(D) Teacher Resource. "Create" Rubric (1of 2)

You will know the level to which your students have achieved the **Learning Outcomes**, and thus the **Instructional Objective(s)**, by using the suggested **Rubrics** below.

Instructional Objective 1: To construct a model according to criteria

Related Standard(s) (will be replaced when new NRC Framework-based science standards are released):

National Science Education Standards (NSES)
(E) Science and Technology: Abilities of Technological Design
Design a solution or a product. Students should make and compare different proposals in the light of the criteria they have selected. They must consider constraints such as cost, time, trade-offs, and materials needed and communicate ideas with drawings and simple models. (Grades 5-8: E1b)

Related Rubrics for the Assessment of Learning Outcomes Associated with the Above Standard(s)

Learning Outcome	Expert	Proficient	Intermediate	Beginner
LO1a: Build an initial model of a sustainable community that meets criteria and constraints	Community model is designed with creative solutions, considering all criteria.	Community model is designed with useful solutions, considering all criteria.	Community model is designed with some solutions, and considers some criteria.	Community model is designed with few solutions, considering very few criteria.

Related Standard(s) (will be replaced when new NRC Framework-based science standards are released):

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(D) Teacher Resource. "Create" Rubric (2 of 2)

National Science Education Standards (NSES)
**(E) Science and Technology: Abilities of Technological Design**
Evaluate completed technological designs or products. Students should use criteria relevant to the original purpose or need, consider a variety of factors that might affect acceptability and suitability for intended users or beneficiaries, and develop measures of quality with respect to such criteria and factors; they should also suggest improvements and, for their own products, try proposed modifications. (Grades 5-8: E1d)

Related Rubrics for the Assessment of Learning Outcomes Associated with the Above Standard(s):

Learning Outcome	Expert	Proficient	Intermediate	Beginner
LO1b: Create quality measures aligned with criteria	Measures were high quality and met all criteria.	Measures were high quality and met most criteria.	Measures met most criteria.	Measures did not meet criteria.
LO1c: Modify a model of a sustainable community to meet a challenge	Amendments were comprehensive, creative, and relevant in meeting the challenge.	Amendments were relevant & comprehensive in meeting the challenge.	Amendments were relevant in meeting the challenge.	Amendments did not adequately meet the challenge.
LO1d: Evaluate a model based on criteria and constraints	Evaluation was extremely honest & creative, appropriate changes were made to the community.	Evaluation was honest & appropriate; changes were made to the community.	Evaluation was mostly honest & some changes were made to the community	Evaluation could have been more honest or no changes were made to improve the community.

