Life Cycles of Animals – Constant Change!

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This curriculum unit is recommended for Elementary Science, N. C. Second Grade

Keywords: life cycles, structures and systems of organisms, "stages" of development, simple and complete metamorphosis

Teaching Standards: See Appendix 1 for teaching standards addressed in this unit.

Synopsis: This curriculum unit (CU) is targeted for second grade students. The unit will address two of the Essential Standards for second grade. The first Essential Standard is Structures and Functions of Living Organisms; Understanding animal life cycles. The clarifying objectives for this strand are: Summarize the life cycle of animals including: birth, developing into an adult, reproducing, and aging and death. The second objection is to compare life cycles of different animals.

The second is Evolution and Genetics; Understanding that organisms differ from or are similar to their parents based on the characteristics of the organism.

The goal of this unit is to first help my second grade students come to an understanding of animals' life cycles which begins with birth, then a period of time in which the animal develops into an adult. At adulthood, animals reproduce in order to sustain their species. All animals are programmed to age and eventually die. This CU will guide students' knowledge that animals might look the same, similar, or completely different at specific stages of development. The second goal of this unit is to provide background information and ideas that other second grade teachers can use to teach these concept

I plan to teach this unit during the coming year to 96 second grade students.

I give permission for the Institute to publish my curriculum unit and synopsis in print and online. I understand that I will be credited as the author of my work.

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Cindy Woolery

Introduction

Elizabeth Traditional Elementary School (ETES) is an institution that has provided educational training for young children since opening its doors in 1912. Our school is a Traditional K-5 magnet program since 1977. The school's building structures, name, and curriculum have been altered over the years to meet various demands on a diverse and ever-shifting population. One quality of the school and its staff has remained constant: Its commitment to a solid educational foundation for all students.

ETES is located in Charlotte, North Carolina in the urban school district of the Charlotte/Mecklenburg School System, which is the nineteenth largest in the nation. The school serves five hundred and fifty students with fifty-seven percent of the population being Africana American. Thirty-four percent of our students are economically disadvantaged.

I have just completed my third year as a full time Science Facilitator at this school and my twenty-fourth year of teaching. I have followed in the footsteps of an outstanding Science Facilitator who had worked many years at establishing a material rich lab. The Lab has five tables for group experiments and cooperative working groups as well as a Media Viewing Space (rugged area where a computer, smart board, ladybug document camera, and digital microscope are located). The Science Lab experience is considered a "Special" on the same level as Media Center and Computer classes. Every student in the school comes to the Lab for a fifty-five minute lesson, on a rotating four day schedule.

This curriculum unit (CU) is targeted for my second grade students. The unit will address two of the Essential Standards for second grade. The main Essential Standard I will base this unit on is Structures and Functions of Living Organisms; Understanding animal life cycles. The clarifying objectives for this standard are: Summarize the life cycle of animals including: birth, developing into an adult, reproducing, and aging and death. The second objection is to compare life cycles of different animals such as, but not limited to, mealworms, ladybugs, crickets, guppies or frogs.

The second standard that will be addressed is Evolution and Genetics; Understanding that organisms differ from or are similar to their parents based on the characteristics of the organism. The two objectives for this standard are: Identify ways in which many plants and animals closely resemble their parents in observed appearance and ways they are different and recognize that there is variation among individuals that are related.

For most lessons I use the Five E's (*Explore, Engage, Explain, Elaborate, and Evaluate)* in planning interactive lessons. I have discovered many excellent interactive science web sites where students can perform virtual experiments. Viewing these web sites as a group has had a real impact on student learning. Many of my students are lacking in life experiences and the use of the computer gives them background knowledge to be able perform their own discovery experiments.

Rationale

The state of North Carolina has elevated the fifth grade Science test as a "gate-way" test. The Science end of grade (EOG) test has been placed on the same level as Reading and Math EOG's. Schools are often judged by the public, parents, teachers and others on how the students score on the EOG's.

How teachers are evaluated is rapidly changing. Beginning this year, students score and growth on these scores will be factored in on the evaluations with the possibility of money being paid to those teachers whose students show the most growth. These facts have had a great impact on the teaching of Science at the elementary level. Testing our students in science is stretching our teaching of science!

