Tri-River Area

STEM/K12 4-H Programs

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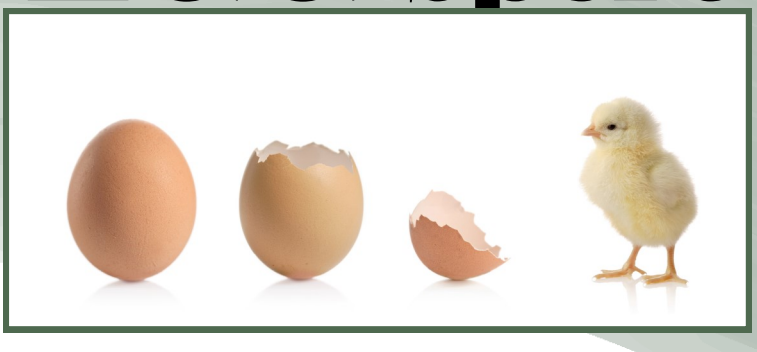

Chicken Embryology

SCIENCE, TECHNOLOGY, ENGINEERING, AND MATH
COLORADO STATE UNIVERSITY EXTENSION

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TRI-RIVER AREA
COLORADO STATE UNIVERSITY EXTENSION

Tri-River Area - STEM/K12 4-H Programs

4-H School Programs

Tri-River Area

About 4-H

The 4-H program is for youth ages 8-18 and comprised of many educational activities and opportunities. 4-H is provided as part of the Colorado State University – Extension Department and is mandated by the Land Grant University system in all 50 States.

School Enrichment/Non-Traditional

4-H agents who work with school enrichment programs provide education in classroom settings to students on a variety of topics. Often these programs have little to no cost for schools, teachers and students. Programs aim to supplement and provide additional education for students on a particular topic or Education Standard, some may also include aspects of the Traditional 4-H program (described below). Some of the programs and topics that can be included through the 4-H School Enrichment Program are; STEM (Science, Engineering, Technology & Math), Ag in the Classroom, Foods and Nutrition, Entomology, Embryology, Respect and Manners, Plant Science and Animal Science. This is just a broad overview of the programs available. If you would like to find out more information about school enrichment programs offered by the 4-H program contact your Local County Extension Office.

Traditional 4-H

The Traditional 4-H program is an extracurricular program that provides structured opportunities for its members to gain life skills. 4-H members are part of a 4-H club and they complete 4-H projects throughout the year, they also must keep records of their project that includes experiences, expenses and possible revenue generated from that project. Traditional 4-H projects cover over 200 different areas and if members do not have a project that is included in those 200 options it is possible for them to 'self determine' a project. Traditional 4-H members have opportunities to serve on county wide activities and attend several leadership conferences throughout the year. They can also compete on competitive teams that represent many topics and contest throughout the project areas. Traditional 4-H program projects include (but are not limited to):

Livestock – Beef, Sheep, Swine, Goats

Equine and Horseless Horse (General Project)

Small Animal – Poultry, Rabbits, Dogs, Cavy (Guinea Pigs)

Family and Consumer Sciences – Cake Decorating, Baking, Cooking, Preserving, Sewing, and more!

General – Shooting Sports, Ag Sciences, Heritage Arts, Leathercraft, Model Rocketry, Ceramics, Photography

If you're interested in learning more about the Traditional 4-H program or starting a 4-H club at your school, contact your Local County Extension Office.

Montrose County Extension:
1001 North 2nd St.
Montrose, CO 81401
970-249-3935

Delta County Extension:
525 Dodge St.
Delta, CO 81416
970-874-2195

Mesa County Extension:
2775 Hwy. 50
Grand Junction, CO 81503
970-244-1834

Visit our website at: tra.extension.colostate.edu

Table of Contents

Kit Teacher Evaluation Form located at end of Workbook. Please fill out and return 1 form after use

Available Online at: TRA Extension STEM Teacher Resources

Worksheet Documents:

- ⇒ Worksheets for Lessons
- ⇒ Watch a Chick Develop Poster
- ⇒ Chick Record
- ⇒ Breed Book

Extra Lessons:

- ⇒ Chicken Careers!
- ⇒ Math with Eggs
- ⇒ National 4-H Embryology "Hatching" Classroom Projects
- ⇒ Photo Links
- ⇒ Virginia 4-H School Enrichment

Tri-River Area - STEM/K12 4-H Programs

Requirements for Embryology Project: Chick Take Home Option

(Interested in taking the chicks home?)

