Formative Assessment Worksheet  
Specification #1

Teacher ID: CALA  
School ID: CALA

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| --- | --- | --- |
| **Target competency:**  special arrow.wmf Student can formulate a scientifically testable question(s) that relates to the context or data provided. | | |
| Anticipated student misconceptions relevant to this target competency:   * None | | |
|  | **Learning Progression Leading to the Target Competency** (List Building Blocks in Reverse Chronological Order) | **Type of Knowledge** |
| 5. | N/A | N/A |
| 4. | Student can identify questions that are scientifically testable. | Procedural |
| 3. | Student can explain why scientific research favors variables that can be objectively measured. | Declarative |
| 2. | Student can describe what makes a particular variable objectively measurable. | Declarative |
| 1. | Student can classify familiar variables as being either objectively measurable or less objectively measurable. | Procedural |

Copy/paste **Building Block 1** into this box:

Student can classify familiar variables as being either objectively measurable or less objectively measurable.

In two to four sentences, describe what you will do with your students to help them achieve this building block.

→ I will briefly explain why scientific research works better with objectively measured variables than less objectively measured ones and describe the differences. I will provide examples of familiar variables that are unequivocally objectively measurable or less objectively measurable and explain why each is so. I will then provide additional examples and have some students volunteer how they would classify the examples, while others either support or disagree with that classification.

State how you will assess this building block. In other words, what will you ask your students to do to establish whether they have achieved this building block? Identify the assessment format you will use.

→ Using a handout, I will ask students to work alone to classify each of five additional examples of variables as being objectively or less objectively measurable.

Copy/paste **Building Block 2** into this box:

Student can describe what makes a particular variable objectively measurable.

In two to four sentences, describe what you will do with your students to help them achieve this building block.

→ This building block and Building Block 1 will be addressed simultaneously. As examples of variables are given to the class, I will ask students to describe what makes each example objectively or less objectively measurable.

State how you will assess this building block. In other words, what will you ask your students to do to establish whether they have achieved this building block? Identify the assessment format you will use.

→ Using the handout described in Building Block 1, I will ask students to work alone to explain what makes each of the five examples of variables objectively or less objectively measurable.

Copy/paste **Building Block 3** into this box:

Student can explain why scientific research favors variables that can be objectively measured.

In two to four sentences, describe what you will do with your students to help them achieve this building block.

→ I will use pairs of familiar variables that are related, in the sense that they could be incorporated into the same or similar research questions. One of each pair will be less objective. As a class, my students and I will discuss why the more objective variable within each pair is preferable in research (e.g., facilitates a researcher replicating a measurement, facilitates researchers comparing their measurements). Using additional pairs of variables that I provide, I will ask students to work in groups of three to engage in the same discussion and report their explanations.

State how you will assess this building block. In other words, what will you ask your students to do to establish whether they have achieved this building block? Identify the assessment format you will use.

→ This building block will be assessed informally, involving the class as a whole. Continuing with the above activity, as groups of three report their explanations, I will ask the class what they liked and/or disliked about each explanation regarding why scientific research favors the objectively measured variable. In the students’ comments, I will look at whether students convey, with clear reference to the variables being discussed, that using more objectively measured variables facilitates replicating a measurement and/or facilitates comparing measurements.

Copy/paste **Building Block 4** into this box:

Student can identify questions that are scientifically testable.

In two to four sentences, describe what you will do with your students to help them achieve this building block.

→ To prompt student thinking, I will begin by stating that scientists try to answer questions but that the questions must be asked in a way that can be tested through a scientific investigation. I will ask students to list the criteria that define a good scientific question. Next, I will challenge them to describe questions that are not suitable for a scientific investigation and have the class identify criteria that the questions fail to meet. I will then provide students a list of questions and ask them to report, from small groups, which questions can be tested through a scientific investigation, explaining why.

The above is adapted from <http://science.education.nih.gov/supplements/nih6/inquiry/guide/nih_doing-science.pdf>, which provides ideas and materials to help students develop skills related to the process of scientific inquiry.

State how you will assess this building block. In other words, what will you ask your students to do to establish whether they have achieved this building block? Identify the assessment format you will use.