This unit will help second grade teachers help prepare their students for this all important 5th grade EOG in two main areas. The first is Evolution and Genetics - Understand why organisms differ from or are similar to their parents based on the characteristics of the organism. And the second is: understanding how structures and systems of organisms perform functions necessary for life.

Previously, in second grade, the two essential standards, Animal Life Cycles and Evolution and Genetics have been taught one after the other, but in isolation. This unit will combine these two standards, which in turn will give my students a better understanding preparing them in a strong way to excel on their 5th grade EOG's.

The goal of this unit is to first help my second grade students come to an understanding of animals' life cycles which begins with birth, then a period of time in which the animal develops into an adult. At adulthood, animals reproduce in order to sustain their species. All animals are programmed to age and eventually die. The life cycle for specific animals can be very different. Animals spend varying periods of time in each stage of the life cycle and some animals have few stages, while others have several. This CU will guide students' knowledge that animals might look the same, similar, or completely different at specific stages of development. Students will gain knowledge that animals may have varied needs at different stages of development, and may occupy unique habitats according to these needs. Adult animals resemble their parents in appearance, needs, life processes, and interactions with the environment, even while being unique. Groups of organisms of

the same type have characteristics in common as well as variation of some of the characteristics.

The second goal of this unit is to provide background information and ideas that other second grade teachers can use to teach these concepts.

Scientific Content: Background Knowledge for Teacher

Every animal goes through "stages" of development that define their life cycle. First, it is born; second, it grows and changes and becomes an adult; third, it produces offspring; and fourth, it dies. The cycle part of the word "lifecycle means that although an individual animal dies, its characteristics can be carried on from generation to generation through reproduction.

Two important factors that cause animals to transform into their adult forms are body chemicals called hormones and the environment. Hormones trigger the metamorphic changes in all organisms, including some of the more commonly studied ones like insects, amphibians such as frogs and salamanders, and fish. Hormones also play an important role in another part of an animal's life cycle, reproduction. In this CU we will study, observe, and compare the details of the life cycles of some of the different groups of animals.

This unit will focus on the six groups of animals studied in elementary education namely; mammals, amphibians, birds, fish, insects and reptiles. Animals featured in each group are NC species that students could very familiar with, and will include North Carolina state species and in some cases endangered species found in North Carolina.

Mammals

Mammals are a class of animals that are born alive, have hair or fur, and feed their young with milk. Mammals are warm blooded animals. Baby mammals require more care from their parents than other animals. Mammals include people and are the animals that second grade students have the most knowledge of. First, the mammal is born alive; it is a smaller version of the parent. The food is provided by the mother. . Then, the baby mammal grows and changes until it becomes an adult. When it is an adult, the mammal can reproduce.

One mammal that is on our NC endangered species list is the West Indian Manatee. These gentle giants have no natural enemies, except for humans. The North Carolina State Mammal is the Eastern Grey Squirrel. If there is plenty of food available, female grey squirrels can produce two litters of young per year, one in early spring, the other in midsummer. There are usually three babies (kittens) in each litter. The mother builds a nest (drey) in which to give birth. The kittens are blind and hairless at birth and cared for only by their mother.

Amphibians

Amphibians begin their lives in the water, but they live on land as adults. Their name means “double life”. In addition, they hatch from eggs. Examples of amphibians include frogs and newts. The life cycle of a frog consists of three stages: egg, larva, and adult. As the frog grows it moves through these stages in a process known as metamorphosis. Metamorphosis means “change of form.” Animals that metamorphose usually go through several different forms before reaching adulthood.

This is an example of a lifecycle of an amphibian using a frog. Frogs lay their soft-shelled eggs in a clear jelly like substance in a pond. The eggs are called spawn. The eggs and clear jelly stick together. In around two weeks the eggs hatch into tadpoles. Tadpoles are baby frogs, but they do not look anything like adult frogs. They have a tail and no legs, they swim like fish, they breathe with gills, and they eat underwater plants. As a tadpole grows, it changes; it loses its tail and gills, it grows legs and lungs, and it begins to eat bugs and plants. Soon, it looks like a small frog and will spend most of their life on land. The adult frogs main diet is insects that they catch with a long tongue. When it becomes an adult, it can lay eggs in the pond that will hatch into new tadpoles.