⇒ Have the proper set up for the Chicks:

- Brooder Box: Chick's home until they are fully feathered
- Food, Water, Heat, Bedding
- Coop: Home after they have fully feathered
- Food, Water, Bedding, Nesting Boxes, Roosting Bars, Heat (During winter if needed)

⇒ **(Youth) Must Join** Tri River Area 4-H (Mesa, Montrose, Delta, or Ouray Counties):

A. Sign up on http://co.4honline.com - You will register as a new family under "I don't have a profile". If you need help to register, please call your local Extension Office.

Montrose/Ouray County - 970-249-3935

Delta County - 970-874-2195

Mesa County - 970-244-1834

B. Bring $50.00 enrollment fee to Extension Office

C. Fill out all paper work in Extension Office

D. Call your 4-H Club Leader for information on Club meetings (Extension Office can help you set your club and answer any questions you might have)

E. Attend Club meetings on the set day of each month and follow Club requirements

⇒ Have a plan for Rooster vs. Hen:

- What are you going to do if you get some roosters?
- What is your purpose for taking the chicks?

Please contact Stephanie Lamm at 970-249-3935 or Stephanie.Lamm@colostate.edu if you have any questions.

Chicks will be given away on a first come first serve basis, no one is guaranteed chicks. If you don't get chicks this round you will be placed on a waiting list at the office for additional chicks that are hatched.

Visit our website at: tra.extension.colostate.edu

General Incubation Instructions

1) Location of Incubator:

- Ideal room conditions are 70-75 degrees Fahrenheit
- Place the incubator away from drafts, out of direct sunlight and placed on an inside wall.

2) Start and Regulate:

- *Follow the Incubator Directions.*

Teachers: If you are using the wooden or square Styrofoam incubators, you must begin to calibrate them at least two weeks prior to your scheduled embryology presentation. It is absolutely necessary that the incubator be calibrated before setting the eggs.

3) Setting the Fertile Eggs:

- Place the fertile eggs in the incubator. Do not change the temperature settings. The eggs are cool and it will take a few hours to warm them up.
- Place the eggs in the incubator small/pointed end downwards

4) Incubating the Eggs:

- Maintain the temperature at 99.5 F and no more than 102 degrees F. In general, overheating can cause more problems than under-heating. The temperature should not fluctuate more than a degree if at all possible.

IMPORTANT NOTE: In working with local teachers, a temperature of 102 degrees F has increased the hatching success rates in our classrooms. This may be because students and teachers are opening the lids of the incubators more to work with the eggs than in a typical situation. If you are not opening the incubator, then adjust the temperature accordingly by following the instructions that came with your incubator and/or checking the resources listed below.

- Make sure the egg turners are working in the incubators. If they do not turn or quit turning during the process, you will need to turn them 3 times a day. (This must be done or the yolk sac could attach to one side of the shell.)
- Make sure there is enough humidity in the incubator, fill the water pan (different in different incubators) with about ¾ to 1 cup of *warm* water as needed. This usually needs to be done every 2 or 3 days.
- Ideal humidity is between 55-60%, This should be increased to 65% during hatching!

*On day 18 add warm water. You may need to add warm water and/or wet sponges. Close the incubator and DO NOT OPEN until the baby chicks hatch.

When Chicks Hatch

Hatched chicks should remain in the incubator until they are dried off and may remain in the incubator as long as 24 hours. If chicks get cold because they're not totally dry, they may get sick. If they are sick, you will see crusted excrement on their bottoms. This must be removed or they will die. Chicks will begin pipping (pecking through the shell) around the 21st day of incubation. Pipping will take place for one to six hours before the chick emerges from the shell. **If eggs do not hatch in 21 days, leave them for another two to four days as they may still hatch. After that, consider the project finished. DO NOT help the chicks out of their shells – this will only damage them.

Continue on next page.

General Incubation Instructions Cont.

