Texas A&M AgriLife Extension

EXPLORE

Texas 4-H Science Project

Explore the Scientific Method - Lifecycles

texas4-h.tamu.edu

EXPLORE

TEXAS 4-H SCIENCE PROJECT

Description

The Texas 4-H Explore series allows 4-H volunteers, educators, members, and youth who may be interested in learning more about 4-H to try some fun and hands-on learning experiences in a particular project or activity area. Each guide features information about important aspects of the 4-H program, and its goal of teaching young people life skills through hands-on experiences. Additionally, each guide contains at least six learning experiences, which can be used as a project guide, or as activities for six different 4-H meetings.

Purpose

Texas 4-H is designed to develop the youth of our state into productive adult citizens. The 4-H Program uses a non-formal educational process of engaging youth in a "learning by doing" process. This includes hands-on opportunities, participation in workshops and clinics conducted by volunteer leaders or professionals, as well as competitive experiences which allow 4-H members to demonstrate the knowledge they have gained. Through this entire process, the youth are learning key life skills such as working with others, teamwork, cooperation, and goal setting. Through all experiences, youth get to interact with adult volunteers and county Extension agents.

What is 4-H?

4-H members across the nation are responding to challenges every day in their communities and their world.

As the youth development program of the Cooperative Extension System of land-grant universities, 4-H is the nation's largest youth development organization, empowering six million young people throughout the United States. Cooperative Extension of 1862 and 1890 land-grant universities provide leadership to engage young people in 4-H in all 3,007 counties of the United States. The impact of the Cooperative Extension partnership is profound, bringing together National Institute of Food and Agriculture of USDA, land grant universities and county government to resource learning opportunities for youth.

Through America's 110 land-grant universities and its Cooperative Extension System, 4-H reaches every corner of our nation—from urban neighborhoods to suburban schoolyards to rural farming communities.

With a network of more than 6 million youth, 600,000 volunteers, 3,500 professionals, and more than 25 million alumni, 4-H helps shape youth to move our country and the world forward in ways that no other youth organization can.

Texas 4-H

Texas 4-H is like a club for kids and teens ages 5-18, and it's BIG! It's the largest youth development program in Texas with more than 550,000 youth involved each year. No matter where you live or what you like to do, Texas 4-H has something that lets you be a better you!

You may think 4-H is only for your friends with animals, but it's so much more! You can do activities like shooting sports, food science, healthy living, robotics, fashion, and photography.

Look for 4-H clubs at your school, an after-school program, a community center, or even on a military base or through the reserves for military families.

Texas 4-H is part of the Texas A&M AgriLife Extension Service and the Texas A&M System. Founded in 1908, 4-H is the largest youth development program in Texas, reaching more than 550,000 youth each year.

The 4-H Motto and Pledge

"To Make the Best Better!"

I pledge: My HEAD to clearer thinking, My HEART to greater loyalty, My HANDS to larger service and My HEALTH to better living, For my Club, my Community, my Country, and my world.

Participating in 4-H

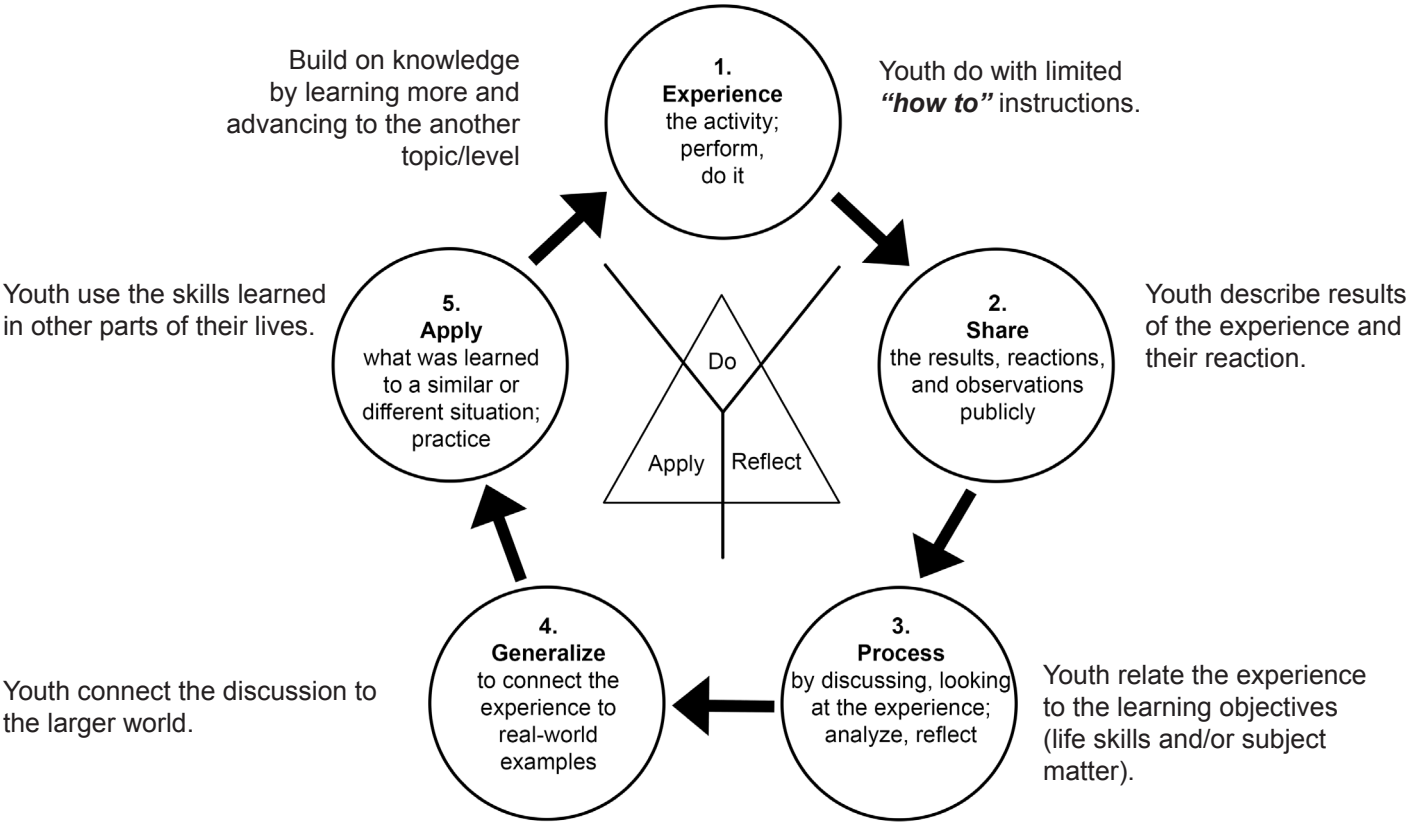
4-H is a great program because it provides options for young people to participate. From a 4-H club located in your community, a SPIN club that focuses on one particular project area, or participating in 4-H through your classroom at school, 4-H allows youth to learn in many different environments. If you are interested in joining 4-H, contact your County Extension Office and ask for a list of the 4-H clubs in your area. If you are a school teacher/educator and would like to use 4-H curriculum or these project guides in your classroom, contact your Extension Office as well for assistance.

4-H "Learning by Doing" Learning Approach

The Do, Reflect, Apply learning approach allows youth to experience the learning process with minimal guidance from adults. This allows for discovery by youth that may not take place with exact instructions.

EXPLORE THE CONTENT

Introduction of the topic, overview and exploration of content, and review of objectives



Developed by:
Roxanna Reyna-Islas

EXPLORE
Science Project

Life Cycles

TIME:
90 minutes for initial experience, with follow-up observation time of 30 minutes.

MATERIALS NEEDED:
- 6 small boxes or petri dishes
- 12 mealworms (Available on Petco, PetStore, and different websites including Amazon)
- 90gr of Oatmeal (oats not processed and also called old fashion or all natural)
- Cold (4oC) Refrigerator, hot (24oC) heat lamp and warm (20oC) room temperature source.
- 3 Thermometers
- 4 Sliced potatoes (source of moisture and food source)

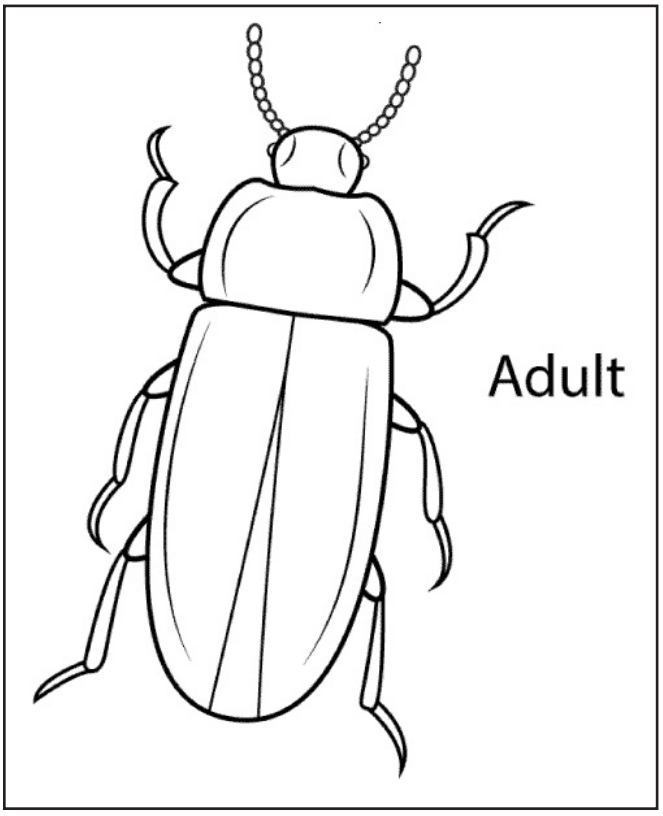
OBJECTIVES:
The participants will:
- Learn the Steps of the Scientific Method
- Learn about mealworm lifecycle
- Practice the 15 SET Abilities (build, categorize, collaborate, demonstrate, describe, contrast, solve, design, evaluate, hypothesize, invent, infer, interpret, measure and learn basics of graphical representation)

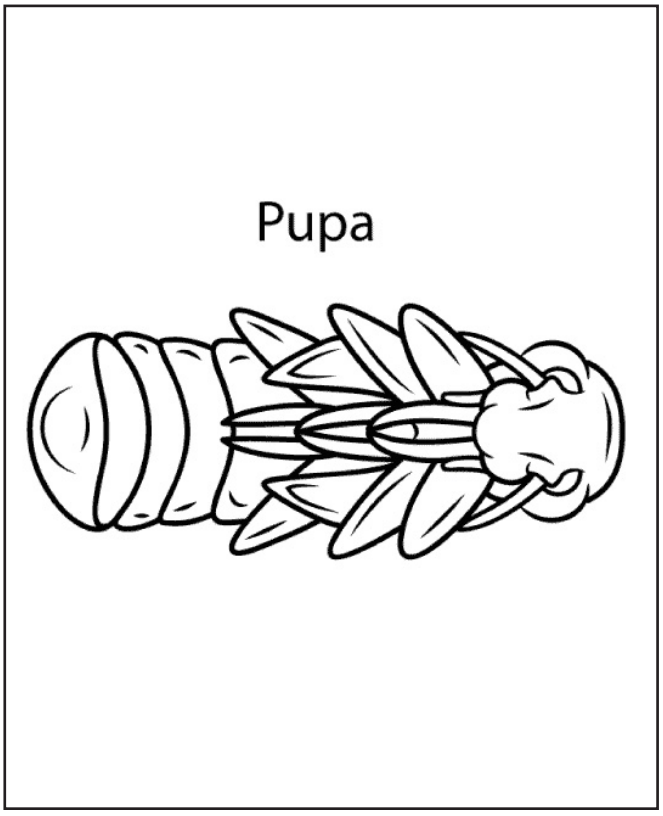
EXPLORE THE CONTENT:
Vocabulary:
- Life cycle - the series of stages through which a living thing passes from the beginning of its life until its death.
- Metamorphosis - Also called transformation. A change in the form and often habits of an animal during normal development after the embryonic stage. Metamorphosis includes, in insects, the transformation of a maggot into an adult fly and a caterpillar into a butterfly and, in amphibians, the changing of a tadpole into a frog.
- Larvae - the active immature form of an insect, especially one that differs greatly from the adult and forms the stage between egg and pupa, e.g., a caterpillar or grub.
- Pupa - an insect in its inactive immature form between larva and adult, e.g., a chrysalis.