North Carolina last year adopted the Marbled Salamander - a charismatic, chunky-bodied salamander with unique "marbled" patterns on its back as our state amphibian. Adults spend most of their time in their burrows or under logs, as is the case with most mole salamanders. The marbled salamander lays its eggs on land. The female lays 50-200 eggs, one at a time, in a depression under a log or in a clump of vegetation that will fill with water when it rains. The female usually curls her body around the eggs to keep them moist and waits for rain to fill the depression. The larvae hatch a few days after being covered by water.[1] Juvenile marbled salamanders hatch early compared to most salamanders. Larvae typically mature as quickly as two months or can take up to six months to mature into adults that produce eggs. Marbled salamanders, like other members of this genus, are reported to have relatively long life spans, 8–10 years or more.

Birds

Birds have wings and feathers. They hatch from hard-shelled eggs after many days to weeks of being protected and kept warm by their parent(s). This is called incubation. After they hatch, many species will be fed by their parent(s) while others such as a chick will be able to fend for themselves. At this stage of their lives they are called hatchlings and will grow into fledging or immature birds. When they have finished growing, they become mature or adult birds. Some birds migrate and some birds spend their whole lifecycle in one area.

Birds exhibit wonderful variation within and between species; they can be different colors, sizes, consume different foods, etc. Males and females often look different. One bird lifecycle that most students are familiar with is that of a chicken. Adult chickens lay their eggs in a nest. Bird eggs have hard shells to prevent them from drying out. Each egg contains one chick which develops for about 21 days. When the chick hatches from the

egg it has a soft down. The chick grows and the down is replaced by feathers, and begins to resemble the parents. As an adult chicken the hen can lay its own eggs.

North Carolina designated the northern cardinal as official state bird in 1943. This bird is one of America's favorite backyard birds known for its beautiful red coloration and song. Their favorite food is sunflower seeds and they make nests that tend to be wedged into a fork of small branches in a sapling, shrub, or vine tangle, 1-15 feet high and hidden in dense foliage. Northern Cardinals lay three or four pale green eggs, with brown spots. The parents eat mainly seeds and fruit, supplementing these with insects (and feeding nestlings mostly insects).[2] They feed the hatchlings until they fledge and feed on natural seeds and those in your backyard feeders.

The piping plover is on the NC endangered species list and are found in coast regions where they nest on beaches. The male piping plover selects the nest site and defends it from other plovers. He then starts scraping a nest in the sand above the high tide line. Both the male and female may toss stones and shell fragments into the depression. The female piping plover usually lays four eggs. The eggs hatch in about 25 days and the chicks fledge when they are three to four weeks old, but the parents don't feed the chicks. The chicks hop out of the nest and forage for food themselves. If the young are threatened by a predator, the adult may pretend to have a broken wing to lure the predator away.

Fish

Fish live their entire lives in the water. They breathe with gills, swim with fins, and protect themselves with an outside covering of scales. Fish life cycles vary among species. In general, however, fish progress through the following life cycle stages: eggs, larvae, fry (juvenile), and adult.

Many fish lay egg masses or release their eggs, so the fertilized eggs develop into fish with no parental care. Larvae (newly hatched) fish live off a yolk sack attached to their bodies. When the yolk sac is fully absorbed, the young fish are called fry. Fry are able to start eating on their own. Fry (or juvenile fish) grow and change in shape and appearance through several more developmental stages, which vary by species, as they mature into adults. The majority of fish do not survive to become adults, so an important part of their evolutionary success is that they produce lots of eggs and larvae. Water temperatures, oxygen levels, competition for habitat and predators are among the threats to their survival. When a fish is able to reproduce it is considered an adult.

North Carolina designated the channel bass (red drum) as the official state saltwater fish in 1971. Red drum are estuarine dependent; they spend at least part of their life in the bays. Life for a red drum begins as an egg spawned during late summer and fall. Adults gather in near-shore oceanic waters around barrier islands. Each female can produce from 20,000 to 200,000 eggs per spawn and can spawn over a dozen times during a season. Females

broadcast their eggs into the current where they are fertilized by the male and start their life cycle. After hatching, the larvae are carried by tidal currents into the shallow waters of bays and estuaries. The larvae remain in these areas, feeding on small invertebrates and zooplankton until they are about an inch long -- usually a few weeks. Red drums ranging from an inch to 30 inches are considered juveniles. They grow rapidly reaching 12 inches by the end of their first year and 22 inches by the time they are two years old. Then the adults mostly live off-shore feeding off small fish.