- After emerging from the shell, the chicks will dry, become strong and begin to move about. This may take four to six hours. It is important to leave the chicks in the incubator until they are completely dry.
- Remove the hatched chicks from the incubator and place in a heated box. The heated box should contain a 40-watt light bulb lowered to within six inches from the bottom of the box. Keep the box in a warm place and away from drafts.
- Chicks do not need additional food for about 48 hours after they hatch.
- Remove empty shells from the incubator and clean it

Tips for Successful Embryology Projects

1. Make sure you always wash your hands well before handling the eggs. Bacteria transmitted to the egg can kill the embryo.

2. Once the eggs are in the incubator, you will need to make sure that the temperature is constant between 99.5 F and 102 F. At about 14 days you may have to readjust the temperature because the developing chicks may be giving off heat. Just watch the temperature closely at all times.

3. Make sure there is water in the water pan. If more is needed, make sure to add *warm* water.

4. Candle the eggs at between a week and 10 days. If you see vessels, you will know the egg is developing. If not, wait a few days and try again. If no vessels are seen, the egg may not be fertilized and will need to be taken out of the incubator. The fumes given off by an unfertilized egg as it rots or from a dead embryo, can kill the other embryos in the incubator. Candle again at 15 to 17 days to make sure eggs are still developing. **DO NOT candle the eggs after day 18.**

5. If you have one of the Styrofoam incubators, at 18 days you will need to remove the egg turners and put the eggs on the screen, close together. It is not necessary to turn them at this point. Add warm water to reservoirs and close lid. DO NOT open until after hatching.

6. Hatched chicks should remain in the incubator until they are dried off and may remain in the incubator as long as 24 hours. If chicks get cold because they're not totally dry, they may get sick. If they are sick you will see crusted excrement on their bottoms. This must be removed or they will die.

Please mention to your students prior to hatching:

Some eggs may not hatch.

Some chicks may die after hatching.

When this happens there is usually something wrong with the chick and this is a fact of life. We hope this will not happen but sometimes it does. Explaining this in advance does minimize the sadness that the children feel.

Colorado Regulations Regarding Younger Kids

6.7.4 Insect, Rodent Control and Classroom Animals

Live poultry (e.g., chicks and ducklings), reptiles, and amphibians shall be prohibited from classrooms with children kindergarten age or younger or communal areas that these children use. Because infections from these animals spread via fecal-oral transmission (hand to mouth behaviors), use of these animals in other classrooms where children engage in frequent hand to mouth behaviors is discouraged.

We **HIGHLY ENCOURAGE** Avid Hand Washing before and after all interactions with eggs, incubators, and chicks.

Lesson Plans

SCIENCE, TECHNOLOGY, ENGINEERING, AND MATH
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Embryology (Hatching Chicks) Lesson 1

4-H Content:
- Embryology
- Poultry

Goals:
- Relate how an incubator is similar to a mother hen.
- Discuss some fun facts about chickens
- Prepare students for the incubation of eggs in their classroom.

Grade/Age:
1st - 4th Grade

4-H Life Skills:
- Critical thinking
- Learning to learn
- Observation

Colorado Academic Standards
Science
1.1.1. All organisms have external parts that they use to perform daily functions.
1.2.2. Young organisms are very much, but not exactly, like their parents, and also resemble other organisms of the same kind.
2.2.2. A range of different organisms lives in different places.
3.2.1 Organisms have unique and diverse life cycles.
3.2.2. Being part of a group helps animals obtain food, defend themselves and cope with changes.
4.2.1. Organisms have both internal and external structures that serve various functions.

Setting up the Incubator

BACKGROUND:

Do you know that the incubator is like a mother hen for our eggs?

The incubator is designed to do all of the things that a mother hen does during the 21 days to insure that the chicks will hatch healthy and happy! The incubator provides: heat, humidity, turning, and protection for the fertilized eggs.

GETTING STARTED:

1. Ask students what they know about hatching chickens?
2. Show students the incubator; ask them how they think it is like the mother hen.
3. Talk to students about how many days it takes for the chicks to hatch, show them the *Chick Development* poster to hang by the incubator.
4. Go over the following parts of the incubator with the students:
   - **Temperature:** We need to keep the eggs warm like the mother hen. We will keep the temperature set to 99.5 degrees. Body heat produced from the hen keeps the eggs around this temperature.
   - **Humidity:** The water in the air that helps soften the shell so the chick can get out. When the hen gets up to eat, the dew in the air mixed with her body heat creates humidity.
   - **Turner:** Grey/white tray that moves from side to side to prevent the chicks from sticking to the egg. When the hen gets up the eggs move, she also moves them around with her beak throughout the day.
   - **Safety:** The lid and incubator protect our eggs, just as a hen would sitting on her eggs. We want to make sure we don't bump the incubator or harm the eggs. We also don't want to move the lid because the heat and humidity will escape.
5. Have students help you to watch the incubator and keep our chicks safe! Talk to them about looking with their eyes and not with their hands.