→ In a handout to each student, I will provide five pairs of questions. Questions within each pair pertain to the same content; however, only one question within the pair is scientifically testable. Students are asked to identify the scientifically testable question within each pair. With two of the five pairs, the wrong answer pertains to a question concerned with personal preference (e.g., which type of music is best versus which type of music sells the most copies). With the other three pairs, the wrong answer pertains to a question that would be of interest to scientists, but is worded without reference to a measurable variable (e.g., how human and bug blood is different versus do humans and bugs contain the same kinds of cells).

Copy/paste **Building Block 5** into this box:

→ N/A (There are only four building blocks in this learning progression.)

In two to four sentences, describe what you will do with your students to help them achieve this building block.

→ N/A

State how you will assess this building block. In other words, what will you ask your students to do to establish whether they have achieved this building block? Identify the assessment format you will use.

→ N/A

**Target Competency:**

Student can formulate a scientifically testable question(s) that relates to the context or data provided.

In two to four sentences, describe what you will do with your students to help them achieve this target competency, assuming they have achieved the above building blocks.

→ To begin, I will ask students to compare the pairs of questions from Building Block 4, asking why the chosen question is scientifically testable. From this context, I will provide the class with a list of seven variables that meet criteria provided in *Specification for Assessment #1* and, as a class, we will formulate two or three scientifically testable questions that use pairs of these variables. The scoring criteria (not the points) from the specification will be introduced and our research questions evaluated. This process will be repeated with a different set of seven variables, with students now working in small groups that will each formulate one scientifically testable question.

NOTE: **Do not state how you will assess this target competency in this box.** The design of the assessment is established by the specification. Use the following pages of the worksheet to describe what you will do to assess this target competency. Refer to the guidelines in the “**Procedure for Creating Parallel Tasks**” section in Specification #1 when developing this formative assessment.

**Student Answer Sheet Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

In this exercise, you will **create a** **scientifically testable question** related to behaviors and other characteristics of flowers. Use **two** of the following seven variables when you create your scientifically testable question:

* How beautiful a flower looks
* How often insects (pollinators) visit a flower
* How many flowers there are in a certain area
* How much nectar a flower produces
* How much a person enjoys the smell of a flower
* How much time insects spend visiting a flower
* How much familiarity a person has with a flower

1. **Choose two variables from the list above** that you think might have a relationship with one another. Be careful about which two variables you choose. Only pick variables you (or another scientist) could actually **observe or measure scientifically**. Write those two variables in the space below.

1st variable:

2nd variable:

1. For each of the two variables you chose, tell why it is possible to study the variable. To do this, **explain how each variable could be observed or measured**.

Explain how your 1st variable could be observed or measured:

Explain how your 2nd variable could be observed or measured:

1. In the space below, **write a** **scientifically testable question** that relates your two variablesto each other.

Student Formative Assessment Checklist

**Directions:** Use this checklist to evaluate your work. Read each section below and put a check in the box (🗹) next to each statement that accurately describes your work.

**1st Variable**

|  |  |
| --- | --- |
| I selected one of the following for the 1st variable. These are the **more** objectively measurable variables.   * How often insects (pollinators) visit a flower * How many flowers there are in a certain area * How much nectar a flower produces * How much time insects spend visiting a flower | 🞎 |
| I explained how someone could measure this variable. | 🞎 |

OR

|  |  |
| --- | --- |
| Instead, I selected one of the following for the 1st variable. These are the **less** objectively measurable variables.   * How beautiful a flower looks * How much a person enjoys the smell of a flower * How much familiarity a person has with a flower | 🞎 |
| I gave a detailed, specific explanation of how this variable could be objectively measured. | 🞎 |

**2nd Variable**

|  |  |
| --- | --- |
| I selected one of the following for the 2nd variable. These are the **more** objectively measurable variables.   * How often insects (pollinators) visit a flower * How many flowers there are in a certain area * How much nectar a flower produces * How much time insects spend visiting a flower | 🞎 |
| I explained how someone could measure this variable. | 🞎 |

OR

|  |  |
| --- | --- |
| Instead, I selected one of the following for the 2nd variable. These are the **less** objectively measurable variables.   * How beautiful a flower looks * How much a person enjoys the smell of a flower * How much familiarity a person has with a flower | 🞎 |
| I gave a detailed, specific explanation of how this variable could be objectively measured. | 🞎 |

**Question Characteristics**

|  |  |
| --- | --- |
| My scientifically testable question is worded as a question. | 🞎 |
| My scientifically testable question uses the two variables I selected from the list. It includes no other variables. | 🞎 |
| My scientifically testable question suggests that there could be a relationship between the two variables. | 🞎 |