

Formative Assessment

Identifying Misconceptions

INTRODUCTION

Students begin the unit with an activity in which they consider their prior knowledge and identify misconceptions they may have about research involving human participants. In the *Human Research Background Sort*, students decide whether research statements are accurate or not by sorting them into two categories and explaining their reasoning. This helps teachers elicit student ideas about research involving human participants and take into consideration the students' prior knowledge for the remainder of the unit. Students will revisit these statements throughout the unit to confirm or refute their positions.

CLASS TIME

About 20 minutes.

KEY CONCEPTS

- Human participation in research studies is part of a multi-step process in which new medicines, prevention tools, treatments, and medical devices are made available to the public.
- Involving humans in research brings up a number of ethical considerations.

ASSESSING AND ADDRESSING STUDENT MISCONCEPTIONS

In order to advance student scientific thinking process, it's important for teachers to ask thought-provoking questions about the topic and acknowledge any student misconceptions. The concepts presented in this *Formative Assessment* are relevant to the entire *Understanding Research and Ethics* curriculum series, which includes this module on humans in research. In *Benchmarks for Scientific Literacy: The Research Base*, the American Association of the Advancement of Science (AAAS) revealed some common misconceptions about the history of science pertinent to this curriculum:

- Research has shown that when students are exposed to the history of science, they view science as a "more philosophical, historical, and humanitarian discipline than they had thought." (AAAS, 2009).
- Students may have difficulty understanding the points of view of people in the past, and think that these people were "dumb" or "just didn't get it." It's important for students to grasp that historic values, beliefs, and attitudes may differ from those of today (AAAS, 2009).
- Students show little regard for the thinking of scientists whose theories they know are no longer supported by the data (AAAS, 2009).
- Students don't realize that values, beliefs, and attitudes may be different between cultures within a given population or between populations (AAAS, 2009).

LEARNING OBJECTIVES

Students will:

- Express their ideas about humans in research.

MATERIALS

Materials	Quantity
Student Handout FA-1— <i>Formative Assessment: Humans in Research Background Sort</i> [Note: Alternatively, you may project the <i>Student Handout</i> and ask students to write the answers in their notebooks.]	1 per student
Possible Answers for Student Handout FA-1— <i>Formative Assessment: Humans in Research Background Sort</i>	1

NOTE TO THE TEACHER

The National Research Council (NRC) has done extensive research on the cognitive and developmental aspects of learning. Their research shows that students learn science best when certain principles are met. These are a deliberate acknowledgement of and connection to prior knowledge, a connection between what they are learning and “big ideas,” and a meta-cognitive reflection on the learning accomplished. Basically, students need to know what they thought before a concept was introduced, what they are being taught *and* why, followed by time for reflection back on what they learned and *how their thinking changed*. Without this reflection, many students will revert back to their prior knowledge even after direct instruction and activities. Sometimes students will remember the information long enough to take a test on it before reverting back to prior knowledge (NRC, 2005).

Before beginning this activity, review the Possible Answers for Student Handout FA-1—*Formative Assessment: Humans in Research Background Sort*.

TEACHER PREPARATION

- Make copies of *Student Handout*.

PROCEDURE

Activity One: Humans in Research Background Sort

1. Pass out one copy of the Student Handout FA-1—*Humans in Research Background Sort* to each student, and ask students to work on it for about 10 minutes. [**Note:** Alternatively, you may project the *Student Handout* and ask students to sketch a chart and write the answers in their notebooks.]
2. As a class, invite students to share their thoughts, expressing how they sorted the statements and why.
3. Work together as a class to decide whether each statement is accurate or not and record this on a class chart, PowerPoint, overhead transparency, or other visual aid. Fill in the chart with answers from the class as a whole; this chart will be revisited throughout the unit. At this point in the unit, the goal is not to have all of the statements in the correct place, but to have students decide as a group whether each statement is accurate or inaccurate.

Closure

4. Tell students that you will be referring back to these answers throughout the unit.

You will revisit the *Formative Assessment* statements at the end of each unit lesson using the class statement sort chart as a reference. Use this as a time for reflection, when students have a chance to confirm or refute/change where statements are placed on the class chart.