Time Required:
15 minutes - (45 minutes with the Parts of an Egg Lesson)

Materials:
- Incubator
- Fertilized Eggs
- Distilled Water - 2 Gal.
- Chick Development poster (Find a copy on the STEM Teachers Resources Page - Link under 'Supplemental Resources')

Vocabulary:
- Incubator
- Humidity
- Temperature
- Turning

Fun Facts about Chickens:
- On average they lay one egg a day, depending on the breed
- It takes chicks 21 days, ducks 28 days, quail 23 days, and ostrich 43 days to hatch
- You can tell if a chicken is going to lay a colored egg or a white egg by the color of her ear lobes
- A female chicken is called a Hen and a male chicken is called a Rooster
- A hen can start laying eggs at 4-6 months old
- Chicks start getting wing feathers at 3 days old
- A hen can lay an egg without a baby chick in it. These are the ones you buy in the grocery store

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Embryology (Hatching Chicks) Lesson 2

4-H Content:
- Embryology
- Poultry

Goals:
- Distinguish the various parts of an egg.
- Prepare students for the incubation of eggs in their classroom.

Grade/Age:
1st - 4th Grade

4-H Life Skills:
- Critical thinking
- Learning to learn
- Teamwork

Colorado Academic Standards
Science
1.1.1. All organisms have external parts that they use to perform daily functions.
1.2.2. Young organisms are very much, but not exactly, like their parents, and also resemble other organisms of the same kind.
2.2.2. A range of different organisms lives in different places.
3.2.1 Organisms have unique and diverse life cycles.
3.2.2. Being part of a group helps animals obtain food, defend themselves and cope with changes.
4.2.1. Organisms have both internal and external structures that serve various functions.

Parts of an Egg

BACKGROUND:

Do you know what a chalaza is? How about the albumen? An egg has eight essential parts, from the chalaza to the albumen, and the shell.

The chalaza helps hold the egg yolk in the center of the egg, while the albumen is more commonly known as the egg white. Each part has a different importance, and students will learn about each part of an egg, as well as its "importance," in this lesson!

GETTING STARTED:

1. Divide the students into groups of 3-4 students, depending on the size of the classroom.
2. Give each group of students an egg parts diagram, a bowl and an egg, and tell the students to crack the egg into the bowl, being careful not to break the yolk.
3. Have the students examine the egg (without touching it!) and try to determine what the parts of the egg are.
4. Go over the following parts of the egg with the students:
   - **Air Cell:** An air space formed when the contents of the egg cools and contracts after the egg is laid
   - **Germinal Disk:** A spot on the yolk from which the embryo develops after fertilization occurs
   - **Vitelline Membrane:** The clear casing that encloses the yolk and keeps it intact
   - **Albumen (White):** The liquid medium in which the embryo develops, which contains a large amount of the protein necessary for proper development
   - **Membranes:** The inner and outer membrane beneath the shell protect the contents of the egg from bacteria and prevent moisture from leaving the egg too quickly
   - **Yolk:** Source of food for the embryo; contains all the fat in the egg
   - **Chalaza:** Holds the yolk in the center of the egg
   - **Shell:** Hard, protective covering made of calcium carbonate, which allows the transfer of gases through the shell
5. Have students fill in their own egg parts diagram.