Teacher Guide

(E) Teacher Resource. Placement of Instructional Objective and Learning Outcomes in Taxonomy (1 of 3)
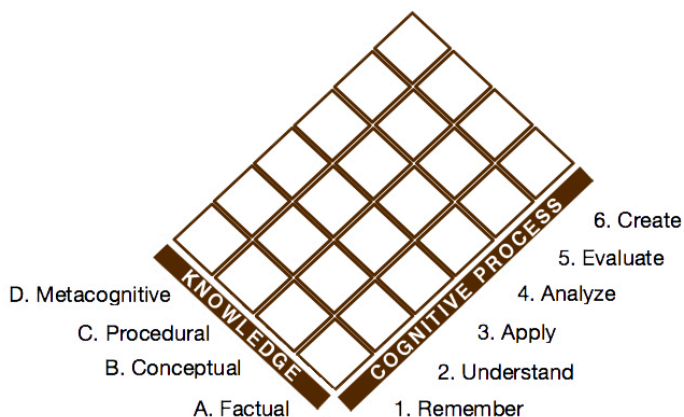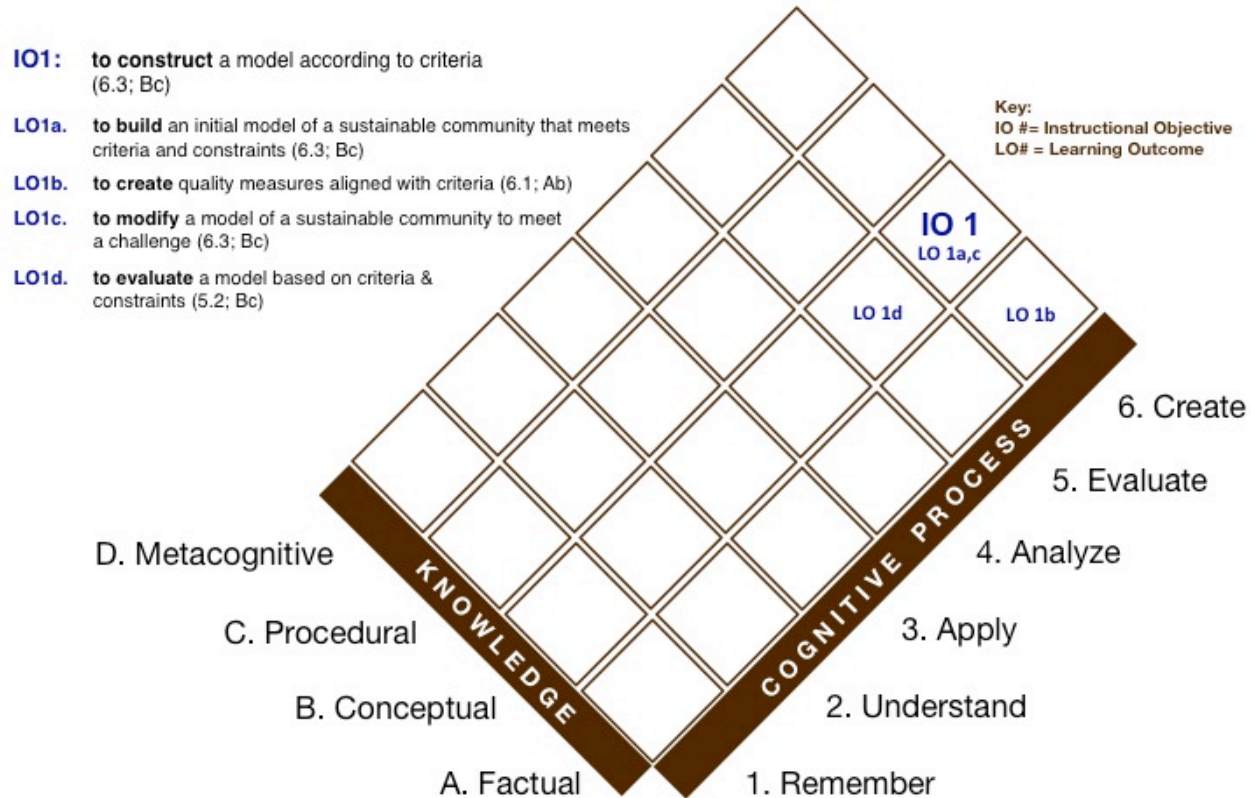

This lesson adapts Anderson and Krathwohl's (2001) taxonomy, which has two domains: Knowledge and Cognitive Process, each with types and subtypes (listed below). Verbs for objectives and outcomes in this lesson align with the suggested knowledge and cognitive process area and are mapped on the next page(s). Activity procedures and assessments are designed to support the target knowledge/cognitive process.

