

GED® Preparation Lesson Plan

Module: Science

Lesson Title: Forming a Conclusion

Standards: GED® Preparation (Adult General Education)

Scientific Practices 2014 Assessment Targets	Related Indicators from Other Content Areas
<p>Understand and explain textual scientific presentations. (SP.1.a)</p> <p>Identify the strengths and weaknesses of one or more scientific investigation (i.e., experimental or observational) designs. (SP.2.c)</p> <p>Evaluate whether a conclusion or theory is supported or challenged by particular data or evidence. (SP.4.a)</p>	<p>Reasoning through Language Arts: Evaluate the relevance and sufficiency of evidence offered in support of a claim. (R.8.3)</p> <p>Social Studies: Analyze in detail how events, processes, and ideas develop and interact in a written document; determine whether earlier events caused later ones or simply preceded them. (SSP.3.b)</p> <p>Mathematical Reasoning: Improve or correct a flawed line of reasoning. (MP.3.c)</p>

Objectives of the Lesson

Students will:

- Review the steps and processes of the scientific method
- Identify steps in the process to write a scientific conclusion
- Identify evidence that supports a conclusion or solution

Materials

- Prep Activity, The Scientific Method Explained! – (3:55)
You Tube video: <https://www.youtube.com/watch?v=JA3yhdNXiFM>
- Exploring the Scientific Method: Conclusions – (6:18)
You Tube video: <https://www.youtube.com/watch?v=jksLnNu6qiA>
- Computer and Speakers (Projector for use with class)
- Handout A: The Scientific Method Vocabulary
- Handout B: Steps to Forming a Conclusion
- Handout C: Introduction to the Scientific Method Worksheet
- Handout D: Can You Spot the Scientific Method?

Instructional Plan

Overview

The GED® Science test focuses on the fundamentals of scientific reasoning, including a deep conceptual understanding of scientific processes, procedural skill and fluency, and the application of these fundamentals in realistic situations. Forming a conclusion is one of the identified steps in the scientific method that contains a description of the propose of the experiment (hypothesis), a discussion and explanation of major findings (data), a statement that demonstrates whether or not the hypothesis was supported or not supported and recommendations for further study. The GED Testing Service® has identified this assessment target as a high impact indicator that describes some of the critical thinking skills students need to be successful in college, career training, and the workforce.

Process

Introduce the lesson by asking the following questions and discussing them as a class:

- What is the scientific method? Can you list the steps in the scientific method?

After the review, write the following words/terms on the board:

- Hypothesis
- Controlled Variable
- Independent Variable
- Dependent Variable
- Qualitative Data
- Quantitative Data
- Forming a conclusion

- Show the YouTube video on the scientific method.

<https://www.youtube.com/watch?v=JA3yhdNXiFM>

Review vocabulary definitions on **Handout A: The Scientific Method Vocabulary** and discuss each term.

- After prep activities with vocabulary show the YouTube video “Exploring the Scientific Method: Conclusions”.

<https://www.youtube.com/watch?v=jksLnNu6qiA>

*After viewing the video, discuss the steps in forming a conclusion for the scientific method.

Provide students with the **Handout B: Steps to Forming a Conclusion**. Have students answer each of the questions based on the information from the video. Discuss their answers.

Once students have an understanding of the process for forming a conclusion, review the scientific method and form a conclusion by doing the exercises from Mr. Hill’s Science Website

<http://www.mrscienceut.net>

This activity is located on **Handout C: Introduction to the Scientific Method Worksheet**.

Sample Debriefing Questions

- List the steps in the scientific method.
- Identify the steps in the process to write a scientific conclusion.
- What support do you need to form a strong conclusion?

Modifications for Different Levels

To modify instruction, provide students with samples from science texts, and have them work in pairs to list all the steps in the scientific method.

Have students brainstorm a real-world situation for which they would want to set up an experiment. For instance, “If you are streaming a video on your cell phone, how long will it take to totally drain the battery?”

- How would you form your hypothesis?
- What would the experiment look like?
- What would be the dependent and independent variables?
- What data would you need to collect?
- What would be your controlled variable?
- Have the students perform the experiment and share conclusions.

Assessments/ Extensions

Throughout the lesson, be sure to monitor and check for student understanding for each new concept or vocabulary term. Allowing students to work in pairs helps to build confidence and share knowledge. There are several resources available on the internet, as well in the GED® preparation materials, which will give students more practice with GED® type questions that deal with each step in the scientific method process. Provide students with **Handout D: Can You Spot the Scientific Method?** and use the worksheet as an extension activity. This worksheet provides students with practice in identifying the steps in the scientific method and forming a conclusion.