Time Required:
45 Minutes

Materials:
- Disposable bowls
- Eggs (1 egg per every 3-4 students)
- Egg parts diagram worksheet (Find a copy on the STEM Teachers Resources Page - Link under 'Supplemental Resources')

Vocabulary:
- Air Cell
- Germinal Disk
- Vitelline Membrane
- Albumen
- Membranes
- Yolk
- Chalaza
- Shell

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Embryology (Hatching Chicks) Lesson 3

4-H Content:
- Embryology
- Poultry

Goals:
- Discover the development the eggs have made
- Review parts of an egg from last lesson
- Identify what an unfertilized egg is
- Appraise all the eggs and remove the unfertilized eggs

Grade/Age:
1st - 4th Grade

4-H Life Skills:
- Learning to learn
- Observation

Colorado Academic Standards
Science
1.1.1. All organisms have external parts that they use to perform daily functions.
1.2.2. Young organisms are very much, but not exactly, like their parents, and also resemble other organisms of the same kind.
2.2.2. A range of different organisms lives in different places.
3.2.1 Organisms have unique and diverse life cycles.
3.2.2. Being part of a group helps animals obtain food, defend themselves and cope with changes.
4.2.1. Organisms have both internal and external structures that serve various functions.

Candling an Egg

BACKGROUND:

Did you know you can see the embryo growing inside of the egg? This process is called candling.

Students will have the opportunity to see the embryo growing inside of the egg. Students will also have the opportunity to compare what they are seeing in the egg to the growth chart provided to the classroom. Candling will also enable us to remove any of the eggs that may be unfertilized.

GETTING STARTED:

1. Divide the class into groups of 4-5 students, depending on the size of the classroom.
2. Place two eggs from the incubator into the carton (these eggs must not be out of the incubator for very long so you will have to change out eggs in-between groups)
3. Tell students the goal of candling is to see inside of the egg and see how the chick is growing. Tell them it is called candling because we want the egg to glow similar to the end of a candle.
4. Hold your fingers over the box light and show them how your fingers glow, explain that our goal is for the egg to do the same, then hold an egg over the box and ask if they can see anything. Explain to them the shell is protecting the egg so you have to turn the lights off to see inside. Ask someone to be your light person, make sure that the kids are ready for the lights to be off.
5. Hold the egg over the light.

<u>If Fertilized:</u>

- Point out the air cell; tell the kids the purpose of the air cell.
- Point out the pores; talk about the purpose of the pores.
- Point out blood vessels; just like humans chicks need them to survive too.
- Point out the chick; talk about what stage they are in and encourage the kids to look at the *Chick Development* poster in the classroom.

<u>If Unfertilized:</u>

- Point out the yolk; hopefully you will be able to show them the difference between a fertilized and unfertilized egg.
- Explain what unfertilized means.

Time Required:
5 minutes/Group

Materials:
- Completely dark room with an electrical plug in
- Candler
- Egg carton to carry eggs
- Chick Development poster (Find a copy on the STEM Teachers Resources Page - Link under 'Supplemental Resources')

Vocabulary:
- Air Cell
- Yolk
- Shell
- Pores
- Blood Vessels

Additions to the Lesson:
Have students write/ draw the observations of what they saw inside of the egg as it was being candled. Each group should have seen at least two eggs, have them draw both. Ask students to record at least one new thing they learned.

Teacher Note:

Lesson can only happen with a small group of kids at a time. The youth will need something else to do when they are not in the candling room.

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Embryology (Hatching Chicks) Lesson 4

4-H Content:
- Embryology
- Poultry

Goals:
- Recognize necessities needed for caring for the chicks after they have hatched
- Discover the vital supplies needed for survival

Grade/Age:
1st - 4th Grade

4-H Life Skills:
- Critical thinking
- Teamwork
- Learning to learn
- Observation

Colorado Academic Standards
Science
1.1.1. All organisms have external parts that they use to perform daily functions.
1.2.2. Young organisms are very much, but not exactly, like their parents, and also resemble other organisms of the same kind.
2.2.2. A range of different organisms lives in different places.
3.2.1 Organisms have unique and diverse life cycles.
3.2.2. Being part of a group helps animals obtain food, defend themselves and cope with changes.
4.2.1. Organisms have both internal and external structures that serve various functions.

Setting up a Brooder

BACKGROUND:

Did you know that chicks only stay in the incubator for up to 24 hours after they hatch?

Students will learn the essential needs to caring for a chick once they come out of the egg and incubator. Students will set up the brooder box with food, water, shelter, and soft bedding to insure proper health of the chicks.

