

[NV] Using Model-Based Reasoning in Conservation of Matter - UDL | Design Pattern 2090

[[Duplicate](#) | [Permit](#) | [Delete](#) | View:]

Title	[Edit] [NV] Using Model-Based Reasoning in Conservation of Matter - UDL
Overview	[Edit] Students are given models of physical and chemical changes to make explanations, predictions, and inferences about the conservation of matter. Can students use a model to show that matter is conserved (neither created or destroyed) during physical and/or chemical changes?
Focal Knowledge, Skills, and Abilities	<p>[Edit]</p> <ul style="list-style-type: none"> FK1. Knowledge that when matter goes through a physical or chemical change, the total matter remains the same FK2. Knowledge that conservation of matter holds for every chemical and physical reaction FK3. Knowledge that physical changes rearrange, but do not alter, particles FK4. Knowledge that chemical changes are able to alter the structure of the particles or elements but do not impact or change the mass FK5. Knowledge that mass does not disappear during a physical or chemical change FK6. Ability to reason through the concepts and relationships of a given model and apply it to conservation of matter problems (given model for a physical or chemical change - e.g., water, adding acid to a base)
Rationale	<p>[Edit]</p> <p>R1. A common misconception that students hold is that matter is created or destroyed during a process of physical or chemical change. To understand the topic area through a scientific perspective, students need to understand that matter is conserved during physical and chemical changes. This understanding can be best represented using correct models of physical and chemical change. Students can use these models to make explanations, predictions, and inferences such as filling in missing information.</p>
Additional Knowledge, Skills, and Abilities	<p>[Edit]</p> <p>AK1. ===== The following Additional KSAs are prerequisite knowledge that can be required for tasks that address the Focal KSAs. Whether they are to be supported or not (e.g., glossary, background facts, equation list) is a decision to be made -- either by the assessment design team, either at the level of the testing program or at the level of the individual task if that is appropriate in the testing program. =====</p> <p>AK2. Ability to construct simple chemical equations details</p> <p>AK3. Ability to identify balanced basic chemical equations details</p>

- AK4. Ability to understand mass (definition) [details](#)
- AK5. Ability to understand states of matter [details](#)
- AK6. Familiarity with representations of models [details](#)
- AK7. Ability to understand vocabulary related to conservation of matter [details](#)
- AK8. Ability to understand concepts related to conservation of matter [details](#)
- AK9. Ability to distinguish between physical and chemical changes [details](#)
- AK10. Familiarity with simulations for conducting demonstrations of physical and chemical changes
- AK11. Familiarity with hands-on kit for conducting demonstrations of physical and chemical changes
- AK12. =====
 The following group of additional KSAs are generally construct-irrelevant knowledge, skills, or other attributes that may be involved in tasks generated under this design pattern. The task author can consider offering supports, presenting material, or getting work products that reduce or avoid requirements for these Additional KSAs, either through accommodated forms of a task or UDL principles. Many of these Additional KSAs are linked to Variable Task Features or Potential Work Products for suggestions on how to do this.
 =====
- AK13. Perceptual
 - . vision
 - . hearing
 - . touch
- AK14. Language and symbols
 - . vocabulary and symbols
 - . syntax and underlying structure
 - . English-language proficiency
 - . decoding text or math notation
 - . decoding charts, graphs, or images
- AK15. Cognitive
 - . background knowledge
 - . concepts and categories
 - . information processing strategies
 - . memory and transfer
- AK16. Skill and fluency
 - . dexterity, strength, and mobility
 - . navigation and object manipulation
 - . automaticity (e.g., calculations, writing)
 - . familiarity with media
 - . facility with tools
- AK17. Executive
 - . goal and expectation setting

- . goal maintenance and adjustment
- . planning and sequencing steps in a process
- . managing information and resources
- . working memory
- . monitoring progress

AK18. Affective

- . intrinsic, task-specific motivation (challenge and/or threat, interest)
- . sustaining effort and persistence
- . coping skills and frustration management

Potential observations



[Edit]

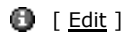
Po1. Correctness of illustrating that when matter goes through a physical or chemical change the total matter remains the same

Po2. Accuracy of explanations, predictions, and retrodictions reasoned through the models (with respect to the conservation of matter)

Po3. Accuracy of identification of a correct result from a chemical or physical change

Po4. Accuracy of identification of a misconception about conservation of matter [details](#)

Potential work products



[Edit]

Pw1. A drawing of the result of an experiment that produces a chemical or physical change

Pw2. A drawing of the molecular or atomic representation of a chemical change

Pw3. Written or oral explanation of the concept of conservation of matter [details](#)

Pw4. Written or oral explanation and/or prediction of the result of an experiment that produces a chemical or physical change [details](#)

Pw5. Written or oral explanation that describes the molecular or atomic representation of a chemical change [details](#)

Pw6. Written or oral description of a model of physical or chemical change and accompanying drawing that represents the change [details](#)

Pw7. Selection of the correct model that would result in a given chemical or physical change

Pw8. Selection of the correct chemical or physical change produced by a given model

Potential rubrics



[Edit]

Pr1. Separate rubrics for quality of content and quality of inquiry

Pr2. Multiple-choice dichotomous scoring of correct chemical or physical change or model that would result in change

Pr3. Error analysis (distractors based on misconceptions or typical errors in procedures)

Pr4. Partial credit scoring of written responses:

o Written specification of the model (5 points total)

. Full (3 points)- Complete written description of model that includes: (a) all relevant variables; (b) accurated description of relationships among variables; and (c) correct outcome of chemical and physical change.