Insects

Insects have six jointed legs, three main body parts (head, thorax, and abdomen), and a protective exoskeleton. Insects include grasshoppers and butterflies. Insects are the most abundant group of animals on earth.

Metamorphosis is an important part of an insect's lifecycle and all insects grow and change either through simple metamorphosis (sometimes called incomplete metamorphosis) or complete metamorphosis. The stages of metamorphosis are not always apparent when looking at the outside of an animal. Many changes happen on the inside of an animal's body. One part that can be observed is molting. Because they have a hard exoskeleton, they must shed or molt this outer covering periodically to be able to grow. The different molt stages (or instars) also sometimes look different from each other. The first instar emerges from the egg and develops to the first molt. The last instar develops into the adult in simple metamorphosis, or into the pupa in complete metamorphosis.

Simple Metamorphosis (incomplete metamorphosis)

Insects with simple metamorphosis have three life stages: egg, nymph and adult. Adults and nymphs of these insects usually feed on the same or similar foods. These insects may have wings, which if present, develop externally. The nymph looks similar to, but is a smaller version of, the adult. Examples of insects that go through simple metamorphosis are grasshoppers, cockroaches and milkweed bugs.

Complete Metamorphosis

Insects with complete metamorphosis have four life stages: egg, larva, pupa and adult. Larvae are very different in form from the adult. The active, feeding, immature stages are known generally as larvae. The larvae typically molt many times before they transform into a non-feeding stage known as a pupa. The pupae stage is a transition stage, when the larva transforms into the adult using the energy stored during the larval stages. The pupa then molts, revealing the adult form with wings if present[3]
Examples of Insects with complete metamorphosis include butterflies and moths, beetles, and wasps and bees.

North Carolina designated the honeybee as the official state insect in 1973. The life cycle of honey bees begins when an egg hatches. During the first stage of its development, the offspring form a digestive system, nervous system and outer covering. Each member of a colony develops as an adult over varying durations. Queens become full-grown adults within 16 days; drones develop in under 24 days and female workers require 21 days during larval and pupal development.

The Saint Francis' Satyr Butterfly is an endangered butterfly found in N. C. This rare butterfly is known to exist only in the sandhills of Cumberland County. Until its recent rediscovery in 1986, the species was believed to have been collected to extinction. Only one population is now known to survive.

Saint Francis' satyr is a small, dark brown butterfly that has conspicuous "eye spots" on the lower surfaces of the wings. The eye spots are usually round to oval and are well-developed on the fore wing as well as on the hind wing.

The annual life cycle of the Saint Francis' satyr include two generations per year. Larval host plants are believed to be grasses, sedges, and rushes. Little else is known about the life history of this butterfly. The habitat occupied by this satyr consists primarily of wide, wet meadows dominated by sedges. In the North Carolina sandhills, such meadows are often relicts of beaver activity. Saint Francis' satyr has also been observed in pitcher plants. It is, however, unknown whether the satyr uses such habitat for reproduction or simply as a dispersal corridor.[4]

Reptiles

Reptiles have dry, scaly skin, and are cold blooded. Most of them hatch from eggs which have been buried in the ground. When a reptile is ready to hatch, it uses an egg tooth to break through the shell of the egg. The little reptile is able to care for and defend himself from birth. Juvenile reptiles look similar to the adults of their species -- they do not undergo the dramatic metamorphosis common in insects and amphibians. Examples include turtles and lizards and alligators.

The Eastern box turtle was designated as the official state reptile of North Carolina in 1979. Listed as "near threatened" by the International Union for Conservation of Nature and Natural Resources (IUCN), the eastern box turtle should be monitored and protected to avoid further population decline. In June or July females deposit eggs in a hole that she digs in loose or sandy soil. They lay between 2 to 7 eggs. Most hatching occurs in September. Young either remain in the nest after hatching, emerge and go directly into hibernation, or emerge and explore for a few days to weeks, then hibernate. They do not require food during their first summer or fall before going into hibernation. Individual turtles become reproductive at 4 to 5 years in age. They can live to be older than 20 years in age.

