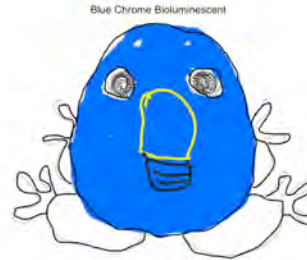Carlotta Rody and Angela Adams
Cross Creek School
1010 NW 31st Ave, Pompano Beach, Fl 33069
754-321-6450
Carlotta.rody@browardschools.com
Angela.adams@browardschools.com

Blue Chrome Bioluminescent

padded Frogs for Ranidaphiles (People Who LOVE Frogs!)

Aqua Caelus Aquafortia

For information concerning IMPACT II opportunities, such as interschool visits, staff development, workshops, and Adapter and Disseminator grants, please contact:

The Broward Education Foundation
600 SE Third Avenue, 1st Floor
Fort Lauderdale, Fl 33301
754-321-2032
www.BrowardEdFoundation.net

IMPACT II is a program of the Broward Education Foundation

cesti ∠8
Nimbus

golden-ceres-Teleporte
Michael Banks

Table of Contents

Goals and Objectives

According to the latest Broward County benchmarks and FCAT scores, vocabulary continues to be one of the largest deficits in student performance. By using technology and online gaming to learn about root words and vocabulary, students will be able to increase their knowledge of how language develops and the ways in which humans use language to identify items and organisms. Scores on vocabulary assessments are anticipated to increase.

Students will be able to:
- Use Dictionary.com© app to look up root word definitions;
- Use Notability© app to take notes and write the required paragraph;
- Use TypeDrawing© app to create the initial design;
- Use Educreations© app to create the presentation or document the design;
- Demonstrate the ability to use an IOS/Windows/Android platform to create the project;
- Demonstrate the ability to use a whiteboard to complete the design with color;
- Demonstrate critical thinking through the scientific nomenclature, and
- Utilize non-linguistic representations and build models.

Note: Students in a non-MAC classroom can utilize Windows/Android platforms. None of these applications cost more than $3.00 at the time of this authorship. There are hundreds of other applications that will work just as well as the ones we have listed. These were the easiest to use, took the least amount of time to learn, offered the best product for the time spent and were easy to share among devices and platforms.

S**tudents**:
Our high school, 9th grade remedial reading class used this project to learn Greek and Latin root words that were required for the course. Needless to say, the students could see no real world application for learning these root words. We came up with this lesson as a way to have students learn in their preferred method of using technology but doing so through a game they liked to play. The majority of the students completed the project, and there were some incredible designs submitted for the contest. We did contact NimbleBit, LLC, and asked about submitting the designs to the company. They are not working on the update release for the Pocket Frogs game at this time, but they indicated that they would be happy to look at what we have accomplished.

Quotes:

"I chose this root word because as soon as I saw it, a design popped into my head!" made by a student who originally did not want to do the project.
"I chose a strong root word because I want a strong frog." made by a student who does not like to read or write.
"I wish we would have had this class before we designed the game. It would have helped us with the designs." This was a statement made by one of the game's online support staff.

We used this lesson in a high school reading class but have had students in K-12 classrooms play the game and learn some of the Latin and Greek root names. With little modification, this lesson can be taken up or down. The 2D or 3D model can just as easily be a coloring page or an art project with finger paints for the younger grades or become a tandem project between science and art classes to incorporate the writing standards.

Disseminators:

Mrs. Carlotta Rody

Mrs. Rody has been a science teacher for students with emotional/behavioral disabilities for over 16 years and currently serves as the curriculum specialist for Cross Creek School. She has been the recipient of several BEF grants including Disseminator, Adapter and Teacher grants. During her 16+ years, she was named the 1999 Environmental Teacher of the Year award, the 2007 Cross Creek Teacher of the Year, and was a District finalist for 2007 Teacher of the Year. She earned the 2006 National Outstanding Teacher of the Year from the Council for Children with Learning Disabilities and was presented with her award in Washington, D. C. In 2006, she was named as the Outstanding Graduate Student of the Year for the Exceptional Student Education Department at FAU. She is an adjunct and doctoral candidate at Florida Atlantic University. She holds elementary, middle and high school certifications in Elementary content, Earth Science, Biology, and Exceptional Education K-12 certifications in Varying Exceptionalities and Emotional/Behavior Disabilities. As part of her professional growth and doctoral pursuit, she presents topics at major district, state, regional, national and international conferences that include learning disabilities, assistive technologies, instructional strategies and research outcomes. Her hobbies are creating art glass, reading, working in her yard and garden, and being a Wildlife Habitat Steward for the County.

Mrs. Angela Adams

Beginning as a teacher's assistant, Mrs. Angela Adams has worked in special education for over 20 years, but began her teaching career nearly 10 years ago. After raising her family, she returned to college and completed her education earning a Bachelor's of Science degree in Education with a concentration in Varying Exceptionalities from Nova Southeastern University in 2003. In the 2002-2003 school year, Mrs. Adams was inducted into Nova's chapter of the Alpha Chi Honor Society. She continued her education through Capella University, earning a Master's of Science degree in Education with a concentration in Reading and Literacy in 2009. Mrs. Adams has taught elementary and middle school students and currently teaches high school reading. She chooses to assist students with emotional and behavioral disabilities at Cross Creek School. In addition to her responsibilities at Cross Creek, Mrs. Adams is an adjunct professor at Broward College working with pre-service teachers in the Teacher Education Program (TEP). Mrs. Adams earned a BEF Adapter grant last year that was utilized this year for this lesson plan. In her free time Mrs. Adams enjoys listening to music, reading inspirational books, watching old movies (black and white) and spending time with family.