The Scientific Method Vocabulary

Science

- 1) Scientific Method: An organized and sequential approach taken to try to solve a problem and involves the following: a) stating the problem, b) forming a hypothesis, c) testing the hypothesis, d) analyzing the data, e) forming a conclusion.
- 2) Hypothesis: A prediction about a problem that can be tested. @hat you think will happen?
- 3) Independent variable: The variable that is changed or manipulated.
- 4) Dependent variable: A variable that is measured or observed to see if change had an effect.
- 5) Controlled variable: A standard that is used to compare results in an experiment – no independent variable is applied.
- 6) Qualitative data: Observations that involve descriptions using your senses.
- 7) Quantitative data: Observations that are measured with numbers or amounts.
- 8) Forming a Conclusion: Statement or paragraph that responds to the hypothesis. Did the results support or not support the hypothesis? Discuss the data and experiment design; demonstrate that the experiment served its intended purpose effectively.

Steps to Forming a Conclusion

1. Restate the purpose of the experiment (include independent variable) and the dependent variables.

Example: The purpose of the experiment was to investigate the effect of the independent variable (plant food) on the (dependent variable) growth and maturity of sunflowers.

Example: The purpose of the experiment was to investigate the effect of plant food on the growth of sunflower plants, by comparing the growth of plants given plant food with plants that did not receive any (controlled variable).

2. What were the major findings? (Summarize your data and graph results)

Example: A significant difference existed between the height of fertilized plants and non-fertilized plants. Sunflower plants that received the plant food showed an increase in the average height by 25% (14- 16 inches) over plants that did not receive any plant food (quantitative data). In addition, the flowers produced were of more rich and intense yellow color and the stalks seemed sturdier(qualitative data).

3. Was the hypothesis supported by the data?

Example: The hypothesis that plant food given in recommended amounts will produce taller, sturdier, and more colorful blooms was supported by qualitative and quantitative data collected.

4. What were your errors & how could this experiment be improved?

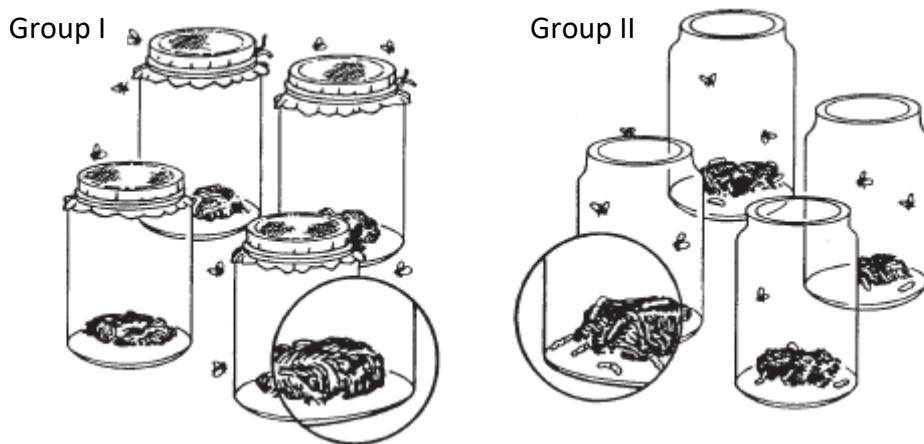
Example: This experiment was performed inside of a classroom where the temperature was not constant. Some plants were closer to the window and may have been exposed to a different temperature and light than other plants. Perhaps this experiment could be improved by placing all plants equal distance from the window to ensure equal amounts of light and heat exposure.

5. What could be studied next after this experiment? What new experiment could continue study of this topic?

Example: Additional investigations using other plant food mixers or other plant varieties could yield different results.

Introduction to the Scientific Method Worksheet

Long ago, many people believed that living things could come from nonliving things. They thought that worms came from wood and that maggots came from decaying meat. This idea was called spontaneous generation. In 1668, an Italian biologist, Francesco Redi, did experiments to prove that maggots did not come from meat. One of his experiments is shown below.



Redi placed pieces of meat in several jars. He divided the jars into two groups. He covered the first group of jars with fine cloth. He left the second group of jars uncovered. Redi observed the jars for several days. He saw flies on the cloth of the covered jars, and he saw flies laying eggs on the meat in the uncovered jars. Maggots appeared only on the meat in the group of jars left uncovered.

Questions

1. Which is not a step in the scientific method?
 - a. Problem or question.
 - b. Research.
 - c. Ask other people for their opinion.
 - d. Arrive at a conclusion.