Strategies

The first strategy is to bring my students to a basic understanding of animals as it pertains to the standards in their grade level. I will start with my students own questions and personal curiosity about life cycles, adapting, evolving and genetics of the different groups of animals listed above. The questions they formulate as they contemplate animals will be used to guide the unit.

The second strategy is to help my students to understand life cycles through hands-on experiments and observations of animals. During this unit we will observe the life cycles of mealworms turn as they turn into beetles, of caterpillars that turn into butterflies, and eggs that hatch into chicks.

Models, videos, books, games and songs will be used to reinforce the basic concepts. Students will create their own "mini-poster" or lifecycle project such as flipbooks, circular diagrams, a "Life of An Animal" book showing the stages of an animal they have selected and dioramas of an animal life cycle. As a culminating project we will invite parents and other grades to our gallery walk. During the gallery walk students will explain their animal project to other students and adults. Students will also be able to share from their science journals their observations of the chicks, butterflies and beetles.

Social Studies will be integrated by looking at endangered species in North Carolina as well as the state's bird, reptile, insect, mammal, and fish. Advanced students will research factors that have contributed to species decline to the point of being placed on the endangered list of animals. Areas to research would include the characteristics of their life cycle that make them vulnerable to extinction, e.g. picky eaters (e.g. food specialists vs generalists), how they nest (birds that nest on the ground or beaches are very vulnerable to predators, flooding, etc.). Or did humans just overfish or overhunt them, or take away their habitat.

Practical Tips for Teachers

Mealworms

Mealworms are a very interesting and easy to maintain insect for your classroom. They require very little work and the cost is minimal; and they are harmless as well as clean and odorless. Mealworms are of high interest to students and many experiments can be done with meal worms. Like butterflies, they go through complete metamorphosis. The life cycle begins with a tiny white oval egg, which is invisible to the eye, and even hard to find with a hand held magnifying glass. The mealworm larva is cream-colored and has six legs near their head (upper part of their bodies). They will go through several molts as they grow and reach the pupa stage. The pupa appears shorter and wider than the larvae and does not actively move or feed. When an adult beetle molts out of the pupa case, it is still white, but has the characteristics of an adult beetle. Then it will turn brown and last changes to black, indicating that it is now capable of laying eggs.

The first step to preparing a habitat is to obtain a plastic shoebox. These can be found at the Dollar Tree, in your closet or ask a parent to donate one! Next you will need some plain oatmeal found at the grocery store. Place the oatmeal about an inch thick in the bottom of the shoebox. This is a food source for the mealworms and will also be their bedding. Place toilet paper rolls cut in half on top of the oatmeal. Mealworms like it dark and this will provide a place for them to crawl into or under. The habitat is now ready to receive the mealworms.

Mealworms can be obtained from bait shops or can be ordered online. Personally, I buy them at a local bait shop so I do not have to pay shipping charges (which are normally as much as the worms.) One hundred worms are around eight dollars.

Place the mealworm in their new habitat and add a slice of carrot, potato or apple for moisture. Once a week take out old vegetation and add fresh. Use a squirt bottle (the kind you would mist a plant with) to spray the sides of container every week to ten days. Hint: students love to be the zookeeper for the week and bring in a scrap to feed the worms!

Watch for the mealworms to molt, as they shed their exoskeleton as they grow. Soon they will become white pupae. After a time of transformation they will emerge as a very light colored beetle. In a few days they will turn a shiny black. Although the beetles have wings they will not be able to climb the steep and slippery sides of the shoe box so you do not have to worry that you will have beetles flying around your room. Also note that because these are not being raised to sell you do not have to divide them into stages allowing them to self-regulate their numbers. Keep in mind that one adult female can lay up to 500 eggs in her life time.

Butterflies

Butterflies develop through the process of complete metamorphosis. Watching and being part of this process is a wonderful experience for students. For classroom purposes beginning with the larva, or caterpillar stage works best.

Carolina Biology has a complete butterfly kit. The Butterflies in the Classroom Kit (with live caterpillars) includes everything you need to raise painted lady butterflies from larvae to adults - including a mesh Butterfly Sanctuary. The cost of this kit is $60.00.

Students will watch individual caterpillars eat and eat some more! They will see the remains of the outer skin after it is molted. Students will see the caterpillar attach itself to the lid then watch as it changes to a pupa. Later students will watch as the butterfly emerges, dries it wings and takes its first flight. Truly a miraculous wonder of nature.