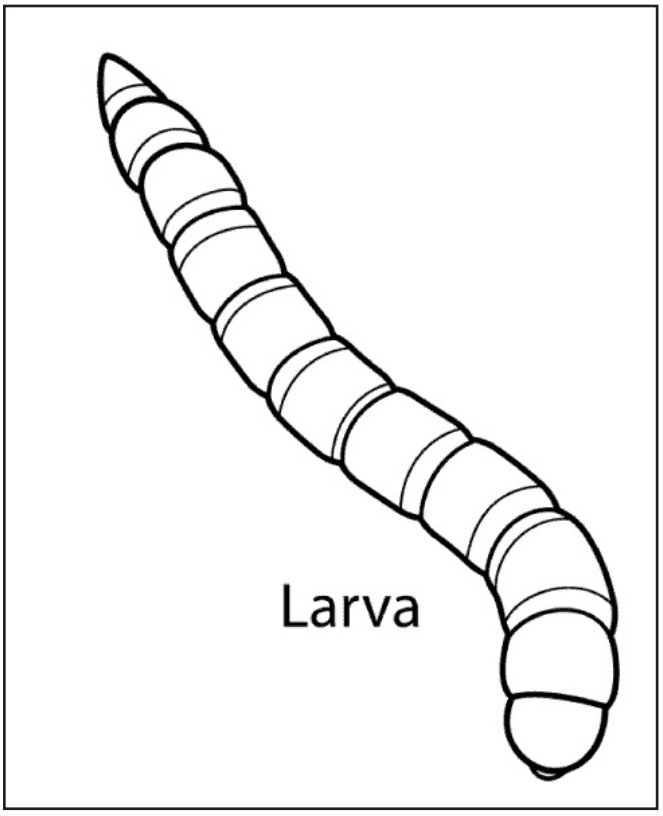
Main Question: Does temperature affect the time (in days) in which the mealworms go through metamorphosis?
- Independent Variable: Cold Temperature, Warm Temperature and Room Temperature.
- Dependent Variable: Time (in days)
- Possible Hypothesis:
  - If mealworms are in a cold environment, metamorphosis will take longer to occur.
  - If mealworms are in a warm environment, metamorphosis will take shorter to occur.

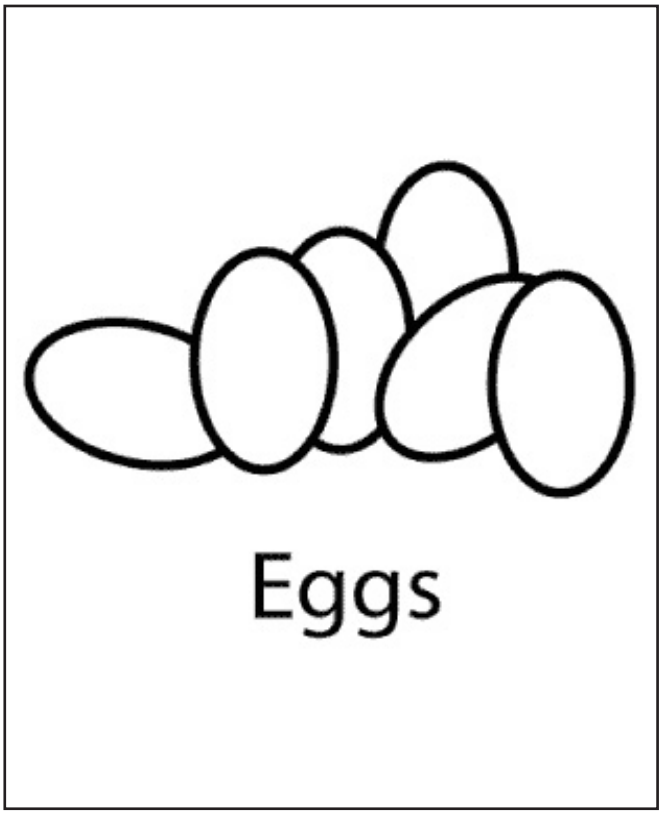
DO:
Activity 1
Learn the Grain Beatle Life Cycle – Divide participants into groups of 4 with one diagram of each different life cycle stage to organize in the correct order and act out or demonstrate to the other groups.

Instructions: Using the pictures below, cut each one out and have the youth place them in the proper life cycle order.



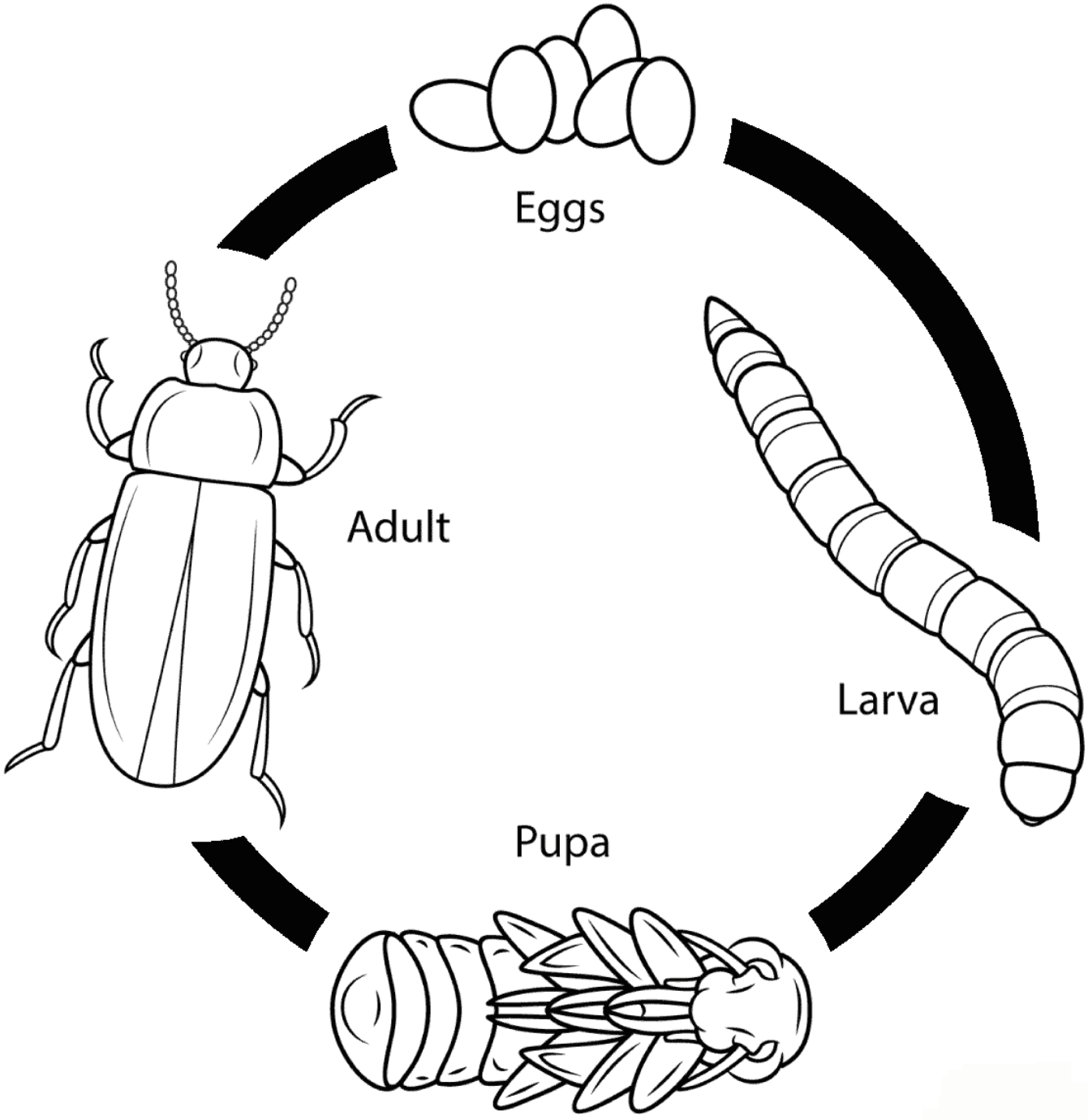




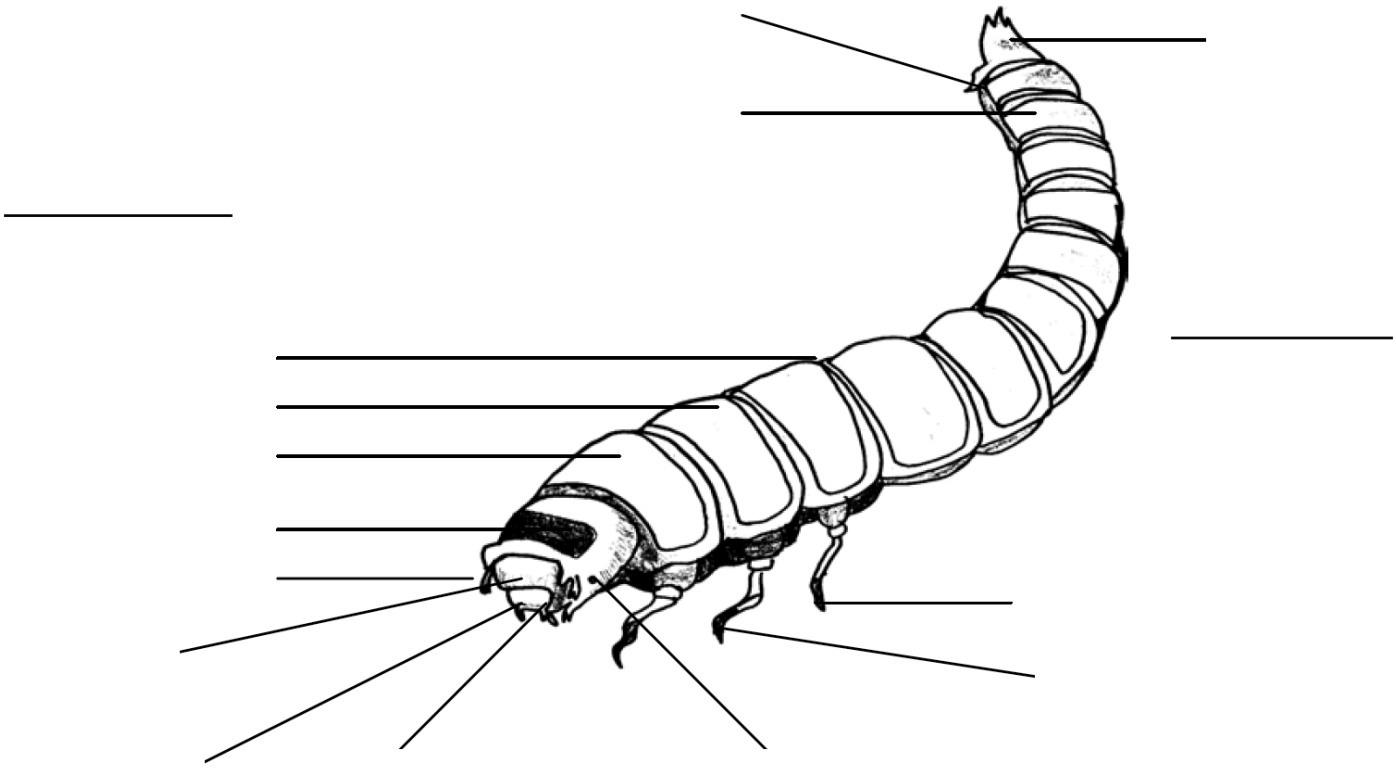


ANSWER KEY

Instructions: Using the pictures below, cut each one out and have the youth place them in the proper life cycle order.



Activity 2
Learn the Mealworm (Larvae) parts. Provide each youth a copy of the page below and have them label the various parts of the meal worm



ANSWER KEY

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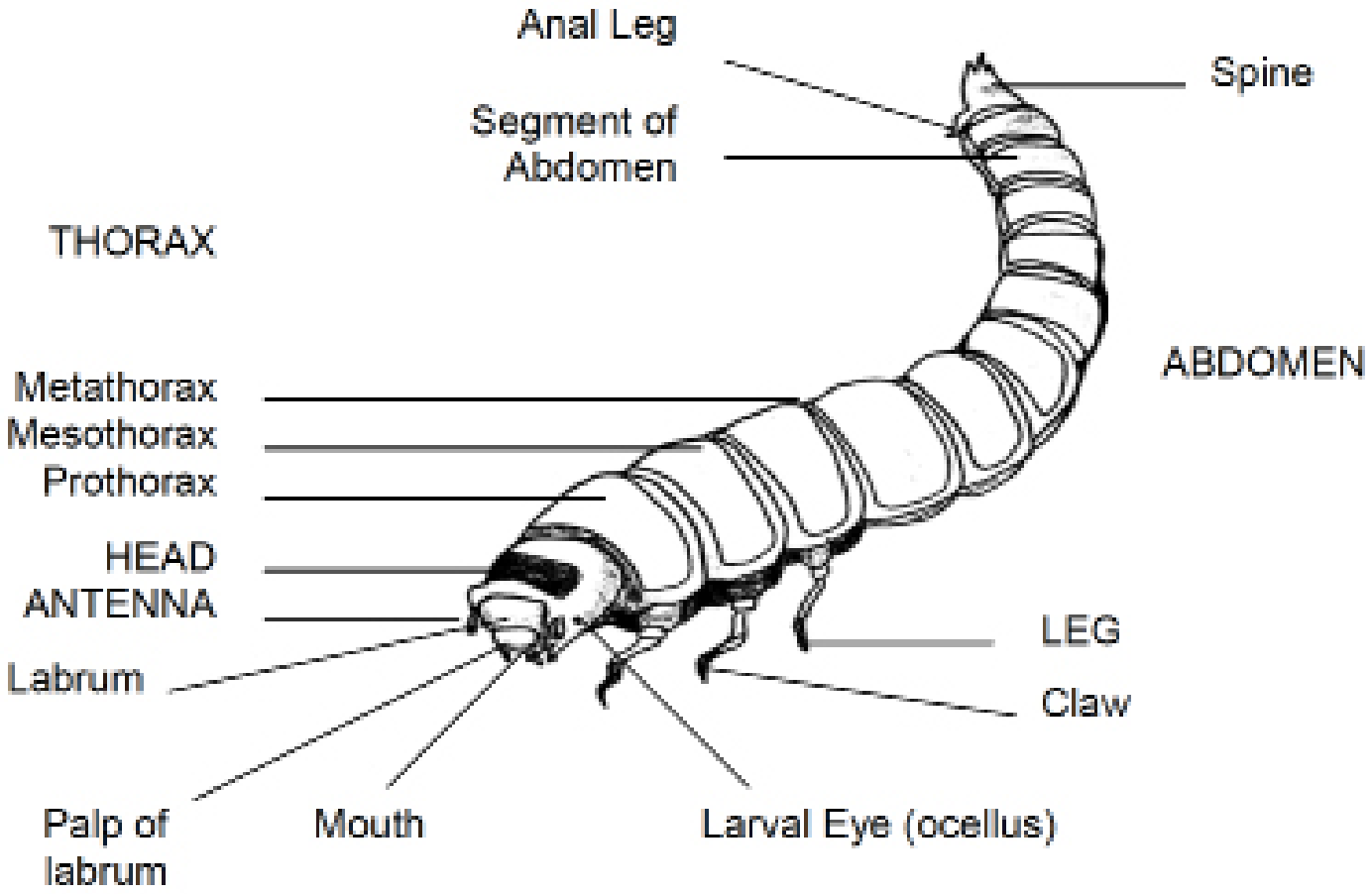

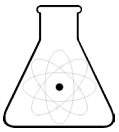

Activity 3
Conduct your own Research Project

1. Properly label each container; date and treatment (hot, warm or cold temperature). Place 4 worms in each container filled with 10gr oatmeal and a potato slice.
2. The fist container (with 4 worms) should be placed in a cold environment (4-6oC)
3. The second container must be in a warm environment, under a lamp or hotplate (26-28oC) always monitoring the humidity.
4. The third container should be at room temperature (21-24oC)
5. Observe for 4 to 8 weeks and collect data using a data log sheet.