GETTING STARTED:

1. Ask students to think about what items are needed for the chick to grow. Brainstorm the list and write on a white board all the student ideas.
2. Talk about all of their ideas, confirm the ones that are necessary and briefly talk about why some of the others may be optional.
3. Bring out the Brooder box with all of the supplies.
4. Go over the following parts of the brooder with the students:
   - **Box:** A safe home for the chicks to go once they are completely dry.
   - **Shavings:** A comfortable bedding to keep the chicks dry and to keep them from slipping on the bottom of the box.
   - **Feeder/Food:** Chicks need food just like humans do. We need to make sure they have clean food every day.
   - **Water Holder/Water:** Chicks also need water to survive. This water holder is great for the chicks as they are attracted to the shiny part at the bottom of the water holder.
   - **Heat Lamp:** Helps to keep the chicks warm in their new home until they get all of their feathers. The heat lamp should be placed on the opposite side from the food and water so the chicks can gather together.
5. Talk to students about keeping the chicks safe in their new home. Students should not pick the chicks up out of the brooder without the teacher and **should not touch the chicks without washing their hands before and after.**

Time Required:
30 minutes

Materials:
- Rubbermaid tub, with mesh top lid
- Wood shavings
- Feeder/food
- Water holder/water
- Heat Lamp

Vocabulary:
- Brooder
- Temperature

Teacher Note:

Please observe the chicks with the heat lamp. You will be able to tell if it is too hot. The chicks won't go under it and will gather at the side with the food and water. If it is too cold the chicks will huddle together under the lamp. Please adjust the temperature as necessary for the chicks.

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Embryology (Hatching Chicks) Lesson 5

4-H Content:
- Embryology
- Poultry

Goals:
- Implement care techniques for the hatched chicks
- Review the vital supplies needed
- Utilize students ability to be creative by designing their very own farm.

Grade/Age:
1st - 4th Grade

4-H Life Skills:
- Teamwork
- Creativity/Design

Colorado Academic Standards
Science
1.1.1. All organisms have external parts that they use to perform daily functions.
1.2.2. Young organisms are very much, but not exactly, like their parents, and also resemble other organisms of the same kind.
2.2.2. A range of different organisms lives in different places.
3.2.1 Organisms have unique and diverse life cycles.
3.2.2. Being part of a group helps animals obtain food, defend themselves and cope with changes.
4.2.1. Organisms have both internal and external structures that serve various functions.

Create Your Own Chicken Farm

BACKGROUND:

Did you know that there are many different kinds of chickens, and many different kinds of chicken houses?

Students will review the essential needs of a chick once they are at the farm. Students will design a farm with food, water, shelter, and soft bedding to insure proper health of the chicks. Students will also be able to choose a few chickens to raise on their farm.

GETTING STARTED:

1. Divide students into groups of 3-4, depending on the size of the class.
2. Review with the students all of the necessities that are needed for chickens to survive on the farm. Add in coop, roosting bar, nesting boxes, play yard to what they discussed when setting up the brooder.
3. Ask groups to design a farm for their chickens. Write a list of all the things they must include in the farm: Coop, food, water, roosting bar, nesting boxes, play yard, heat, and protection. Ask students to think about where their farm is going to be, is it hot, cold, humid, high elevation, etc.
4. Talk to the kids about different breeds of chickens.
   - **Egg Laying:** Specific purpose is to lay eggs. On average they lay one egg a day.
   - **Meat:** Specific purpose is to grow rapidly to provide meat.
   - **Dual:** These chickens are great layers and are good for meat production.
   - **Ornamental:** These chickens are bred to look cool. They are the fancy chickens that look pretty, show birds. These chickens usually only lay 1-2 eggs a week.
5. Give each group 3-4 different chickens. Have them review the stats on the chickens, keeping in mind where their farm is, and what they are raising the chickens for. Have them pick 2 chickens to raise on their farm.
6. Ask each of the groups to share their farm design with the class and explain why they picked their chickens.

Time Required:
45 minutes

Materials:
- Construction paper
- Markers
- Colored pencils
- Chicken Breeds doc. laminated (Find a copy on the STEM Teachers Resources Page - Link under 'Supplemental Resources')

Vocabulary:
- Coop
- Breeds
- Ornamental
- Dual
- Meat
- Egg Laying

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Col.st/ll0t3 ~ https://col.st/0WMJA

Supplemental Resources

Worksheets

Worksheets, photos, and additional lessons for *Chicken Embryology* can be downloaded from:

TRA Extension STEM Teacher Resources

Or by going to our website below.