Hatching eggs in the classroom is a very “eggciting” event! It takes 21 days from the time you place them into the incubator until you have newly hatched chicks. Preplanning is very important when hatching eggs in a classroom.

The first consideration is your time frame of when you will hatch the eggs. Ideally incubation should begin in the middle of the week so that they will hatch on a school day. Some chicks may hatch a day sooner or a day later than day 21. The other area you will need to plan ahead for is what you will do with the chicks after they hatch. You can keep the chicks for up to 5 days after they hatch, but then they need to be transported to a safe, loving place. As soon as you are committed to hatch eggs begin to gather materials and information. Materials you need are an automatic turning incubator and fertile eggs. The 4H nearest your home occasionally will have incubators you can check out for classroom usage as well as a source for eggs and a location to return the chicks. 4H also has a great curriculum called *4-H-Embryology Hatching Chickens Resource Guide* which can be downloaded.[5] If you do not have access to a 4H office, fertile eggs can be ordered on line from a variety of businesses. Carolina Biology has a hatching kit that includes 12 fertile eggs, charts and information on how to hatch eggs as well as elementary lessons for a cost of $50.00. New incubators can be obtained through EBay for $85.00 plus shipping and handling. It is very important to buy an automatic turning incubator because the eggs need to be turned twice daily and most teachers do not have access to classrooms over the weekend.

On day seven and fourteen you will want to candle the eggs. Candling involves shining a bright light into the egg, allowing you to see its contents and check whether it is developing properly. An overhead projector works well, but so will a high power flash light. When you are hatching eggs in your classroom, you will never get a 100% hatch rate. Some eggs will not be fertile to begin with (these are called "yolkers") while others will stop developing at some point during the incubation process (these are known as "quitters"). We call those who hatch “winners”. It is important that you are able to identify and remove these yolkers and quitters during the incubation process; otherwise they can begin to rot and eventually burst inside the incubator, contaminating the other eggs with bacteria. The University of Nebraska Lincoln 4H has a video of how to candle and what a winner, yolker and quitter look like[6] Do not candle eggs after day 16 because the chicks eyes are beginning to form and candling could hurt their development.

Many students will be interested in what is inside the egg. The yolk which supplies food for the developing embryo, albumen, a jelly-like substance and an air space at one end of the egg are all contained in the hard shell. The shell is made of calcite, a crystalline form of calcium carbonate. Students should also be aware that the incubator is taking place of the hen brooding process in which she also keeps the eggs safe from predictors such as snakes, birds and foxes.

Classroom Activities

Insect Live Cycles - Meal worms!

For this activity divide your room into five learning stations. Students will need their Science Journals to record their observations, experimentations and scientific drawings.

Ask students to bring in scraps of food that they believe mealworms would like to eat. Do not feed meal worms for at least two days before this activity.

In station one the students will use their skills to make a scientific drawing in their journals. Place a few mealworms in a container and add hand held lenses for students to use. Ask them to draw a mealworm then label the parts. Place index cards with the words on them that you would like for each child to label. If they have extra time they can draw a habitat for their meal worm.

Station two will have four or five paper plates placed inside of pie tins. Students will choose three or four small amounts of food from the scraps that were brought in and place them on their paper plate. Place 2 or three meal worms on the plate and have students observe which food the worms prefer. Record their conclusions in words or pictures in their journals.

In station three the students will discover whether mealworms like the dark or light. Use a small container and cover one side with black paper. Place a light source (flashlight or bulb) on the other side of the container. Place a few mealworms in the center and observe. Where do the mealworms prefer, the lighted side or the dark side? Students will record their observations

At station four have a poster of the lifecycle of a mealworm. Have students draw and label the stages in their journals. One variation of this life cycle activity is to draw the lifecycle on a paper plate, then cut the paper plate into a puzzle with a stage on each puzzle piece. Students then can put the puzzle together. Each student has created an active learning study material, which they can keep and take home.