Day	Treatment (Hot/Warm/Cold)	Change (Yes/No)	Observations

REFLECT:

- Do mealworm worms ever change?
- Do mealworms need specific temperature to metamorphose (change)?

APPLY:

Report your results in a scientific manner – see handout at end for a graphic representation
Scientific Posters are commonly used to share your scientific project including the results. Typically, a Scientific Posters will have the following parts:

- **Abstract:** The summary of the experiment which includes the purpose of the experiment, and no more than three sentences explaining the procedure, results, and conclusion.
- **Introduction:** Describes the problem or goal of the experiment, it offers background information about; the entity, independent variable, dependent variable and the hypothesis.
- **Materials and Methods:** It describes the experiment's design; what materials were used, how the data was collected, how often date was collected, and how the data was analyzed. Pictures and tables can be used for this section.
- **Results:** Describes and displays data using; tables, photographs. Remember - the figures must always have a descriptive text (figures and tables must have a title number and units of measurement).
- **Conclusions:** The first sentence states the hypothesis or research question and the second should answer the research question with additional sentences explaining the results and procedures that influenced the results.
- **References:** If images from the web were used, it is important to refer the website used. The common method to cite the sources is APA style (you find instructions for APA style on the internet)
- **Acknowledgments:** A formal printed statement that recognizes individuals and institutions that contributed to the work being reported.

REFERENCES:

- Dierenfeld, E., Kutcher, S., & VanDyk, J. (n.d.) Answers to Kids' Questions About Mealworms and Beetles. Retrieved from: http://www.scholastic.com/teachers/article/answers-kids-questions-about-mealworms-and-beetles
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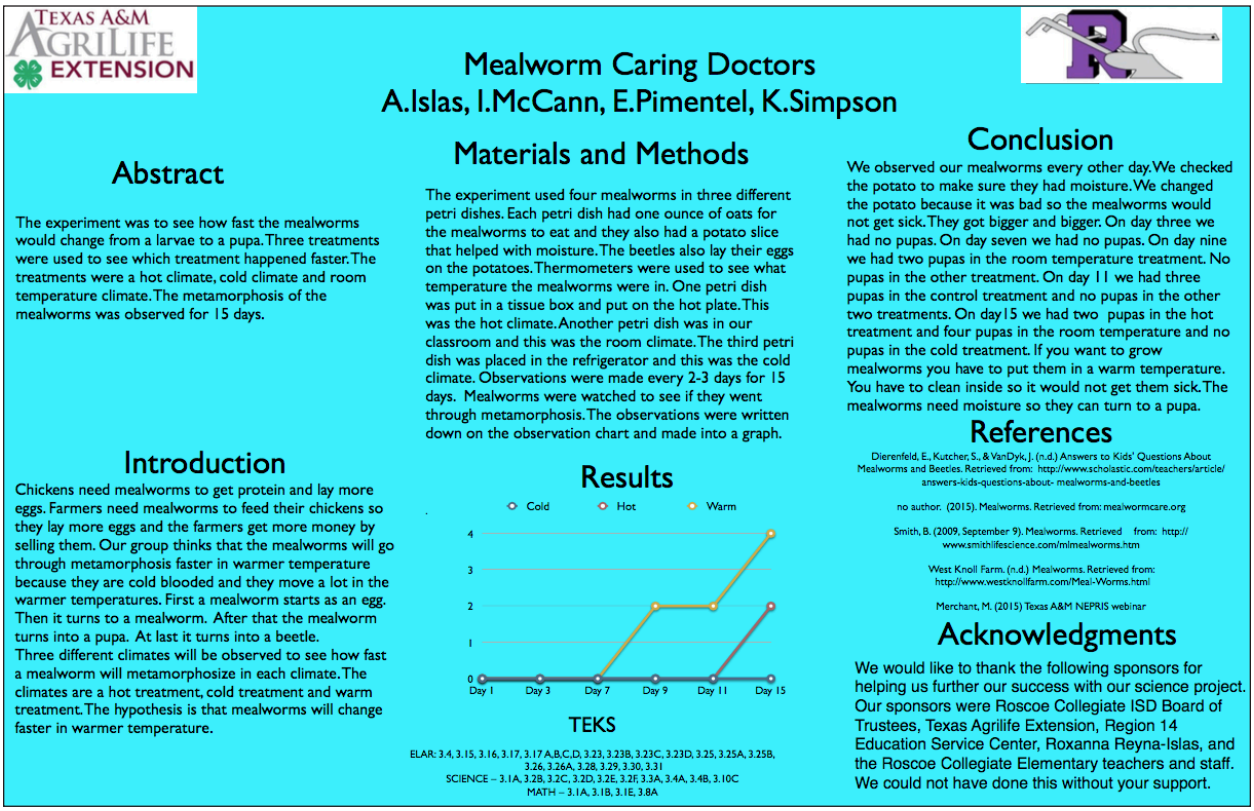
- West Knoll Farm. (n.d.) Mealworms. Retrieved from: http://www.westknollfarm.com/Meal-Worms.html
- Merchant, M. (2015) Texas A&M NEPRIS webinar

WEBSITES:

- APA Citation: http://writing.wisc.edu/Handbook/American_Psychological_Association_%28APA%29_Documentation_M.pdf
- APA Video CitationPoster Creation Using Microsoft Power Point: https://www.youtube.com/watch?v=1c9Kd_mUFDM
- Poster Creation Using Microsoft Power Point. https://www.youtube.com/watch?v=1c9Kd_mUFDM

Example: Scientific Poster



Mealworm Caring Doctors
A.Islas, I.McCann, E.Pimentel, K.Simpson

Abstract

The experiment was to see how fast the mealworms would change from a larvae to a pupa. Three treatments were used to see which treatment happened faster. The treatments were a hot climate, cold climate and room temperature climate. The metamorphosis of the mealworms was observed for 15 days.

Introduction

Chickens need mealworms to get protein and lay more eggs. Farmers need mealworms to feed their chickens so they lay more eggs and the farmers get more money by selling them. Our group thinks that the mealworms will go through metamorphosis faster in warmer temperature because they are cold blooded and they move a lot in the warmer temperatures. First a mealworm starts as an egg. Then it turns to a mealworm. After that the mealworm turns into a pupa. At last it turns into a beetle.
Three different climates will be observed to see how fast a mealworm will metamorphosize in each climate. The climates are a hot treatment, cold treatment and warm treatment. The hypothesis is that mealworms will change faster in warmer temperature.

Materials and Methods

The experiment used four mealworms in three different petri dishes. Each petri dish had one ounce of oats for the mealworms to eat and they also had a potato slice that helped with moisture. The beetles also lay their eggs on the potatoes. Thermometers were used to see what temperature the mealworms were in. One petri dish was put in a tissue box and put on the hot plate. This was the hot climate. Another petri dish was in our classroom and this was the room climate. The third petri dish was placed in the refrigerator and this was the cold climate. Observations were made every 2-3 days for 15 days. Mealworms were watched to see if they went through metamorphosis. The observations were written down on the observation chart and made into a graph.

Results

TEKS

ELAR: 3.4, 3.15, 3.16, 3.17, 3.17 A,B,C,D, 3.23, 3.23B, 3.23C, 3.23D, 3.25, 3.25A, 3.25B, 3.26, 3.26A, 3.28, 3.29, 3.30, 3.31
SCIENCE – 3.1A, 3.2B, 3.2C, 3.2D, 3.2E, 3.2F, 3.3A, 3.4A, 3.4B, 3.10C
MATH – 3.1A, 3.1B, 3.1E, 3.8A

Conclusion

We observed our mealworms every other day. We checked the potato to make sure they had moisture. We changed the potato because it was bad so the mealworms would not get sick. They got bigger and bigger. On day three we had no pupas. On day seven we had no pupas. On day nine we had two pupas in the room temperature treatment. No pupas in the other treatment. On day 11 we had three pupas in the control treatment and no pupas in the other two treatments. On day15 we had two pupas in the hot treatment and four pupas in the room temperature and no pupas in the cold treatment. If you want to grow mealworms you have to put them in a warm temperature. You have to clean inside so it would not get them sick. The mealworms need moisture so they can turn to a pupa.

References

Dierenfeld, E., Kutcher, S., & VanDyk, J. (n.d.) Answers to Kids' Questions About Mealworms and Beetles. Retrieved from: http://www.scholastic.com/teachers/article/answers-kids-questions-about- mealworms-and-beetles

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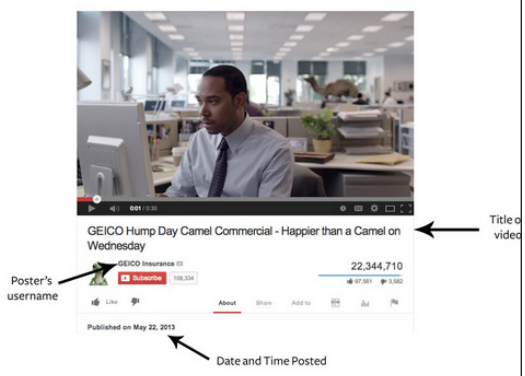
Merchant, M. (2015) Texas A&M NEPRIS webinar

Acknowledgments

We would like to thank the following sponsors for helping us further our success with our science project. Our sponsors were Roscoe Collegiate ISD Board of Trustees, Texas Agrilife Extension, Region 14 Education Service Center, Roxanna Reyna-Islas, and the Roscoe Collegiate Elementary teachers and staff. We could not have done this without your support.

Example: APA Video Citiation

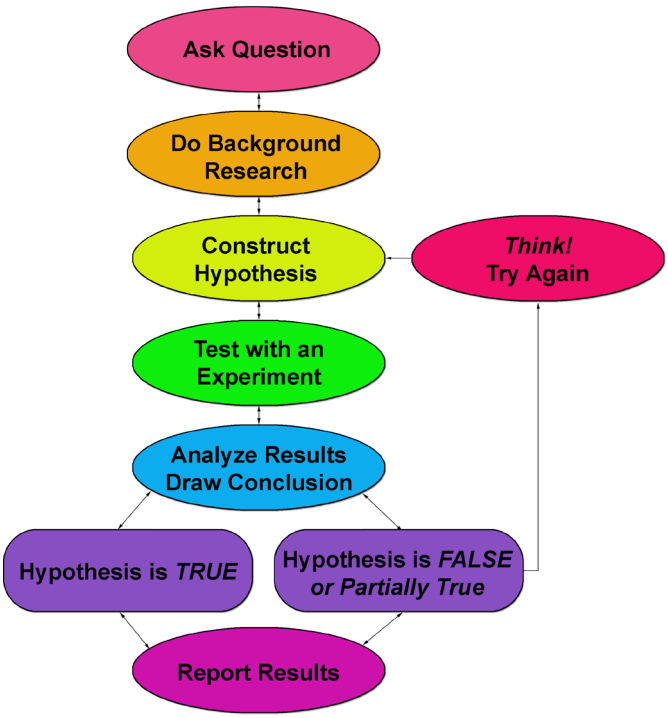
Last Name, F.M. [Username]. (Year, Month Date). *Title of video*. [Video File]. Retrieved from URL.



Example:

[GEICO Insurance]. (2013, May 22). *GEICO Hump Day Camel Commercial – Happier than a Camel on Wednesday*. [Video File]. Retrieved from http://youtu.be/kWBhP0EQ11A.