Partial (2 points)- Any one of the components is missing or incorrect

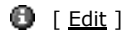
- . Partial (2 points) - Any one of the components is missing or incorrect.
- . Partial (1 point) - Any two of the components are missing or incorrect.
- . Incorrect (0 points) - All three components are missing or incorrect.
- o Drawing of the model (2 points total)
 - . Full (2 points) - Drawing of model that includes all relevant variables; depicts relationship among variables appropriately.
 - . Partial (1 point) - Any one of the components is missing or incorrect.
 - . Incorrect (0 points) - Both components are missing or incorrect.

Characteristic features



- Cf1. Presentation of a situation involving physical or chemical change
- Cf2. Reasoning in the situation that revolves around the conservation of matter

Variable features



- Vf1. Number of variables
- Vf2. Complexity of variable relationships
- Vf3. Perceptual Features (1): Representational Format
 - Flexible size of text and images
 - Flexible amplitude of speech or sound
 - Adjustable contrast
 - Flexible colors
 - Flexible layout
- Vf4. Perceptual Features (2): Auditory Information
 - Text equivalents (e.g. captions, automated speech to text)
 - Visual graphics or outlines
 - Virtual manipulatives, video animation
 - Verbal descriptions
 - Tactile graphics, objects
- Vf5. Perceptual Features (3): Visual Information
 - Spoken equivalents for text and images
 - Automatic text to speech
 - Tactile graphics
 - Braille
- Vf6. Language and Symbols (1): Supports for Vocabulary and Symbols
 - Pre-taught vocabulary and symbols
 - Embedded support for key terms (e.g. technical glossary, hyperlinks/ footnotes to definitions, illustrations, background knowledge)
 - Embedded support for non-technical terms (e.g. non-technical glossary, hyperlinks/ footnotes to definitions, illustrations, background knowledge)
 - Embedded alternatives for unfamiliar references (e.g. domain specific notation, jargon, figurative language, etc.)
- Vf7. Language and Symbols (2): Supports for Syntactic Skills and Underlying Structure
 - Alternate syntactic levels (simplified text)
 - Grammar aids
 - Highlighted syntactical elements (e.g. subjects, predicates, noun-verb agreement, adjectives,

phrase structure, etc.)

- Highlight structural relations or make them more explicit

- ☞ Vf8. Language and Symbols (3): Supports for English Language
 - All key information in the dominant language (e.g. English) is also available in prevalent first languages (e.g. Spanish) for second language learners and in ASL for students who are deaf
 - Key vocabulary words have links to both dominant and non-dominant definitions and pronunciations
 - Domain-specific vocabulary (e.g. "matter" in science) is translated for both special and common meanings
 - Electronic translation tools, multi-lingual glossaries
- ☞ Vf9. Language and Symbols (4): Supports for Decoding and Fluency
 - Digital text with automatic text to speech
 - Digital Braille with automatic Braille to speech
- ☞ Vf10. Cognitive Features (1): Supports for Background knowledge
 - Advanced organizers, pre-teaching, relevant analogies and examples
 - Links to prior knowledge (e.g. hyperlinks to multimedia, concrete objects in students' environments)
 - Provision of an example
- ☞ Vf11. Cognitive Features (2): Supports for Critical features, Big Ideas, and Relationships
 - Concept maps, graphic organizers, outlines
 - Highlight features in text, diagrams, graphics, and illustrations
 - Reducing the field of competing information or distractions, masking
 - Using multiple examples and non-examples to emphasize critical concepts
- ☞ Vf12. Cognitive Features (3): Options that Guide Information Processing
 - Explicit prompts for each step in a sequential process
 - Interactive models that guide exploration and inspection
 - Graduated scaffolds that support information processing strategies
 - Multiple entry points and optional pathways through content
 - Chunking information into smaller elements, progressive release of information, sequential highlighting
 - Discrete question (s) or scenario-based text presentation
 - Complexity of the scientific investigation presented in the scenario
 - Cognitive complexity (Webb's Depth of Knowledge Levels)
 - If selected response, distractors based on misconceptions/typical errors vs. non-misconceptions
- ☞ Vf13. Cognitive Features (4): Supports for Memory and Transfer
 - Checklists, organizers, sticky notes, electronic reminders
 - Prompts for using mnemonic strategies and devices
 - Templates, graphic organizers, concept maps to support note-taking
 - Scaffolding that connects new information to prior knowledge
 - Embedding new ideas in familiar ideas and contexts, use of analogy, metaphor, example
- ☞ Vf14. Skill and Fluency (1): Supports for Manipulations
 - Virtual manipulatives, Snap-to constraints
 - Nonstick mats, Larger objects
- ☞ Vf15. Skill and Fluency (2): Supports for Navigation