SOURCES

American Association for the Advancement of Science (2009). *Benchmarks for scientific literacy: The research base*. Retrieved from: <http://www.project2061.org/publications/bsl/online/index.php?chapter=15§ion=C&band=1#11c>.

Driver, R., Squires, A., Rushworth, P., & Wood-Robinson, V. (2007). *Making sense of secondary science: research into children's ideas*. New York, NY: RoutledgeFarmer.

Keeley, P. (2005). *Science curriculum topic study*. Thousand Oaks, CA: Corwin Press.

National Research Council (2005). *How students learn science in the classroom*. Washington, DC: National Academies Press.

University of California Museum of Paleontology (2011). Misconceptions about science. *Understanding Science*. Retrieved from: <http://undsci.berkeley.edu/teaching/misconceptions.php#b1>.

STUDENT HANDOUT FA-1

Formative Assessment: Human Research Background Sort

Name _____ Date _____ Period _____

Instructions:

Sort the following statements (identifying them by A, B, C, D, E, or F) into “accurate” or “not accurate” and explain why you sorted the answers the way you did.

- A) Most of our medicines and modern medical treatments would not be available without experiments that were done on people.
- B) Because the general public is pushing for new treatments, medications, and prevention methods, researchers often have to turn away qualified people who want to participate in studies because the studies are full.
- C) Scientists follow several established guidelines to respect the privacy, dignity, and culture of their human participants.
- D) Cells or tissue samples left over from medical tests performed by doctors or nurses can be used in experiments without patient permission.
- E) All of the current regulations for research involving humans today, compared to years past, means there are few or no ethical problems or debates about research involving humans.
- F) Computer simulations are making research with humans unnecessary.

These statements are accurate (EXPLAIN WHY).	These statements are not accurate (EXPLAIN WHY).

HANDOUT

Possible Answers for STUDENT HANDOUT FA-1

Formative Assessment: Human Research Background Sort

Instructions:

Sort the following statements (identifying them by A, B, C, D, E, or F) into “accurate” or “not accurate” and explain why you sorted the answers the way you did.

- A) Most of our medicines and modern medical treatments would not be available without experiments that were done on people.
- B) Because the general public is pushing for new treatments, medications, and prevention methods, researchers often have to turn away qualified people who want to participate in studies because the studies are full.
- C) Scientists follow several established guidelines to respect the privacy, dignity, and culture of their human participants.
- D) Cells or tissue samples left over from medical tests performed by doctors or nurses can be used in experiments without patient permission.
- E) All of the current regulations for research involving humans today, compared to years past, means there are few or no ethical problems or debates about research involving humans.
- F) Computer simulations are making research with humans unnecessary.

These statements are accurate (EXPLAIN WHY).	These statements are not accurate (EXPLAIN WHY).
<p>A) <i>Most medicines and modern medical technologies would not be available without experiments that were conducted with humans. This includes insulin used to treat diabetes, prosthetic limbs, birth control hormones, etc.</i></p> <p>C) <i>There have been many unethical studies done on humans in the name of “scientific progress.” Many times these studies were a result of scientists dehumanizing their subjects. As a result, scientists follow ethical guidelines (i.e., The Belmont Report) developed to explain how subjects should be treated during the research process.</i></p> <p>D) <i>There are different rules regarding cells or tissues in different medical settings and different states, but often after a medical or clinical test (like a biopsy, a Pap Smear, a simple surgery, or blood draw), leftover cells are considered “medical waste” and can be used by scientists without patient permission. Many times the patient will have signed a form that says s/he understands that the tissues/cells could be used, although the patient may or may not understand what they are agreeing to.</i></p>	<p>B) <i>It is common for research studies relying on human participants to be behind schedule or even canceled because researchers can’t recruit enough qualified people to participate in the studies.</i></p> <p>E) <i>Even though there is more research regulation from Institutional Review Boards and scrutiny from the public due to the internet, research studies often bring up ethical questions.</i></p> <p>F) <i>Although computer simulations may be a part of the experimental process, human volunteers are required for all levels of clinical research. Computer modeling is usually considered part of “pre-clinical” research (studies that do not involve human participants). Typically, successful computer modeling and research with animals are used to justify why a study should move forward into the human trial phase.</i></p>