Example: The Scientific Method



Photosynthesis

TIME:
60-90 minutes for initial experience with follow-up observations of 30 minutes

MATERIALS NEEDED:
- 1 cardboard carton or box
- Black construction paper
- 8 plastic pots (all similar in size and color)
- 8 plant seeds (any seed that germinates quickly)
- Soil mix (enough to fill up the 8 plastic pots)
- Ruler
- Watering container

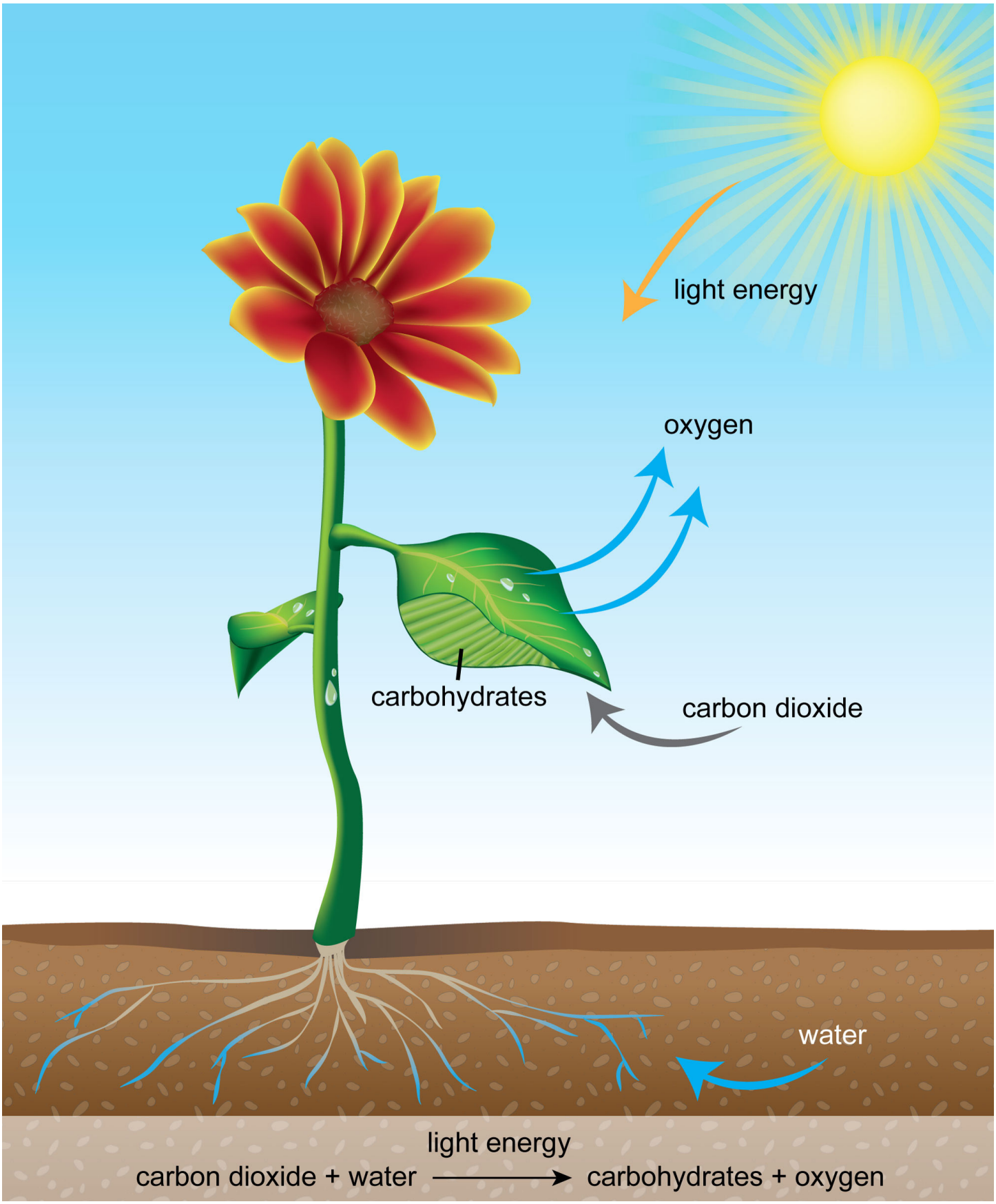
OBJECTIVES:
The participants will:
- Learn the Steps of the Scientific Method
- Learn about photosynthesis
- Practice the 15 SET Abilities (build, categorize, collaborate, demonstrate, describe, contrast, solve, design, evaluate, hypothesize, invent, infer, interpret, measure and learn basics of graphical representation)

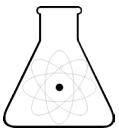
EXPLORE THE CONTENT:
Vocabulary:
- Photosynthesis - a process used by plants and other organisms to convert light energy, normally from the Sun, into chemical energy that can be later released to fuel the organisms' activities (energy transformation).
- Roots - the part of a plant that attaches it to the ground or to a support, typically underground, conveying water and nourishment to the rest of the plant via numerous branches and fibers.
- Stem - the main body or stalk of a plant or shrub, typically rising above ground but occasionally subterranean.
- Leaves - a flattened structure of a higher plant, typically green and bladelike, that is attached to a stem directly or via a stalk. Leaves are the main organs of photosynthesis and transpiration.
- Seeds a flowering plant's unit of reproduction, capable of developing into another such plant.
- Flower - also known as a bloom or blossom, is the reproductive structure found in plants that are floral.
- Fruit - the seed-bearing structure in flowering plants formed from the ovary after flowering.

Main Question: Do plants grow better under light or in the dark?
- Independent variable: Light and Dark
- Dependent variable: Plant's height in centimeters
- Possible Hypothesis: The plants under the light will grow higher than the plants in the dark.
- The plants in the dark will grow less than the plants under the light.

DO:

Activity 1: Learn the steps for photosynthesis to happened





Activity 2: Conduct Your Own Research Project

Set up your area

1. Find a carton cardboard box that will fit 4 of the plastic pots and cover it with black construction paper so the light doesn't penetrate inside the box. Plan to maintain a temperature around 230C - 25oC.
2. Find an open area where you can place the other 4 pots. Plan to keep the second container at room temperature (21-24oC)
3. Properly label each plastic pot (treatment - 4 light and 4 dark and plant number 1-8).
4. Begin Your Experiment
5. Fill each pot with soil and place one seed per container one and a half inches deep.
6. Wet soil and water all plants every other day or as needed.
7. After germination place 4 of the plants marked as dark under the black carton box and let the other 4 remain in the natural light of the room
8. Observe during the 4 to 8 weeks and collect data using a data log sheet.
9. Note: Be sure to control the temperature inside and outside the box so it is consistent (use a thermometer to monitor temperature).

Day	Plant Number	Treatment (Light or Dark)	Plant height	Observations

REFLECT:

- Did you notice any differences between the plants that were under the box and the ones outside the black box?
- Which plants grew higher? The ones under the box or the ones outside the box?
- Were all plants the same color?

APPLY:

Report your results in a scientific manner – see handout at end for a graphic representation

Scientific Posters are commonly used to share your scientific project including the results. Typically, a Scientific Poster will have the following parts:

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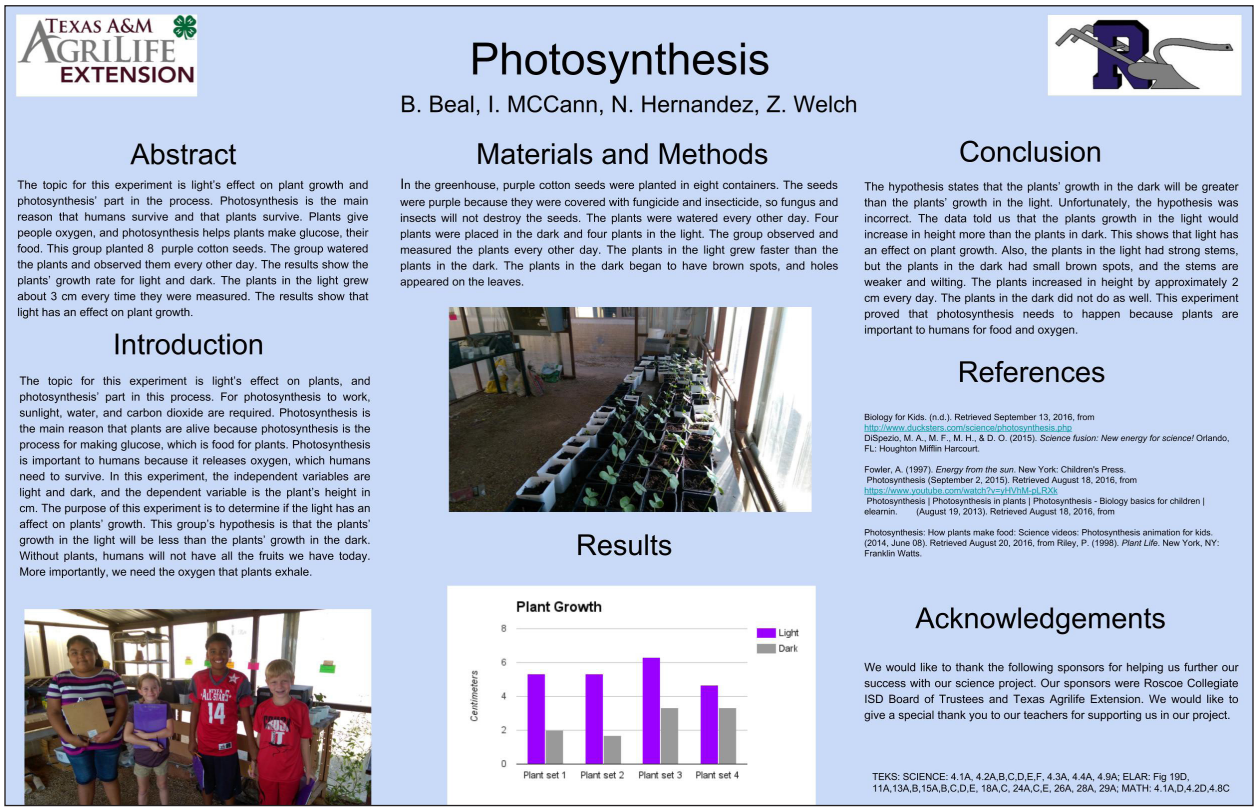

Photosynthesis

B. Beal, I. MCCann, N. Hernandez, Z. Welch

Abstract

The topic for this experiment is light's effect on plant growth and photosynthesis' part in the process. Photosynthesis is the main reason that humans survive and that plants survive. Plants give people oxygen, and photosynthesis helps plants make glucose, their food. This group planted 8 purple cotton seeds. The group watered the plants and observed them every other day. The results show the plants' growth rate for light and dark. The plants in the light grew about 3 cm every time they were measured. The results show that light has an effect on plant growth.

Introduction

The topic for this experiment is light's effect on plants, and photosynthesis' part in this process. For photosynthesis to work, sunlight, water, and carbon dioxide are required. Photosynthesis is the main reason that plants are alive because photosynthesis is the process for making glucose, which is food for plants. Photosynthesis is important to humans because it releases oxygen, which humans need to survive. In this experiment, the independent variables are light and dark, and the dependent variable is the plant's height in cm. The purpose of this experiment is to determine if the light has an affect on plants' growth. This group's hypothesis is that the plants' growth in the light will be less than the plants' growth in the dark. Without plants, humans will not have all the fruits we have today. More importantly, we need the oxygen that plants exhale.

Materials and Methods

In the greenhouse, purple cotton seeds were planted in eight containers. The seeds were purple because they were covered with fungicide and insecticide, so fungus and insects will not destroy the seeds. The plants were watered every other day. Four plants were placed in the dark and four plants in the light. The group observed and measured the plants every other day. The plants in the light grew faster than the plants in the dark. The plants in the dark began to have brown spots, and holes appeared on the leaves.

Results

Plant Growth

Centimeters

Light

Dark

Plant set 1 Plant set 2 Plant set 3 Plant set 4

Conclusion

The hypothesis states that the plants' growth in the dark will be greater than the plants' growth in the light. Unfortunately, the hypothesis was incorrect. The data told us that the plants growth in the light would increase in height more than the plants in dark. This shows that light has an effect on plant growth. Also, the plants in the light had strong stems, but the plants in the dark had small brown spots, and the stems are weaker and wilting. The plants increased in height by approximately 2 cm every day. The plants in the dark did not do as well. This experiment proved that photosynthesis needs to happen because plants are important to humans for food and oxygen.

References

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Acknowledgements

We would like to thank the following sponsors for helping us further our success with our science project. Our sponsors were Roscoe Collegiate ISD Board of Trustees and Texas Agrilife Extension. We would like to give a special thank you to our teachers for supporting us in our project.

TEKS: SCIENCE: 4.1A, 4.2A,B,C,D,E,F, 4.3A, 4.4A, 4.9A; ELAR: Fig 19D, 11A,13A,B,15A,B,C,D,E, 18A,C, 24A,C,E, 26A, 28A, 29A; MATH: 4.1A,D,4.2D,4.8C

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- Roth, K. J., & Anderson, C. W. (1987). The power plant: Teacher's guide to photosynthesis. East Lansing, MI: Institute for Research on Teaching, Michigan State University.

