#)
- ☞ Vf5. Type of data representation (e.g., patterns in geographically distributed phenomena via geospatial visualizations; patterns in data; similarities in specialized representations appropriate to the scientific phenomenon) [details](#)
- ☞ Vf6. Sufficient or insufficient data about an already established relationship [details](#)
- ☞ Vf7. Amount of scaffolding given to student to guide the presentation or representation of data collected [details](#)
- ☞ Vf8. Amount of observational data from which an analysis, explanation, or conclusion is to be drawn [details](#)
- ☞ Vf9. Completeness of model given from which predictions or hypotheses can be generated [details](#)

Narrative structure ⓘ

- Cause and effect. An event, phenomenon, or system is altered by internal or external factors.
- Change over time. A sequence of events is presented to highlight sequential or cyclical change in a system.

Investigation. A student or scientist completes an investigation in which one or more variables may be observed or ...

Specific to general and Parts to whole. Specific characteristics of a phenomenon are presented, culminating in a description of the system o...

National educational standards



NSES 8ASI1.1. Identify questions that can be answered through scientific investigations. Students should develop t...

NSES 8ASI1.2. Design and conduct a scientific investigation. Students should develop general abilities, such as sy...

NSES 8ASI1.3. Use appropriate tools and techniques to gather, analyze, and interpret data. The use of tools and te...

NSES 8ASI1.4. Develop descriptions, explanations, predictions, and models using evidence. Students should base the...

NSES 8ASI1.5. Think critically and logically to make the relationships between evidence and explanations. Thinking...

NSES 8ASI1.6. Recognize and analyze alternative explanations and predictions. Students should develop the ability ...

State standards



State benchmarks



MCA II: 6.I.A.2. The student will explain why scientists often repeat investigations to be sure of the results.

MCA II: 6.I.B.1. The student will identify questions that can be answered through scientific investigation and those ...

MCA II: 6.I.B.2. The student will distinguish among observation, prediction and inference.

MCA II: 6.I.B.4. The student will present and explain data and findings from controlled experiments using multiple re...

MCA II: 7.I.A.2. The student will explain natural phenomena by using appropriate physical, conceptual and mathematica...

MCA II: 7.I.B.1. The student will formulate a testable hypothesis based on prior knowledge.

MCA II: 8.I.B.1. The student will know that scientific investigations involve the common elements of systematic obser...

MCA II: 8.I.B.2. The student will describe how scientists can conduct investigations in a simple system and make gene...

MCA III: 7.1.1.1.1. Understand that prior expectations can create bias when conducting scientific investigations. For ex...

MCA III: 7.1.1.1.2. Understand that when similar investigations give different results, the challenge is to judge whethe...

MCA III: 7.1.1.2.1. Generate and refine a variety of scientific questions and match them with appropriate methods of inv...

MCA III: 7.1.1.2.3. Generate a scientific conclusion from an investigation, clearly distinguishing between results (evid...

MCA III: 7.1.1.2.4. Evaluate explanations proposed by others by examining and comparing evidence, identifying faulty rea...

MCA III: 7.1.3.4.1. Use maps, satellite images and other data sets to describe patterns and make predictions about natur...

MCA III: 8.1.1.1.1. Evaluate the reasoning in arguments in which fact and opinion are intermingled or when conclusions d...

MCA III: 8.1.1.2.1. Use logical reasoning and imagination to develop descriptions, explanations, predictions and models ...

MCA III: 8.1.3.4.1. Use maps, satellite images and other data sets to describe patterns and make predictions about local...

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These are kinds of me	
These are parts of me	
Templates	
Exemplar tasks	
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