Math/Science Leadership
January 2016

MONTANA STATE UNIVERSITY


Who Are
you?

Conceptual Change...


Integration
(Building on 3 D Practice)
Reinterpreting Beliefs
(Reorganization of 3 D Beliefs)
Invention
(Onging 3 D Growth & Planting 3 D Seeds in Others)
Building Awareness
(Learning about the 3 Dimensions)
Exposing Beliefs
(Questioning Validity of 3D Teaching)
Confronting Beliefs
(Questioning Pedagogy in light of 3 D)

3. Planning and Carrying Out Investigations

Scientific investigation may be conducted in the field or the laboratory. A major practice of scientists is planning and carrying out a systematic investigation, which requires the identification of what is to be recorded and, if applicable, what are to be treated as the dependent and independent variables (control of variables). Observations and data collected from such work are used to test existing theories and explanations or to revise and develop new ones.

Engineers use investigation both to gain data essential for specifying design criteria or parameters and to test their designs. Like scientists, engineers must identify relevant variables, decide how they will be measured, and collect data for analysis. Their investigations help them to identify how effective, efficient, and durable their designs may be under a range of conditions.

verbs

skills

tools

products

Practice 3 Planning and Carrying Out Investigations

Scientists and engineers investigate and observe the world with essentially two goals: (1) to systematically describe the world and (2) to develop and test theories and explanations of how the world works. In the first, careful observation and description often lead to identification of features that need to be explained or questions that need to be explored.

The second goal requires investigations to test explanatory models of the world and their predictions and whether the inferences suggested by these models are supported by data. Planning and designing such investigations require the ability to design experimental or observational inquiries that are appropriate to answering the question being asked or testing a hypothesis that has been formed. This process begins by identifying the relevant variables and considering how they might be observed, measured, and controlled (constrained by the experimental design to take particular values).

Phenomena

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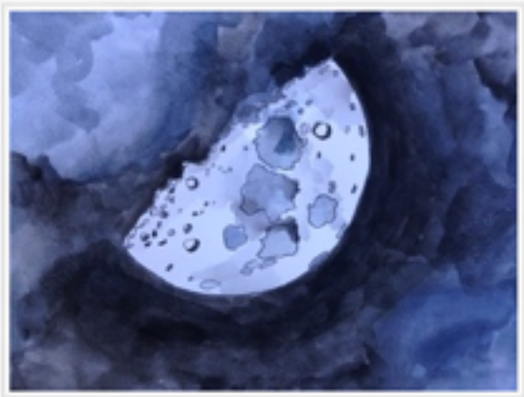
Crosscutting Concepts



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Patterns

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Cause and Effect

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Scale, Proportion, and Quantity

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Stability and Change

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Energy and Matter

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Systems and Systems Models

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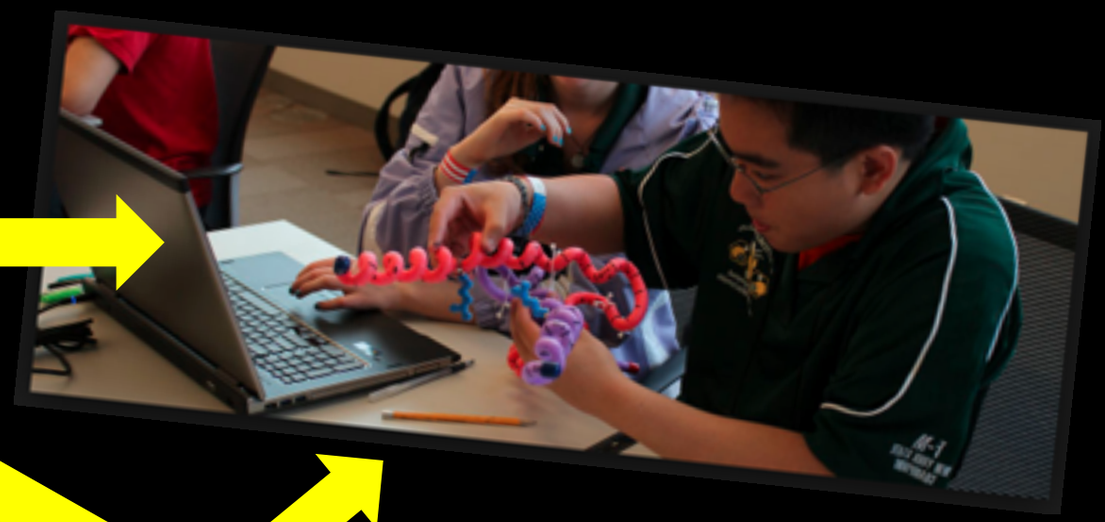
Structure and Function

Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.					
Record information (observations, thoughts, and ideas).					
Use and share pictures, drawings, and/or writings of observations.					
Use observations (firsthand or from media) to describe patterns and/or relationships in the natural and designed world(s) in order to answer scientific questions and solve problems.					
Compare predictions (based on prior experiences) to what occurred (observable events).					
Analyze data from tests of an object or tool to determine if it works as intended.					

Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.					
Represent data in tables and/or various graphical displays (bar graphs, pictographs, and/or pie charts) to reveal patterns that indicate relationships.					
Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation.					
Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings.					
Analyze data to refine a problem statement or the design of a proposed object, tool, or process.					
Use data to evaluate and refine design solutions.					

Interconnectedness of Practices

Engaging in Argumentation



Analyzing and Interpreting Data

Using Mathematics and Computational Thinking

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