Soil Erosion

TIME:
60 – 90 minutes

MATERIALS NEEDED:
Activity 1
- Giant chocolate chip cookies - 3
- Dropper - 1
- Ice cubes - several
- Tooth picks - several
- Plastic plates – 3

Activity 2
- Three-aluminum foil loaf pans or trays
- Potting soil – to fill pans about 1/3 full
- Wheat seed – to cover the tray or pan when grown
- Straw – Ratio 1:1 (1 part straw or grass to 1 part soil)
- 3 Plastic bags
- Carton or cardboard box approximately the same size or larger than the loaf pans or trays
- Net made of fabric to be used for collecting soil
- Coffee filters – several
- Scale
- Hair dryer

OBJECTIVES:
Participants will:
- Learn the Steps of the Scientific Method
- Learn about Types and Causes of Soil Erosion
- Practice the 15 SET Abilities (build, categorize, collaborate, demonstrate, describe, contrast, solve, design, evaluate, hypothesize, invent, infer, interpret, measure and learn basics of graphical representation)

EXPLORE THE CONTENT:

Vocabulary:
- Erosion: the action of surface processes (such as water flow or wind) that remove soil, rock, or dissolved material from one location on the Earth's crust, then transport it away to another location.
- Abrasion: the process of scraping or wearing away.
- Water flow: Movement of water.
- Earth's crust: Outermost solid shell of a rocky planet or natural satellite which is chemically distinct form the underlying mantle.
- Sediment: matter that settles to the bottom of a liquid.

Main Question: Which agricultural practice prevents soil erosion from wind and/or water in the South Plains Texas area
1. Independent variable: Soil type (Soil with wheat seed, soil with dry grass or straw and soil with nothing added)
2. Dependent variable: Amount of soil that flows erodes from the effect of water and/or wind.
3. Possible Hypothesis:
- The soil with nothing added erodes more from the effects of water than soil with wheat and dry grass.
- The soil with nothing added displaces more from the effects of wind than soil with wheat or dry grass.

DO:

Activity 1: Soil Inspiration

In order to be inspired the importance of soil, watch video.
https://www.youtube.com/watch?v=rfwcLaqT7Kc

Activity 2: Rock erosion (cookie erosion)

1. Place three giant chocolate chip cookies (representing rocks) on three plates (label cookie #1 water, cookie #2 ice and cookie #3 wind)
2. Add water to cookie #1 with a dropper, always adding the drops on the same exact place. Repeat that 5 times
3. Place an ice cube (representing glacial ice) on top of cookie #2. Let the ice cube melt.
4. Using a toothpick (representing erosion by abrasion) break cookie #3 and
5. Observe and classify the type of erosion and the characteristics

Day	Erosion Type	Observations

Activity 3: Soil Erosion by Water and Wind

Conduct your own Research Project

1. Cut one narrow side of each of the 3 aluminum foil loaf pans or aluminum trays.
2. Label the three foil pans or trays (#1 soil, #2 soil with dry grass, and #3 soil with wheat).
3. Add only potting soil to tray #1, add dry grass mixed potting soil to tray #2, and add wheat seeds to tray #3.
4. Place the three trays in an environment where wheat can grow (temperature 23oC-25oC).
5. Water the soil once a day for two weeks (water the three trays to maintain the same level of moisture).
6. Start the experiment when the wheat is approximately 2cm to 3cm high (measuring it form bottom to top).
7. Place the three containers in a place where soil can be collected after exposing it to water and/or wind (a green house, barn etc.).
8. If the purpose is to observe wind erosion: Build a carton box that can be placed on top of the tray.
9. Build a net made of fabric that can collect the soil that is blown away by the wind.
10. Use a blow dryer to create the wind (always on the same settings).
11. Use goggles to cover your eyes and start your experiment.
12. During the experiment do not water the soil.
13. Blow-dry the three containers one at the time. Before you begin - place a box on top of the tray, and the net on the other side of the box to collect the soil removed from the tray by the blowing air.
14. Place the soil collected in plastic bags labeled with the tray information (soil, soil with dry grass or soil with wheat).
15. Using a scale, weigh the soil collected and record the amount on a table.
16. Repeat the process 5 times (preferable in a period of 5 days), always recording the amount of soil collected in grams.
17. If the purpose is to observe water erosion: have a container ready to collect the water and soil overflowing the tray (a plastic container with a coffee filter on top works well to collect the soil).
18. Make a water sprinkler bottle by using a plastic bottle with holes on the bottom.
19. Water the trays with the sprinkler bottle (always using the same amount of water on each tray). Collect the water mixed with soil that runs out the trays using a container with a filter on top.
20. Using a scale, weigh the soil collected by the coffee filter (it might be necessary to wait a day or two for the soil to dry).
21. Repeat the experiment for 5 days once a day.
22. Collect the weights of the different soil types in grams using a table (see example).

Example:

Day	Soil Type	Amount Soil Collected	Observations

REFLECT:

- Did you notice any differences between the different soil types?
- Which treatment was more eroded?
- What common agricultural practices prevent erosion by water and wind?

APPLY:

Report your results in a scientific manner – see handout at end for a graphic representation
Scientific Posters are commonly used to share your scientific project including the results. Typically, a Scientific Posters will have the following parts:

- **Abstract:** The summary of the experiment which includes the purpose of the experiment, and no more than three sentences explaining the procedure, results, and conclusion.
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- **Conclusions:** The first sentence states the hypothesis or research question and the second should answer the research question with additional sentences explaining the results and procedures that influenced the results.
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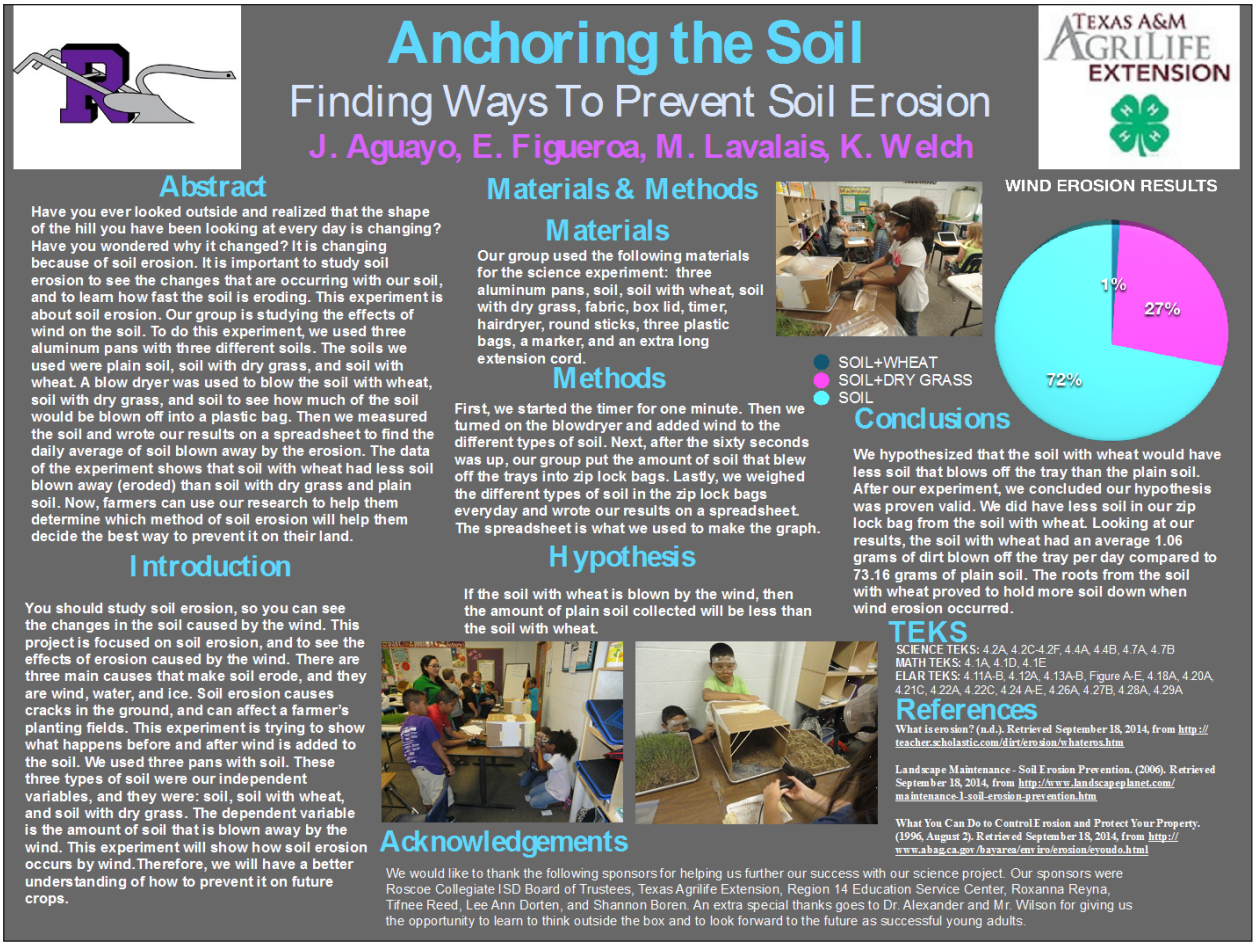
Example



Anchoring the Soil

Finding Ways To Prevent Soil Erosion

J. Aguayo, E. Figueroa, M. Lavalais, K. Welch

TEXAS A&M AGRILIFE EXTENSION

Abstract

Have you ever looked outside and realized that the shape of the hill you have been looking at every day is changing? Have you wondered why it changed? It is changing because of soil erosion. It is important to study soil erosion to see the changes that are occurring with our soil, and to learn how fast the soil is eroding. This experiment is about soil erosion. Our group is studying the effects of wind on the soil. To do this experiment, we used three aluminum pans with three different soils. The soils we used were plain soil, soil with dry grass, and soil with wheat. A blow dryer was used to blow the soil with wheat, soil with dry grass, and soil to see how much of the soil would be blown off into a plastic bag. Then we measured the soil and wrote our results on a spreadsheet to find the daily average of soil blown away by the erosion. The data of the experiment shows that soil with wheat had less soil blown away (eroded) than soil with dry grass and plain soil. Now, farmers can use our research to help them determine which method of soil erosion will help them decide the best way to prevent it on their land.

Introduction

You should study soil erosion, so you can see the changes in the soil caused by the wind. This project is focused on soil erosion, and to see the effects of erosion caused by the wind. There are three main causes that make soil erode, and they are wind, water, and ice. Soil erosion causes cracks in the ground, and can affect a farmer's planting fields. This experiment is trying to show what happens before and after wind is added to the soil. We used three pans with soil. These three types of soil were our independent variables, and they were: soil, soil with wheat, and soil with dry grass. The dependent variable is the amount of soil that is blown away by the wind. This experiment will show how soil erosion occurs by wind. Therefore, we will have a better understanding of how to prevent it on future crops.

Materials & Methods

Materials

Our group used the following materials for the science experiment: three aluminum pans, soil, soil with wheat, soil with dry grass, fabric, box lid, timer, hairdryer, round sticks, three plastic bags, a marker, and an extra long extension cord.

Methods

First, we started the timer for one minute. Then we turned on the blowdryer and added wind to the different types of soil. Next, after the sixty seconds was up, our group put the amount of soil that blew off the trays into zip lock bags. Lastly, we weighed the different types of soil in the zip lock bags everyday and wrote our results on a spreadsheet. The spreadsheet is what we used to make the graph.

Hypothesis

If the soil with wheat is blown by the wind, then the amount of plain soil collected will be less than the soil with wheat.

WIND EROSION RESULTS

Conclusions

We hypothesized that the soil with wheat would have less soil that blows off the tray than the plain soil. After our experiment, we concluded our hypothesis was proven valid. We did have less soil in our zip lock bag from the soil with wheat. Looking at our results, the soil with wheat had an average 1.06 grams of dirt blown off the tray per day compared to 73.16 grams of plain soil. The roots from the soil with wheat proved to hold more soil down when wind erosion occurred.

TEKS

SCIENCE TEKS: 4.2A, 4.2C-4.2F, 4.4A, 4.4B, 4.7A, 4.7B
MATH TEKS: 4.1A, 4.1D, 4.1E
ELAR TEKS: 4.11A-B, 4.12A, 4.13A-B, Figure A-E, 4.18A, 4.20A, 4.21C, 4.22A, 4.22C, 4.24 A-E, 4.26A, 4.27B, 4.28A, 4.29A

References

What is erosion? (n.d.). Retrieved September 18, 2014, from http://teacher.scholastic.com/dirt/erosion/whateros.htm

Landscape Maintenance - Soil Erosion Prevention. (2006). Retrieved September 18, 2014, from http://www.landscapeplanet.com/maintenance-1-soil-erosion-prevention.htm

What You Can Do to Control Erosion and Protect Your Property. (1996, August 2). Retrieved September 18, 2014, from http://www.abag.ca.gov/bayarea/enviro/erosion/eyoudo.html

Acknowledgements

We would like to thank the following sponsors for helping us further our success with our science project. Our sponsors were Roscoe Collegiate ISD Board of Trustees, Texas Agrilife Extension, Region 14 Education Service Center, Roxanna Reyna, Tifnee Reed, Lee Ann Dorten, and Shannon Boren. An extra special thanks goes to Dr. Alexander and Mr. Wilson for giving us the opportunity to learn to think outside the box and to look forward to the future as successful young adults.

