



A Classification of Scientific Models

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Fundamental Premises

- Knowledge structures, such as classification schemes, should and can be used to promote science learning.
- Classificatory principles and structures are viable strategies for capturing and describing the complexity of information resources such as scientific models.

Science Learning Skills

- ☛ Acquisition of observations; includes selectivity of information
- ☛ Analysis and interpretation of observational data
- ☛ Construction and experimentation with conceptual (mental & linguistic) and mathematical expressions and representations
- ☛ Verification (reliability and validity)
 - Source: NASA. (1988)

Definition of Models

Models

- Approx. 15 definitions of the word in OED Online
 - Denotative meaning
 - Connotative meaning
- Scientific Models
 - "A simplified or idealized description or conception of a particular system, situation, or process (often in mathematical terms: so ***mathematical model***) that is put forward as a basis for calculations, predictions, or further investigation."
Source: OED Online. (2002)

Research Questions

- Are scientific models “works”?
- What are the facets in a scientific models classification scheme?
- Overarching question: What is a scientific model and how can it be represented in the library catalog to reveal disciplinary structures and facilitate information retrieval for learning?

Definition of Scientific Models

- Science and engineering disciplines
- Works: Intellectual artifacts, Creative process
- Domain: Physical Geography (Atmosphere, Soils, Water)
- Tested: document of models on the WWW and content analysis of models in published literature

Scientific models as works

- “A work is the intellectual content of a bibliographic entity; any work has two properties: a) the propositions expressed, which form ideational content and b) expressions of those propositions which form semantic content.”

- Source: Smiraglia, Richard P. (2001)

What is a scientific model?

Information resource (form & format)

- ☞ 1. Theory or Hypothesis (text file or graphic diagram/image)
- ☞ 2. Observations and Measurements (data sets in various formats)
- ☞ 3. Computer Hardware (descriptions only)
- ☞ 4. Computer Software (this includes actual software executable code, other software essential for running the model code itself)
- ☞ 5. Documentation (technical and user guide that accompanies the software)
- ☞ 6. Animations (images, video)
- ☞ 7. Visualizations (images, video)
- ☞ 8. Reports, Reviews, Annotations, Experiments, Articles (text)
- ☞ 9. Tools (applets, services)
- ☞ 10. Mathematic (algorithmic, numeric notation)
- ☞ 11. FAQs, Mailing Lists/Listservs, Discussion Groups, Events (various)

Scientific Model -Facets

- ✓ **Concept:** is an idea, the traditional subject (for example, calculus of variations)
- ✓ **Object:** the object studied in the model
- ✓ **Discipline:** the major discipline to which this model belongs (may be determined either through author affiliations or other means)
- ✓ **Phenomenon:** the phenomenon being modeled
- ✓ **Process:** the process being modeled
- ✓ **MathRepresentation:** the mathematical functions, equations used
- ✓ **Software:** the software needed to run the model
- ✓ **FundamentalLaw:** the fundamental laws that the model is based upon
- ✓ **Type:** the type of model based on its purpose
- ✓ **Variable:** number, types, conditions, and variables in this model
- ✓ **Problem:** the problem the model is analyzing stated often as a question
- ✓ **Theory:** is there an existing theory or research group to which this model belongs

Classification Framework for Scientific Models

- ☞ A Models
- ☞ 1 Scientific models
- ☞ (by object)
- ☞ 2 water
- ☞ 21 rivers
- ☞ 22 lakes
- ☞ 3 (by process)
- ☞ infiltration
- ☞ 4 (by phenomenon)
- ☞ rapids
- ☞ 5 (by mathematical representation)
- ☞ 51 differential equations
- ☞ 6 (by software)
- ☞ *use MIME formats here*
- ☞ 7 (by fundamental law)
- ☞ 8 (by discipline)
- ☞ 9 (by concept) *use controlled vocabularies*

Speciators List

☛ Form

☛ Author/Group

☛ Bibliographic
relationships

☛ Time

☛ Space