2. What was the problem in Redi's experiment?
 - a. How do maggots appear in meats?
 - b. How do worms appear in wood?
 - c. Is spontaneous generation a valid explanation for maggots in meats?
 - d. All of the above are examples of problems

3. What do you think his hypothesis was?

- a. Maggots grow through spontaneous generation.
- b. Maggots come from eggs laid by flies.
- c. Maggots find their way into woods and meats.
- d. The problem cannot be solved.

4. How did he test his hypothesis?

- a. He placed food in two jars, covering one jar and leaving the other uncovered.
- b. He placed food in two jars and left both jars uncovered.
- c. He placed food in two jars and covered both jars.
- d. He put food in one jar and no food in a second jar.

5. What was the variable in his experiment?

- a. Covering both jars.
- b. Covering one jar and leaving the other uncovered.
- c. Leaving both jars uncovered.
- d. There was no variable in this experiment.

6. What do you think Redi's conclusion was?

- a. Living things come from other living things.
- b. Living things are created through spontaneous generation.
- c. He did not have enough data to arrive at a conclusion.

Answer Key: Introduction to the Scientific Method Worksheet (<http://www.mrscienceut.net>)

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b. Research. d. Arrive at a conclusion.

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Can You Spot the Scientific Method?

Mr. Hill's Science Website <http://www.mrscienceut.net>

Each sentence below describes a step of the scientific method. Match each sentence with a step of the scientific method listed below.

- _____ 1. Stephen predicted that seeds would start to grow faster if an electric current traveled through the soil in which they were planted.
- _____ 2. Susan said, "If I fertilize my geranium plants, they will blossom."
- _____ 3. Jonathan's data showed that household cockroaches moved away from raw cucumber slices.
- _____ 4. Rene grew bacteria from the mouth on special plates in the laboratory. She placed drops of different mouthwashes on bacteria on each plate.
- _____ 5. Kathy used a survey to determine how many of her classmates were left-handed and how many were right-handed.
- _____ 6. Jose saw bats catching insects after dark. He asked, "How do bats find the insects in the dark?"
- _____ 7. Justin wondered if dyes could be taken out of plant leaves, flowers, and stems.
- _____ 8. Alice soaked six different kinds of seeds in water for 24 hours. Then she planted the seeds in soil at a depth of 1 cm. She used the same amount of water, light, and heat for each kind of seed.
- _____ 9. Bob read about growing plants in water. He wanted to know how plants could grow without soil.
- _____ 10. Kevin said, "If I grow five seedlings in red light, I think the plants will grow faster than the five plants grown in white light."

- A. Recognize a problem
- B. Form a hypothesis
- C. Test the hypothesis with an experiment
- D. Draw conclusions

- ____ 11. Angela's experiment proved that earthworms move away from light.
- ____ 12. Scott said, "If acid rain affects plants in a particular lake, it might affect small animals, such as crayfish, that live in the same water."
- ____ 13. Michael fed different diets to three groups of guinea pigs. His experiment showed that guinea pigs need vitamin C and protein in their diets.
- ____ 14. Kim's experiment showed that chicken eggshells were stronger when she gave the hen feed, to which extra calcium had been added.

Answer Key: Can you Spot the Scientific Method Worksheet

<http://www.mrscienceut.net>

- | | |
|---|---|
| <p>__B__ 1. Stephen predicted that seeds would start to grow faster if an electric current traveled through the soil in which they were planted.</p> | A. Recognize a problem |
| <p>__B__ 2. Susan said, "If I fertilize my geranium plants, they will blossom."</p> | B. Form a hypothesis |
| <p>__D__ 3. Jonathan's data showed that household cockroaches moved away from raw cucumber slices.</p> | C. Test the hypothesis with an experiment |
| <p>__C__ 4. Rene grew bacteria from the mouth on special plates in the laboratory. She placed drops of different mouthwashes on bacteria on each plate.</p> | D. Draw conclusions |
| <p>__C__ 5. Kathy used a survey to determine how many of her classmates were left-handed and how many were right-handed.</p> | |
| <p>__A__ 6. Jose saw bats catching insects after dark. He asked, "How do bats find the insects in the dark?"</p> | |
| <p>__A__ 7. Justin wondered if dyes could be taken out of plant leaves, flowers, and stems.</p> | |
| <p>__C__ 8. Alice soaked six different kinds of seeds in water for 24 hours. Then she planted the seeds in soil at a depth of 1 cm. She used the same amount of water, light, and heat for each kind of seed.</p> | |
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| <p>__B__ 10. Kevin said, "If I grow five seedlings in red light, I think the plants will grow faster than the five plants grown in white light."</p> | |
| <p>__D__ 11. Angela's experiment proved that earthworms move away from light.</p> | |

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D 14. Kim's experiment showed that chicken eggshells were stronger when she gave the hen feed, to which extra calcium had been added.