Informative Video:

- https://www.youtube.com/watch?v=rfwcLaqT7Kc

Websites to visit:

- http://www.worldwildlife.org/threats/soil-erosion-and-degradation
- http://www.omafra.gov.on.ca/english/engineer/facts/12-053.htm
- http://wildlife.tamu.edu/know-your-soils/

Videos to watch:

- https://www.youtube.com/watch?v=ETRK0tUKMjA
- https://www.youtube.com/watch?v=p7HC2ZxF7aw
- https://www.youtube.com/watch?v=6tSnA9I6uL4
- https://www.youtube.com/watch?v=PQmon7Rj6ns

Soil Texture

TIME:

60 minutes for original experience followed by 30 minute observation and recording sessions

MATERIALS NEEDED:

- Sand – 20lb bag
- Potting Soil – 20lb bag
- Gravel- 20lb bag
- 4 Clear plastic containers (plastic liter bottles from soda/soft drinks)
- Marker
- Large glass jar
- Cotton balls – 4 or more

OBJECTIVES:

The participant will:

- Learn the Steps of the Scientific Method
- Learn about Soil Particles and Texture
- Practice the 15 SET Abilities (build, categorize, collaborate, demonstrate, describe, contrast, solve, design, evaluate, hypothesize, invent, infer, interpret, measure and learn basics of graphical representation)

EXPLORE THE CONTENT:

Vocabulary:

- Loam: Soil with roughly equal proportions of sand, silt and clay
- Silt: earthy matter, fine sand, or the like carried by moving or running water and deposited as a sediment
- Clay: A stiff, sticky fine-grained earth, typically yellow, red, or bluish-gray in color and often forming an impermeable layer in the soil. It can be molded when wet, and is dried and baked to make bricks, pottery, and ceramics.
- Sand: a loose granular substance, typically pale yellowish brown, resulting from the erosion of siliceous and other rocks and forming a major constituent of beaches, riverbeds, the seabed, and deserts.
- Soil permeability: Is the property of the soil to transmit water and air
- Soil Nutrients The three main nutrients are nitrogen (N), phosphorus (P) and potassium (K). Together they make up the trio known as NPK. Other important nutrients are calcium, magnesium and sulfur
- Soil content: Most soils contain a mixture of minerals, organic matter, gases, liquids, and countless organisms.

Main Question: Which soil type is more permeable?

1. Independent variable: Soil type (Sand, Potting soil, gravel and combination)
2. Dependent variable: Water recovered after going through the 4 different types of soils.
3. Possible Hypothesis:

- The soil comprised of sand will be less permeable than the other types of soils
- The soil with only gravel will be the most permeable of all soil types

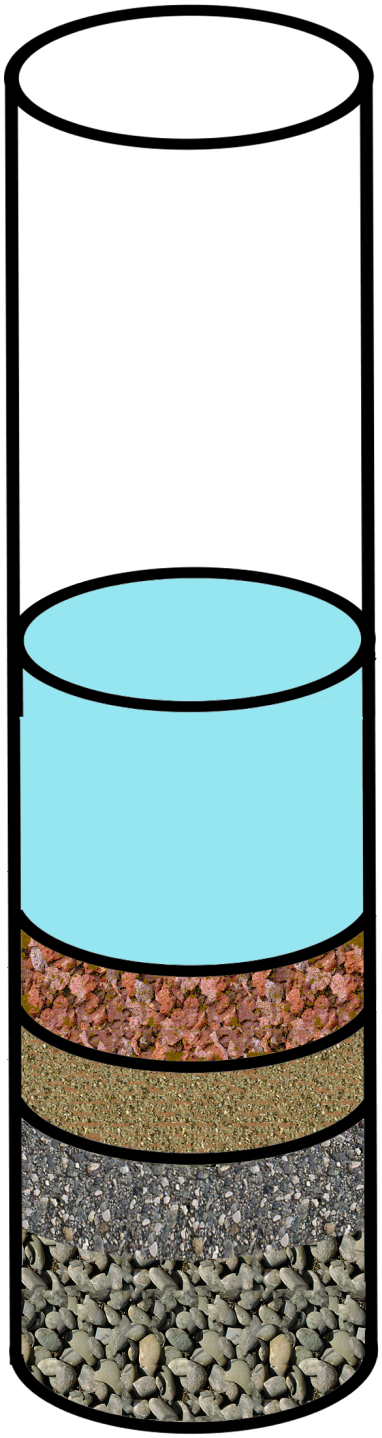
DO:

Activity 1: Important of Soil

In order to understand the importance of soil, watch video.
https://www.youtube.com/watch?v=rfwcLaqT7Kc

Activity 2: Soil Layers

1. Using a glass container add fill it half full of soil (from your school play ground or home back yard)
2. Add water to cover the soil until the container is almost filled
3. Cover the container and shake it
4. Let it set for 3 hrs.
5. Observe and classify the soil layers (clay, silt and sand) as shown in the picture



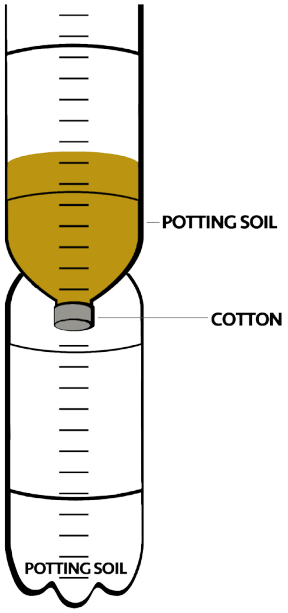
CLAY LAYER - WATER CLEARS

SILT LAYER - 2 HOURS

SAND LAYERS - 1 MINUTE

Activity 3: Conduct your own Research Project - Soil Permeability

1. Cut 4 plastic bottles in half
2. Label the 4 tops of the plastic bottles accordingly; sand, potting soil, gravel, and combination.
3. Label the 4 bottoms of the plastic bottles with the same labels (sand, potting soil, gravel, and combination).
4. Using a ruler, mark each bottle with a marker, every centimeter from bottom to top.
5. Place one cotton ball in the top at the bottle's neck.
6. Add sand (halfway) up the bottle top labeled "sand".
7. Add potting soil (halfway) up the bottle top labeled "potting soil".
8. Add gravel (halfway) up the bottle-top labeled "gravel"
9. Add a combination of the three types of soils (halfway) up the bottle top labeled "combination"
   Example:



10. Place the 4 bottle tops in the bottoms and add water almost to the top.
11. Let the water set for 2 hours and dispose of excess water (do not measure).
12. Every day for a minimum of 3 days add the exact same amount of water to the four containers and measure the amount of water collected.
13. Record your data

Day	Soil Type	Amount water Added	Amount water Collected	Observations

REFLECT:

- Did you notice any differences between the different types of soil?
- Which type of soil retained more water? Which water was clearer?
- Why is soil permeability and nutrient holding important for agriculture?

APPLY:

Report your results in a scientific manner. See revisions to Life Cycles
Report your results in a scientific manner – see handout at end for a graphic representation
Scientific Posters are commonly used to share your scientific project including the results. Typically, a Scientific Posters will have the following parts:

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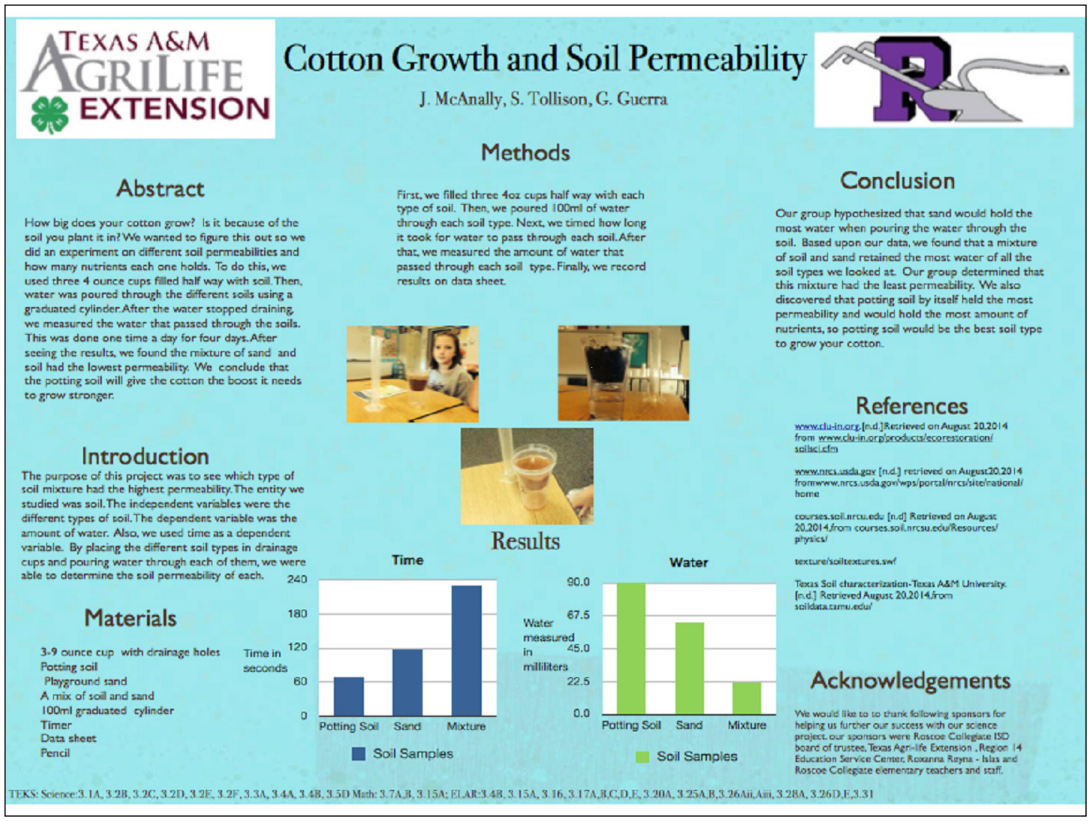
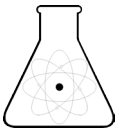
Example:





Informative Video:

- https://www.youtube.com/watch?v=rfwcLaqT7Kc

Websites to visit:

- http://www.clu-in.org/products/ecorestoration/soilsci.cfm
- http://courses.soil.ncsu.edu/resources/physics/texture/soiltexture.swf
- http://www.nrcs.usda.gov/wps/portal/nrcs/site/national/home/
- http://soildata.tamu.edu/

Videos to watch:

- https://www.youtube.com/watch?v=ba_lamdgC4g
- https://www.youtube.com/watch?v=knrmCbctGEA

Textile Science

TIME:
60 – 90 minutes

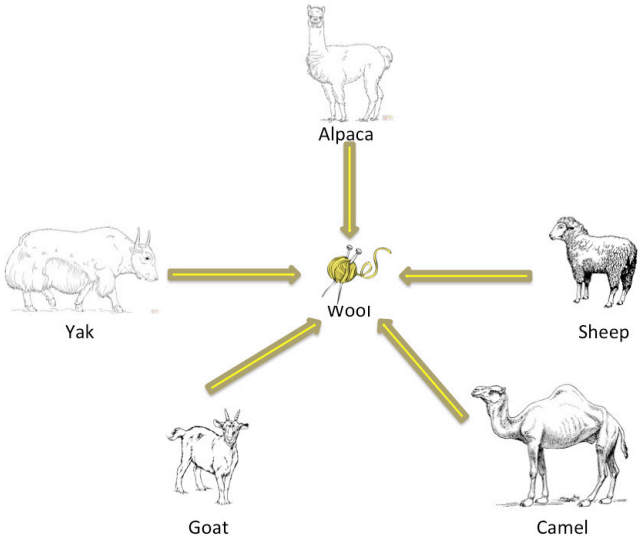
MATERIALS NEEDED:
- Hot plate/Stirring plate
- Stirring magnet
- 8 Beakers
- Forceps
- Water
- Vinegar
- All purpose fabric dye
- Matches
- Small candle
- Aluminum foil plates
- Cotton and polyester fabric samples – 6-6 inch squares of each fabric
- 2 Small plastic bags
- Napkins or paper towels

OBJECTIVES:
Participants will:
- Learn the Steps of the Scientific Method
- Learn about different types of fabrics and dyes
- Practice the 15 SET Abilities (build, categorize, collaborate, demonstrate, describe, contrast, solve, design, evaluate, hypothesize, invent, infer, interpret, measure and learn basics of graphical representation)