Station five will need a long table, string, colored pencils, meal worms, timer and a large piece of bulletin board paper or butcher paper. Lay the paper on the table creasing the paper at the edges to keep the mealworms from falling off. Each student will take one meal worm and place it on the paper then follow behind the meal worm with a colored pencil to records its path. THEY MAY NOT TOUCH THE MEAL WORM! Set the timer for 3-5 minutes. After placing the meal worms back in the container they will take the string and follow the path. Measure the string to see how far the meal worm traveled. Have the students record their findings in their journal. Do small worms or larger worms travel faster?

Similar activities can be developed as the class observes different lifecycles such as butterflies. Examples for butterflies would include what conditions do the caterpillars like best, dark or bright light, what liquids do the butterflies like; Gatorade, water or sugar water?

Life Cycle Research Project

Students will create a research project. Students will decide what animal they would like to research, and if they would like to work alone or with a partner. They can choose to make a poster, flip book, diorama or a Life Cycle book. Advanced students could be encouraged to select endangered animals (see information above). Struggling students might want to select an animal similar to one that was featured in this unit such as mealworms or chickens or they may want to pair with a stronger student. When projects have been turned in, invite parents, other classrooms and staff to come to a Life Cycle Gallery Walk! If possible have students stand next to their projects and explain why they choose the animal and the lifecycle of the animal. Take pictures and post them so that the parents that could not physically come to the school can still be a part of the event.

Adopt a Manatee

It is very important for students to feel like they can make a difference in our world. Many students have little or no knowledge about the magnificent manatees. They are large, fully aquatic, endangered mammals. They are also known by the name of Sea Cows. They may occasionally be disturbed by crocodiles, and suffer from habitat-degradation, but their only significant predator is humans. Manatees are the only surviving marine mammals that eat only plants. Each one of the massive sea cows can eat upwards of 100 pounds of vegetation daily — about a tenth of their body weight. Manatee pregnancies last for 11 to 13 months. Newborns weigh about 60 pounds. After giving birth the mother gently raises the baby to the surface of the water for its first breath. After an hour the baby can swim and breathe on its own.

The students became interested in manatees after reading *Sam the Sea Cow*. After discovering that manatees are on the North Carolina Endangered List, I researched manatees and found the Adopt-A-Manatee program. I showed the students the website and the list of manatees that are up for adoption. They were eager to start a "fund" to adopt a manatee. For twenty dollars the class will receive an adoption certificate with full-color photo, and biography of the real manatee they select. They will also send a 38-page educator's guide and an 8-page coloring and activity book.

When lifecycles cannot continue in sufficient numbers to maintain a healthy population we call that animal endangered. When lifecycles no longer exist we call that extinct!

Appendix: Implementing Teaching Standards

This curriculum unit (CU) is targeted for my second grade students. The unit will address two of the Essential Standards for second grade. The first standard is Structures and Functions of Living Organisms; Understanding animal life cycles. The clarifying objectives for this strand are: Summarize the life cycle of animals including: birth, developing into an adult, reproducing, and aging and death. The second objection is to compare life cycles of different animals such as, but not limited to, mealworms, ladybugs, crickets, guppies or frogs.

The second Essential Standard I will base this unit on is Evolution and Genetics; Understanding that organisms differ from or are similar to their parents based on the characteristics of the organism. The two objectives for this standard are: Identify ways in which many plants and animals closely resemble their parents in observed appearance and ways they are different and recognize that there is variation among individuals that are related.

Reading list for Students

Aston, Dianna Hutts, and Sylvia Long. *An Egg Is Quiet*. San Francisco: Chronicle Books, 2006.

This stunningly beautiful and wonderfully informative book makes for a fascinating introduction to the vast and amazing world of eggs.

Berger, Melvin, and Gilda Berger. *Egg to Robin*. New York: Scholastic, 2004.

Presents the lifecycle of a butterfly in photographs. This is a Rookie Read-about Science book.

Fleisher, Paul. *Life Cycles of a Dozen Diverse Creatures*. Brookfield, Conn.: Millbrook Press, 1996.

Informative book introduces the life stages of 12 animals: oyster, earthworm, daphnia, honeybee, emperor penguin, sea nettle, bullfrog, monarch butterfly, opossum, sea horse, sockeye salmon, and blood fluke. The book describes how each species grows into different forms and how it reproduces its kind. Teacher resource

Fowler, Allan. *It Could Still Be a Butterfly*. Chicago: Childrens Press, 1994.