- Alternatives for physically interacting with materials: by hand, by voice, by single switch, by keyboard, by joystick, by adapted keyboard
- ¶Vf16. Skill and Fluency (3): Alternatives to Writing
 - Voice recognition, Audio taping, Dictation, Video, Illustration
- ¶Vf17. Skill and Fluency (4): Supports for Composition
 - Keyboarding and alternative keyboards, Onscreen keyboard,
 - Wider lines, Larger paper, Pencil grips
 - Drawing tools - with shapes, lines, etc.
 - Blank tables, charts, graph paper
 - Spellcheckers, calculators, sentence starters, word prediction, dictation (voice recognition or scribe), symbol-to-text, sentence strips
- ¶Vf18. Executive Features (1): Support for Goal and Expectation Setting
 - Prompts and scaffolds to estimate effort, resources, and difficulty
 - Animated agents that model the process and product of goal-setting
 - Guides and checklists for scaffolding goal-setting
- ¶Vf19. Executive Features (2): Supports for Goal Maintenance and Adjustment
 - Maintain salience of objectives and goals (e.g. reminders, progress charts)
 - Adjust levels of challenge and support (e.g. adjustable leveling and embedded support, alternative levels of difficulty, alternative points of entry)
- ¶Vf20. Executive Features (3): Supports for Planning and Sequencing
 - Embedded prompts to "stop and think" before acting
 - Checklists and project planning templates for setting up prioritization, schedules, and steps
 - Guides for breaking long-term objectives into reachable short-term objectives
- ¶Vf21. Executive Features (4): Supports for Managing Information
 - Graphic organizers and templates for organizing information
 - Embedded prompts for categorizing and systematizing
 - Checklists and guides for note-taking
- ¶Vf22. Executive Features (5): Supports for Working Memory
 - Note-taking, Mnemonic aids
 - Locate items near relevant text
- ¶Vf23. Executive Features (6): Supports for Monitoring Progress
 - Guided questions for self-monitoring
 - Representations of progress (e.g. before and after photos, graphs and charts)
 - Templates that guide self-reflection on quality and completeness
 - Differentiated models of self-assessment strategies
- ¶Vf24. Affect Features (1): Supports for Intrinsic Motivation (Challenge and/or Threat)
 - Offer individual choice
 - Enhance relevance, value, authenticity (e.g. contextualize to students' lives, provision of an example)
 - Options to vary level of novelty and risk (e.g. options in peer and adult support, alternatives to competition, alternatives to public display or performance, alternative consequences)

- Options to vary sensory stimulation (e.g. shortened work periods, frequent breaks, noise buffers, optional headphones, alternative settings, presentation of fewer items at a time)

Vf25. Affect Features (2): Supports for Sustaining Effort and Persistence

- Maintain salience of goals (e.g. explicit display of goals, periodic reminders, replacement of long-term goals with short-term objectives, prompts for visualization)
- Adjustable levels of challenge and support
- Encourage collaboration and support
- Communicate on-going, mastery-oriented feedback

Vf26. Affect Features (3): Support for Self-regulation

- Guide motivational goal-setting
- Scaffold self-regulatory skills and strategies
- Develop emotional self-assessment and reflection

I am a kind of [ [Edit](#)]

These are kinds of me [ [Edit](#)]

These are parts of me [ [Edit](#)]

Educational standards [ [Edit](#)]

NV (1) Standard P.8.A.5. Students know mass is conserved in physical and chemical changes.

NV (2) Unifying Concept A. Scientific inquiry is the process by which humans systematically examine the natural world. Scientific inquiry is used to formulate and test explanations of nature through observation, experiments, and theoretical or mathematical models.

Templates [ [Edit](#)]

Exemplar tasks [ [Edit](#)]

Online resources [ [Edit](#)]

References [ [Edit](#)]

Tags [[Add Tag](#)]

(No tags entered.)

List of Examples:

[Activity](#) [Continuous Zone](#) [Design Pattern](#) [Educational Standard](#) [Evaluation Phase](#) [Evaluation Procedure \(rubric\)](#) [Materials and Presentation](#)
[Measurement Model](#) [Observable Variable](#) [Student Model](#) [Student Model Variable](#) [Task Exemplar](#) [Task Model Variable](#) [Task Specification](#) [Template](#)
[Work Product](#)

Copyright 2002-2012 SRI International, University of Maryland, Regents of the University of California. Patent Pending.
For more information, see the [PADI Web site](#).