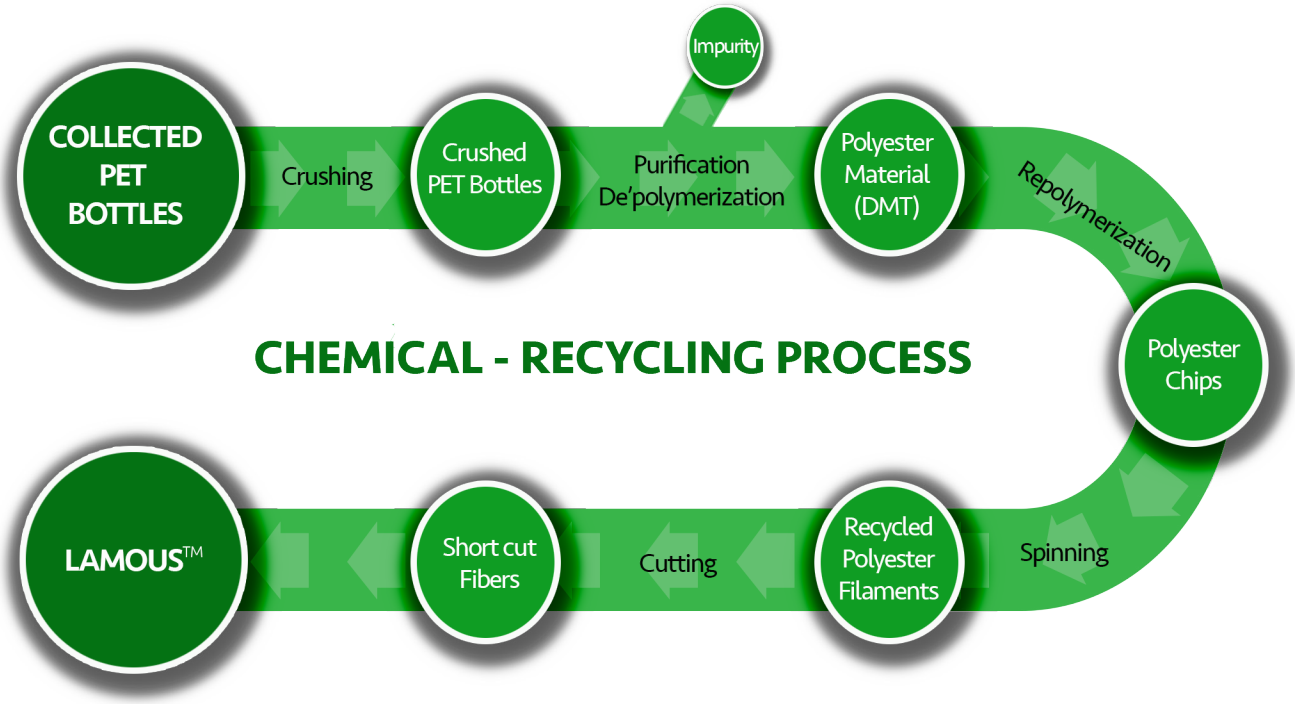
EXPLORE THE CONTENT:
Vocabulary:
- Natural fiber: obtained from plant, animal, and mineral sources. Those from plant sources include cotton, flax, hemp, sisal, jute, kenaf, and coconut. Animal sources of fiber include alpaca, sheep, camel, goat and yaks.
- Synthetic fiber: textiles made from man-made rather than natural fibers. Examples of synthetic fabrics include polyester, ozone, acrylic, nylon, rayon, acetate, spandex, latex, orlon and kevlar.
- Dye: a colored substance that has an affinity to the substrate to which it is being applied.
- Direct dyes: also called Substantive Dye, any of a class of colored, water-soluble compounds that have an affinity for fiber and are taken up directly, such as the benzidine derivatives. Direct dyes are usually cheap and easily applied, and they can yield bright colors.

Main Question: Which type of fiber is harder to dye?
1. Independent variable: Natural fiber and synthetic fiber
2. Dependent variable: Color intensity on fiber
3. Possible Hypothesis:
- The natural fiber color intensity, after exposed to the dye, it will be higher than the synthetic fiber regardless of the chemical solution mixed with the water and dye.

DO:
Activity 1: Fiber Sources
Learn the different sources of natural fibers that come from animals.



Activity 2: Learn the process to create Polyester

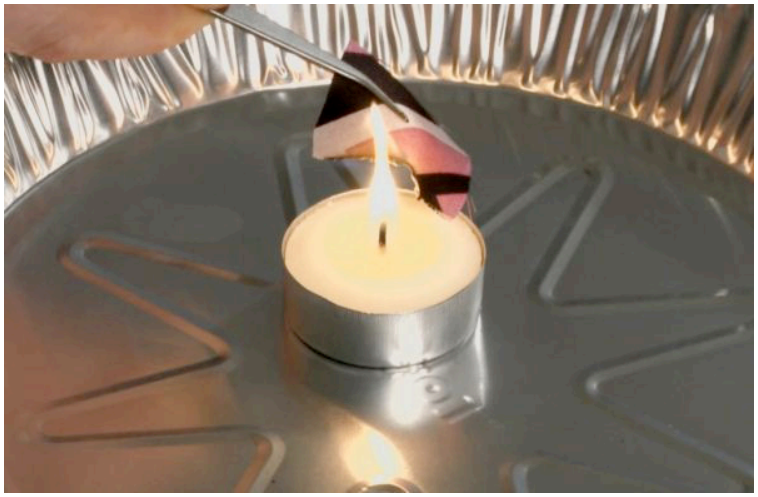


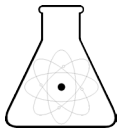
Activity 3: Smoke and ashes give clues to assist with identification and make decisions regarding usage

1. Using forceps, hold one polyester fabric square.
2. Slowly and gradually position the polyester fabric square closer to the fire until touching.
3. Repeat the same operation using one cotton fabric square.
4. Reflect on and record the following for each sample:

- Smell
- Time it took to burn
- Ashes
- Smoke

5. Apply what you have learned
   a. How would you use what you have discovered in deciding what fiber to use for different purposes such as sleepwear or household items?





Activity 4: Conduct your own experiment - Dyeing two different types of fabric

1. Cut several pieces of cotton fabric and several polyester fabrics (make sure to separate the two types in two plastic bags).
2. Label two beakers: #1 Cotton and #2 Polyester
3. Place one stirring magnet in each beaker (use two beakers at the same time).
4. Add the same amount of water to each beaker.
5. Place beakers on hotplates adjusting temperature and using the stirring magnet to create similar properties of each?
6. Add the same amount of dye to each beaker.
7. Let the dye dissolve in water at a high temperature (almost to a boil).
8. Using forceps, place one piece of fabric in each beaker (one polyester piece in beaker labeled polyester and one cotton piece in beaker labeled cotton).
9. If fabric floats, use forceps to push the fabric down so it is thoroughly soaked by the dye.
10. Let it set in the beaker for 5 minutes, then take the pieces out of the beakers and place them on a thick napkin or paper towel to dry.
11. Compare colors.
12. Using new pieces of fabric repeat the experiment again, but now changing the time that the fabric stays in the dye. Let the two types of fabric soak in the dye for 10 minutes.
13. Compare colors, dispose (how?) of the dye used and prepare a new one. (This time add two tablespoons of salt to the water before adding the dye), let it dissolve completely.
14. Repeat the process (add one piece of cotton and polyester to the two previously labeled beakers).
15. Compare results.
16. Dispose directly on the drain and prepare a new batch. (This time add two tablespoons of vinegar to the water before adding the dye), let it dissolve completely.
17. Repeat the process (add one piece of cotton and one of polyester to the two previously labeled beakers).
18. Compare results (Did the addition of vinegar to the mixture change the results?)

Type of fabric	Additional Solution	Color	Observations

REFLECT:

- Which fabric got darker in the first trial?
- Did the time exposed to the dye change the results when additional solutions were not added?
- Did the addition of salt to the mixture change the results?
- Did the addition of vinegar to the mixture, change the results?

APPLY:

Report your results in a scientific manner – see handout at end for a graphic representation
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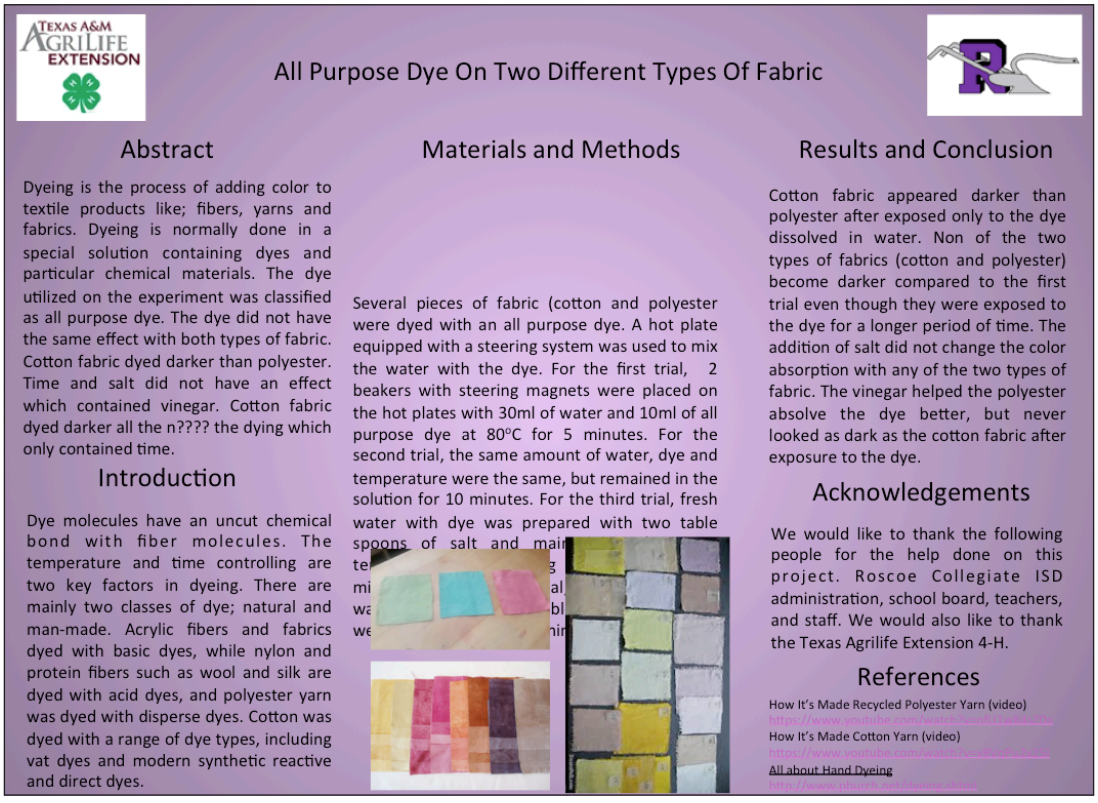
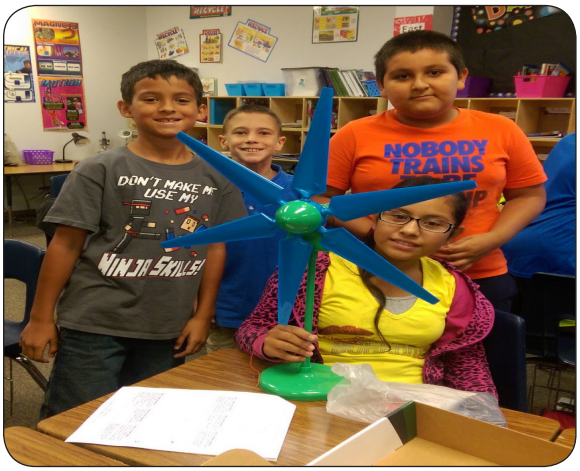
Example:



REFERENCES:

- How Recycled Polyester Yarn Is Made (video) - https://www.youtube.com/watch?v=ofU1wK4sZDs
- How it's Made Cotton Yarn (video) - https://www.youtube.com/watch?v=vBVqPu2v25I
- All about Hand Dyeing - http://www.pburch.net/dyeing.shtml

Wind Turbines



TIME:
60 minutes

MATERIALS NEEDED:
- One Pico turbine
- Fan
- Yardstick or measuring tape
- One voltmeter

OBJECTIVES:
- Learn the Scientific Method Steps
- Learn about renewable energy
- Practice the 15 SET Abilities (build, categorize, collaborate, demonstrate, describe, contrast, solve, design, evaluate, hypothesize, invent, infer, interpret, measure and learn basics of graphical representation)

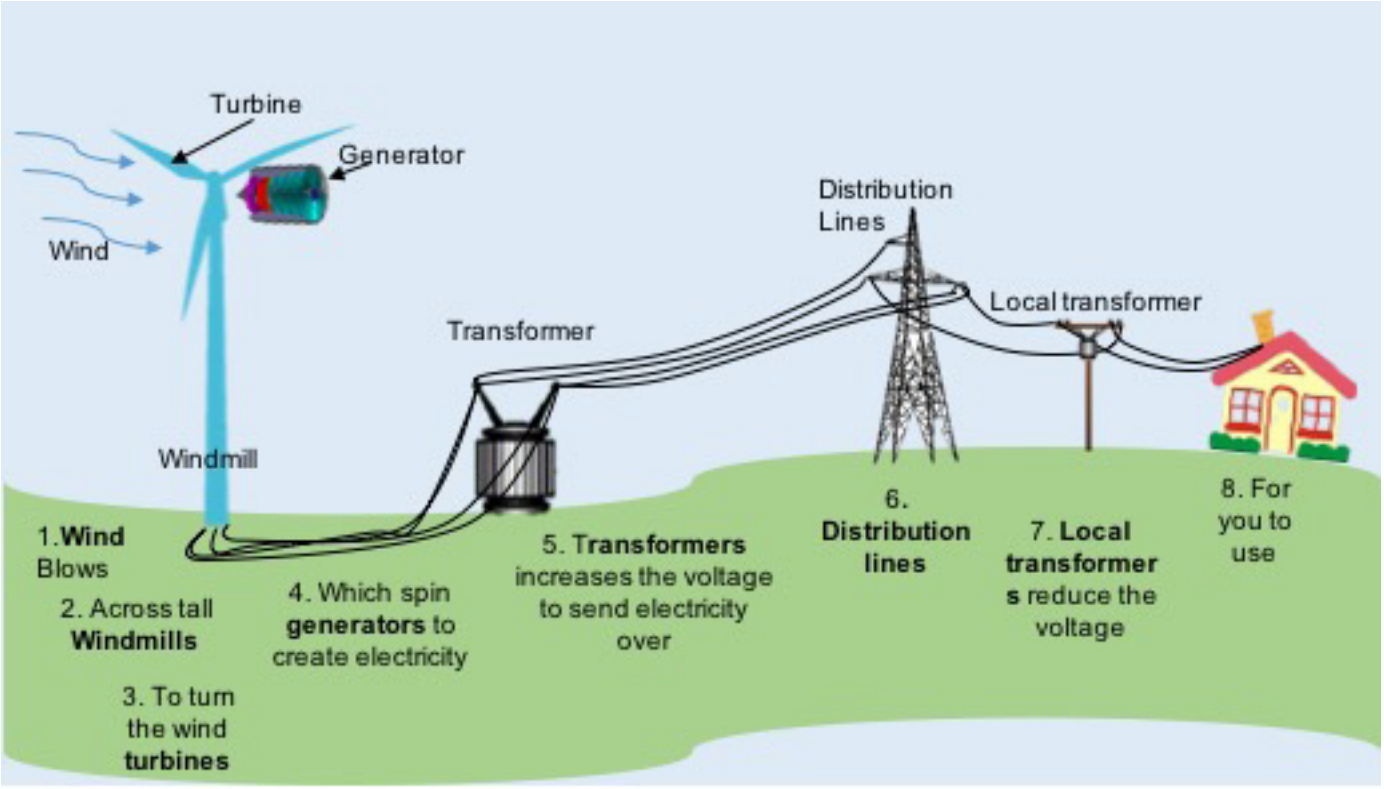
EXPLORE THE CONTENT:
The turbine is exposed to the wind generated by the fan at different distances and with changes to the blade angles.