This is a Rookie Read-About Sciences Book. Beautiful photographs of the stages of a butterfly from egg to adult.

Kalman, Bobbie, and Jacqueline Langille. *What Is a Life Cycle?* New York: Crabtree Pub., 1998.

Introduces the life cycles of plants, insects, amphibians, reptiles, fish, birds, mammals, and humans, discussing birth, growth, parental care, and reproduction.

Legg, Gerald, Carolyn Franklin, and David Salariya. *From Egg to Chicken*. New York: F. Watts, 1998.

If your class is going to hatch out chickens this is the book you will want to use! Very detailed look at the stages from the nest to the adult chicken.

Micucci, Charles. *The Life and times of the Honeybee*. New York: Ticknor & Fields Books for Young Readers, 1995.

Great illustrations. Great chapter titled "From Egg to Bee" and a table of the stages of growth of a bee.

Miller, Heather, and Michael Chesworth. *This Is Your Life Cycle*. New York: Clarion Books, 2008.

In this hilarious and inventive picture book, you'll find out about the different stages of a dragonfly's life, the various predators they face, what they eat, and other amazing facts.

Royston, Angela. *See How They Grow - Frog*. London: Dorling Kindersley, 2007.

A photographic paperback designed to introduce the fascinating world of frogs and how they develop. In this informative and highly visual series, step-by-step photography allows students to see the life cycle of a frog.

Sabin, Francene, and Eulala Conner. *Amazing World of Ants*. Mahwah, N.J.: Troll Associates, 1982.

This book describes the physical characteristics and behavior of ants. Reading Level: Early readers.

Sill, Cathryn P., and John Sill. *About Reptiles: A Guide for Children.* Atlanta, Ga.: Peachtree, 1999.

A must for your classroom library. The illustrations are full page plates with great explanations in the Afterword. Depicts how physical characteristics, habitat, movement, feeding and haunting behaviors, and life cycle can vary in different kinds of reptiles, including eastern box turtle and American alligator.

Singer, Marilyn, and Emma Stevenson. *Eggs*. New York: Holiday House, 2008.

Explains the varieties, functions, and characteristics of the eggs of a multitude of creatures, including insects, birds, and reptiles.

Tate, Suzanne, and James Melvin. *Jenny Jellyfish: A Tale of Wiggly Jellies*. Nags Head, NC: Nags Head Art, 2001.

Story of a Moon Jellyfish's life cycle. Second graders will love the story and learn from the lifecycle of this primitive type of animal.

"What Is a Life Cycle?" Home Science Tools. Accessed October 31, 2014.

Woelflein, Luise, and Ruth Lindsay. *Animals That Change: Metamorphosis*. New York: Lodestar, 1995.

A time-to-Discover Scholastic book with great photographs of each stage of the robin's life cycle. A must for your classroom library.

Young, Ruth M., and Joanna Cole. *A Science/literature Unit for the Magic School Bus inside a Beehive by Joanna Cole*. Huntington Beach, CA: Teacher Created Materials, 1997.

This is a great read out loud for your class although I would recommend the book be broken into sections. Be sure to include the last section - Some things can't happen in real life!

Teacher Resources

Cernek, Kim, and Sheri Rous. *Life Cycles*. Huntington Beach, CA: Creative Teaching Press, 2003.

Teacher resource including activities, easy to use reproducibles and a transparency o help integrate a life cycle theme into the curriculum.

"Field Trip Earth: Eastern Box Turtle Population Study." Field Trip Earth: Eastern Box Turtle Population Study. Accessed November 11, 2014.

Great web site to find information for the box turtle.Teacher resource

Chicago formatting by BibMe.org.

Notes

[1] http://www.nhptv.org/natureworks/marbledsalamander.htm#6
[2] http://www.allaboutbirds.org/guide/Northern_Cardinal/lifehistory
[3] http://aggie-horticulture.tamu.edu/galveston/Gardening-Handbook/overview/Handbook-D_type_metamorphosis.htm)
[4] http://butterflyrecovery.org/species_profiles/saint-francis-satyr-butterfly/
[5] http://mecklenburg.ces.ncsu.edu/wp-content/uploads/2014/02/4-H-Embryology-Hatching-Chickens-Resource-Guide.pdf
[6]http://lancaster.unl.edu/4h/embryology/candlingphotos.shtml