Knowledge	Cognitive Process
A. Factual	**1. Remember**
Aa: Knowledge of Terminology	**1.1** Recognizing (Identifying)
Ab: Knowledge of Specific Details & Elements	**1.2** Recalling (Retrieving)
B. Conceptual	**2. Understand**
Ba: Knowledge of classifications and categories	**2.1** Interpreting (Clarifying, Paraphrasing, Representing, Translating)
Bb: Knowledge of principles and generalizations	**2.2** Exemplifying (Illustrating, Instantiating)
Bc: Knowledge of theories, models, and structures	**2.3** Classifying (Categorizing, Subsuming)
C. Procedural	**2.4** Summarizing (Abstracting, Generalizing)
Ca: Knowledge of subject-specific skills and algorithms	**2.5** Inferring (Concluding, Extrapolating, Interpolating, Predicting)
Cb: Knowledge of subject-specific techniques and methods	**2.6** Comparing (Contrasting, Mapping, Matching
Cc: Knowledge of criteria for determining when to use appropriate procedures	**2.7** Explaining (Constructing models)
D. Metacognitive	**3. Apply**
Da: Strategic Knowledge	**3.1** Executing (Carrying out)
Db: Knowledge about cognitive tasks, including appropriate contextual and conditional knowledge	**3.2** Implementing (Using)
Dc: Self-knowledge	**4. Analyze**
	4.1 Differentiating (Discriminating, distinguishing, focusing, selecting)
	4.2 Organizing (Finding coherence, integrating, outlining, parsing, structuring)
	4.3 Attributing (Deconstructing)
	5. Evaluate
	5.1 Checking (Coordinating, Detecting, Monitoring, Testing)
	5.2 Critiquing (Judging)
	6. Create
	6.1 Generating (Hypothesizing)
	6.2 Planning (Designing)
	6.3 Producing (Constructing)

(E) Teacher Resource. Placement of Instructional Objective and Learning Outcomes in Taxonomy (2 of 3)

The design of this activity leverages Anderson & Krathwohl's (2001) taxonomy as a framework. Pedagogically, it is important to ensure that objectives and outcomes are written to match the knowledge and cognitive process students are intended to acquire.

IO1: **to construct** a model according to criteria (6.3; Bc)

LO1a. **to build** an initial model of a sustainable community that meets criteria and constraints (6.3; Bc)

LO1b. **to create** quality measures aligned with criteria (6.1; Ab)

LO1c. **to modify** a model of a sustainable community to meet a challenge (6.3; Bc)

LO1d. **to evaluate** a model based on criteria & constraints (5.2; Bc)

Key:
IO #= Instructional Objective
LO# = Learning Outcome

IO 1
LO 1a,c

LO 1d   LO 1b

6. Create

5. Evaluate

4. Analyze

3. Apply

2. Understand

1. Remember

COGNITIVE PROCESS

KNOWLEDGE

D. Metacognitive

C. Procedural

B. Conceptual

A. Factual

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Teacher Guide

(E) Teacher Resource. Placement of Instructional Objective and Learning Outcomes in Taxonomy (3 of 3)

The design of this activity leverages Anderson & Krathwohl's (2001) taxonomy as a framework. Below are the knowledge and cognitive process types students are intended to acquire per the instructional objective(s) and learning outcomes written for this lesson. The specific, scaffolded 5E steps in this lesson (see 5.0 Procedures) and the formative assessments (worksheets in the Student Guide and rubrics in the Teacher Guide) are written to support those objective(s) and learning outcomes. Refer to (E, 1 of 3) for the full list of categories in the taxonomy from which the following were selected. The prior page (E, 2 of 3) provides a visual description of the placement of learning outcomes that enable the overall instructional objective(s) to be met.

At the end of the lesson, students will be able

IO1:   to construct a model w/criteria
- **6.3:** to construct
- **Bc:** knowledge of theories, models, and structures

To meet that instructional objective, students will demonstrate the abilities:

LO1a: to build a model that meets reqs.
- 6.3: to build
- Bc: knowledge of theories, models, and structures

LO1b: to create quality measures aligned with criteria
- 6.1: to generate
- Ab: knowledge of specific details and elements

LO1c: to modify designs using criteria
- 6.3: to modify
- Bc: knowledge of theories, models, and structures

LO1d: to evaluate a model based on reqs.
- 5.2: to judge with criteria
- Bc: knowledge of theories, models, and structures

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