Vocabulary:
- Renewable energy: energy that is collected from resources which are naturally replenished on a human timescale, such as sunlight, wind, rain, tides, waves, and geothermal heat.
- Wind turbine: Works by generating lift due to the shape.
- Blade: Shaped to generate the maximum power from the wind at the minimum cost.
- Angle: Power generated by the wind turbine will vary depending on the angle at which the blades are positioned and the angle that produces the maximum power output, is 45 degrees.
- Volts: electrical unit of voltage or potential difference (symbol: V). One Volt is defined as energy consumption of one joule per electric charge of one coulomb.
- Transformer: boosts the generating output of the turbine generator.
- Voltmeter: Instrument used for measuring electrical potential difference between two points in an electrical circuit.
- Main Question: Is the energy produced by a wind turbine different when the blade angles and the wind power are changed?
- Independent Variable: Fan distance (30 cm or 50 cm), blade angles (35o angle or 20o angle)
- Dependent Variable: Volts produced by the wind turbine
- Possible Hypothesis:
- Wind turbine blades at 30-degree angle will produce more volts than wind turbines with blades at 20-degree angles.

DO:

Activity 1: Wind Turbines

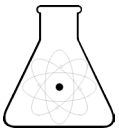
Learn how Wind Turbines generate electricity – Wind turbines use the wind to produce energy. First the wind turns the wind turbine blades on the windmill, which spin a shaft inside the turbine, which connects to a generator and transforms the power to make electricity that is distributed through the power grid.



Activity 2: Conduct your own research project

1. Place two marks on the floor identifying the specific distance you would like to test it. (20cm, 40cm or 60cm is recommended).
2. Place your wind turbine on one of the marks and the fan on the other mark making sure you know the distance between the two objects.
3. Arrange the wind turbine's blade angle to the angle you would like to test.
4. Make sure that the voltmeter is properly connected and set to measure the volts generated.
5. After the fan and the wind turbine are separated by a specific distance (20cm, 40cm or 60cm) turn on the fan (always using the same speed) and collect the data (volts generated)
6. Change the distance (20cm, 40cm or 60cm) between the wind turbine and the fan, knowing specifically the distance between the two, collect your data (volts generated).
7. After collecting the data using the different distances between the wind turbine and the fan, change the angle of the blades and repeat the experiment

Recommendations: On each trial change only one setting at a time (distance or angle), keep the external environment controlled as much as possible by always using the same speed on the fan, keep the same doors and windows closed or open, etc.



Day	Trial Number What is this?	Distance Between Wind Turbine and Fan	Angle	Volts

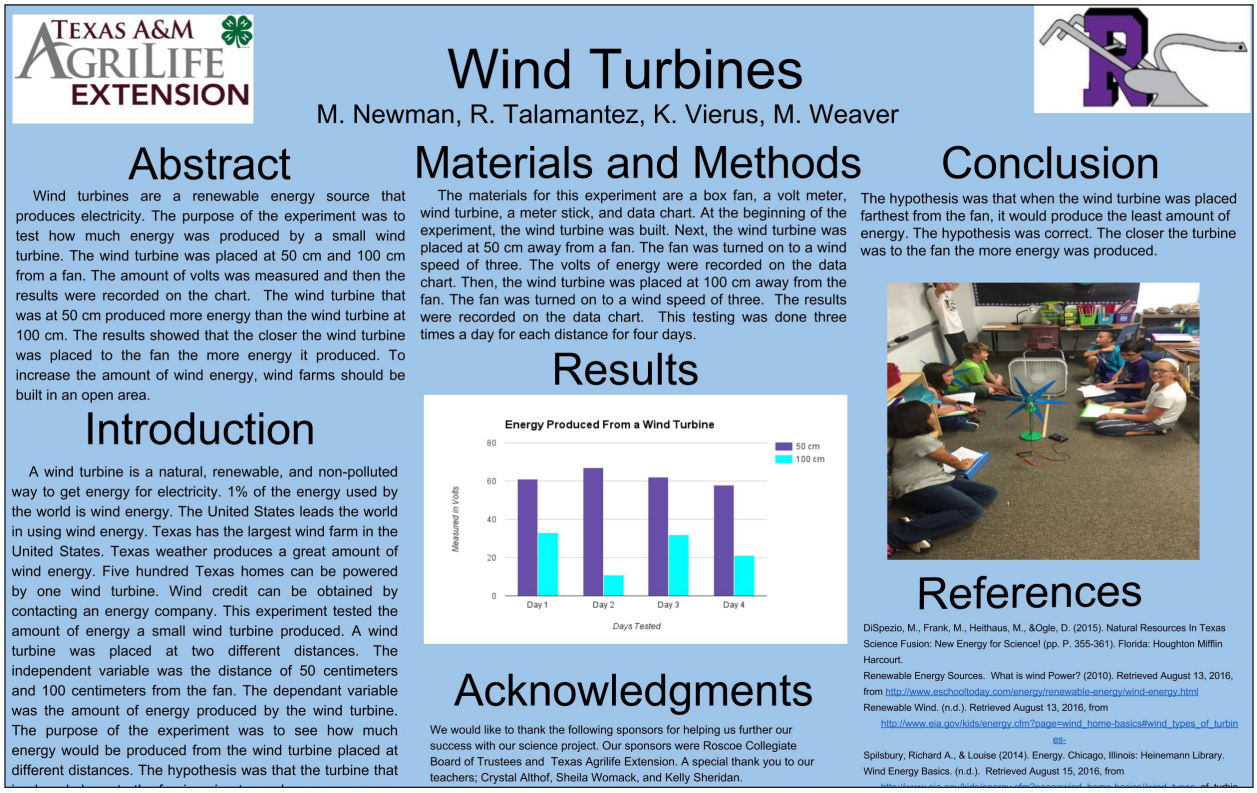
APPLY:

Report your results in a scientific manner – see handout at end for a graphic representation
Scientific Posters are commonly used to share your scientific project including the results. Typically, a Scientific Posters will have the following parts:

- **Abstract:** The summary of the experiment which includes the purpose of the experiment, and no more than three sentences explaining the procedure, results, and conclusion.
- **Introduction:** Describes the problem or goal of the experiment, it offers background information about; the entity, independent variable, dependent variable and the hypothesis.
- **Materials and Methods:** It describes the experiment's design; what materials were used, how the data was collected, how often date was collected, and how the data was analyzed. Pictures and tables can be used for this section.

- **Results:** Describes and displays data using; tables, photographs. Remember - the figures must always have a descriptive text (figures and tables must have a title number and units of measurement).
- **Conclusions:** The first sentence states the hypothesis or research question and the second should answer the research question with additional sentences explaining the results and procedures that influenced the results.
- **References:** If images from the web were used, it is important to refer the website used. The common method to cite the sources is APA style (you find instructions for APA style on the internet)
- **Acknowledgments:** A formal printed statement that recognizes individuals and institutions that contributed to the work being reported.

Example



Wind Turbines

M. Newman, R. Talamantez, K. Vierus, M. Weaver

Abstract

Wind turbines are a renewable energy source that produces electricity. The purpose of the experiment was to test how much energy was produced by a small wind turbine. The wind turbine was placed at 50 cm and 100 cm from a fan. The amount of volts was measured and then the results were recorded on the chart. The wind turbine that was at 50 cm produced more energy than the wind turbine at 100 cm. The results showed that the closer the wind turbine was placed to the fan the more energy it produced. To increase the amount of wind energy, wind farms should be built in an open area.

Introduction

A wind turbine is a natural, renewable, and non-polluted way to get energy for electricity. 1% of the energy used by the world is wind energy. The United States leads the world in using wind energy. Texas has the largest wind farm in the United States. Texas weather produces a great amount of wind energy. Five hundred Texas homes can be powered by one wind turbine. Wind credit can be obtained by contacting an energy company. This experiment tested the amount of energy a small wind turbine produced. A wind turbine was placed at two different distances. The independent variable was the distance of 50 centimeters and 100 centimeters from the fan. The dependant variable was the amount of energy produced by the wind turbine. The purpose of the experiment was to see how much energy would be produced from the wind turbine placed at different distances. The hypothesis was that the turbine that

Materials and Methods

The materials for this experiment are a box fan, a volt meter, wind turbine, a meter stick, and data chart. At the beginning of the experiment, the wind turbine was built. Next, the wind turbine was placed at 50 cm away from a fan. The fan was turned on to a wind speed of three. The volts of energy were recorded on the data chart. Then, the wind turbine was placed at 100 cm away from the fan. The fan was turned on to a wind speed of three. The results were recorded on the data chart. This testing was done three times a day for each distance for four days.

Results

Acknowledgments

We would like to thank the following sponsors for helping us further our success with our science project. Our sponsors were Roscoe Collegiate Board of Trustees and Texas Agrilife Extension. A special thank you to our teachers; Crystal Althof, Sheila Womack, and Kelly Sheridan.

Conclusion

The hypothesis was that when the wind turbine was placed farthest from the fan, it would produce the least amount of energy. The hypothesis was correct. The closer the turbine was to the fan the more energy was produced.

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- How Wind Turbines Works? - https://www.youtube.com/watch?v=qSWm_nprfqE
- Renewable Energy Storage - https://www.youtube.com/watch?v=VKkWApjXCMc

TEXAS A&M AGRILIFE EXTENSION

MARKING INSTRUCTIONS

CORRECT: ● INCORRECT: ⊘ ◒ ◔

4-H Explore
Project Book Evaluation - Discover Scientific Method

1. Please read the statement in the left column of the table below. Bubble in the circles that describe your level of understanding **BEFORE** attending this program. In the section on the far right, bubble in the circles that describe your level of understanding **AFTER** attending this program. You will have two bubbles per row.

LEVEL OF UNDERSTANDING: 1 = Poor, 2 = Average, 3 = Good, 4 = Excellent	BEFORE				AFTER			
As a result of participating in the Discover Scientific Method project lessons and activities…	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
I understand the process of the life cycle.	○	○	○	○	○	○	○	○
I understand the steps required for the photosynthesis process.	○	○	○	○	○	○	○	○
I understand the types and causes of soil erosion.	○	○	○	○	○	○	○	○
I understand the importance of soil permeability.	○	○	○	○	○	○	○	○
I understand the differences between natural and man-made fibers.	○	○	○	○	○	○	○	○
I understand the process of using wind turbines to produce electricity.	○	○	○	○	○	○	○	○

2. For each statement below, fill in the bubble that best describes you.

INTENTIONS TO ADOPT: **As a result of participating in the Discover Scientific Method Project lessons and activities…**	**Yes**	**No**	**Unsure**
I plan to explain the differences between the larvae and pupa stages.	○	○	○
I plan to conduct a photosynthesis research project.	○	○	○
I plan to set up a soil erosion project.	○	○	○
I will use my understanding of the differences in soil types to describe soil permeability.	○	○	○
I plan to explore the differences in natural fibers.	○	○	○
I will determine the amount of electricity produced with different blade angle settings.	○	○	○

3. For each statement below, fill in the bubble that best describes your level of agreement with the following statements.

BEHAVIOR CHANGES: **As a result of participating in the Discover Scientific Method Project lessons and activities…**	**Strongly Disagree**	**Disagree**	**Agree**	**Strongly Agree**
I am more comfortable working in a team.	○	○	○	○
I am more willing to listen to others.	○	○	○	○
I am more comfortable speaking with others.	○	○	○	○
I am more confident in my abilities as a leader.	○	○	○	○
I am more confident in explaining and defending my research to others.	○	○	○	○

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Please continue on the back.

MARKING INSTRUCTIONS

CORRECT: ● INCORRECT: ⊘ ⊗ ◒ ◓

3. What is the most significant thing you learned in the Discover Scientific Method project?

Please tell us about yourself.

Gender: ○ Female ○ Male

I consider myself to be:
○ African American
○ Asian American
○ Native American
○ White
○ Other

I consider myself to be: ○ Hispanic ○ Non-Hispanic

Grade: ○ 3rd ○ 4th ○ 5th ○ 6th ○ 7th ○ 8th ○ 9th ○ 10th ○ 11th ○ 12th

Most of the time, you live . . .
○ Farm or ranch
○ Town less than 10,000
○ City between 10,000 - 50,000
○ Suburb of city between 50,000
○ Central city/urban center with more than 50,000

Please provide any additional comments below.

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Thank you!