Beige Caelus Hyarotaxises

Outcomes:
The high school students liked the project because it was a real-world application for learning the Latin and Greek root words in a way that made sense to them. Seventy percent of the enrolled students finished the project with a passing grade on the project and assessment or quizzes. Behaviorally, out-of-class instruction time due to attendance issues or negative behaviors was reduced by 60% during the lesson. Using Marzano's non-linguistic representation strategy was a good way to have students build a model frog, either by drawing it with the technology tools or creating it in 2D or 3D versions.

List CCS/SSS/NGLN

<u>Standards</u>

NGSSS:

Reading

LA.910.1.6.7 - identify and understand the meaning of conceptually advanced prefixes, suffixes, and root words;

Writing

LA.910.3.4.1 - spelling, using spelling rules, orthographic patterns, generalizations, knowledge of root words, prefixes, suffixes, knowledge of Greek, Latin, and Anglo-Saxon root words, and knowledge of foreign words commonly used in English (e.g., laissez faire, croissant);

LA.910.3.5.1 - prepare writing using technology in a format appropriate to the purpose (e.g., for display, multimedia);

Research

LA.910.6.2.1 - select a topic and develop a comprehensive flexible search plan, and analyze and apply evaluative criteria (e.g., objectivity, freedom from bias, topic format) to assess appropriateness of resources;

CCSS: Reading Craft/Structure

Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings; analyze the cumulative impact of specific word choices on meaning and tone (e.g., how the language evokes a sense of time and place; how it sets a formal or informal tone).

CCSS: Research to Build and Present (Art, Science and Technology)

LACC.910.WHST.3.7<u>:</u> Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Marzano's Instructional Strategies:

Identifying Similarities/Differences, Non-linguistic Presentations, Cooperative Learning

Webb's Cognitive Complexity: L3 Strategic thinking, L4 Extended Thinking

Course Outline

This learning strategy uses the individual's learning modalities to add to his or her vocabulary knowledge base. Today's students are plugged into technology that requires them to learn on the fly as technologies constantly change. Asking students to learn vocabulary the same way it has been taught for hundreds of years is no longer a viable teaching strategy.

In an effort to increase learning gains in this critical deficit area, our teachers tapped into the students' natural kinesthetic learning modes of technology, art and gaming. Students use the technology available within the school or classroom to define Latin or Greek root words, learn how humans use language to name things, create a visual representation of a new species of frog and end with creating a 2D or 3D model of the new frog. Discussions occur over why words were visually depicted in various ways. These review discussions serve two needs: critical thinking about how others see the same subject differently from the artist, and generalization of the vocabulary among peers and settings.

Teachers disseminate the vocabulary root word list.
Students work in pairs, groups or individually:
1. Use Dictionary.com© to look up root definitions;
2. Notablilty© to take lecture notes and identify vocabulary word usage;
3. TypeDrawing© to create the visual representations of the word;
4. iPad2© camera to document the progress of the project;
5. Educreations© to create the presentation of the new species of frog;
6. Create a model, 2D or 3D, of the frog, and
7. Form a judging panel to decide on the best two designs to submit to NimbleBits, LLC.
Teacher and students showcase the models for review discussions. Students take vocabulary assessments.

Note: The strategy is designed to occur over 4-5 50-minute sessions. You may need more time if the models are going to be created out of something other than paper. If you can tap into your Art teacher's lesson, the model can be created in Art classes.

Use the frog outline below and the pen tool above to draw your frog design. When finished with the design, tap back on the text tool and complete the questions below the design.

Frog name:

Please explain the frog's name (Latin or Greek), why you chose the name and why and for what the design stands.

Use complete sentences and check your grammar.

Lesson Plans

Frogs With Roots!

Understandings:

The student will understand that:

- Root words have meanings.
- Knowing the meaning of a root word leads to an understanding of the whole word.

Essential Questions:

How do root words affect the development of language and the ways that humans apply words?

Students will know:

Greek and Latin root words with their meaning, and how those meanings are used scientifically to name items and organisms.

Students will be able to:

- Identify the root of an unfamiliar word.
- State the meaning of identified roots.
- Apply root word knowledge to real-world problem solving.

Performance Tasks

Gaming Design Company: NimbleBits, LLC, a game design company, needs a new frog species in an update release for its most popular game, Pocket Frogs©. You are an engineer and need to develop and name a unique frog species to submit for the collection. The name must include a Latin or Greek root, a primary color and a secondary color. The frog design must be a visual representation of the root word or incorporate the root word into the design. Frogs have levels, status, stamina and value, all of which should relate to the root. Design a 2D or 3D model of the frog to be used in a presentation to the company.

Frog Design Contest: Several frogs have been submitted to the Pocket Frog Design Contest. Form a panel of judges to evaluate each submission. Using the **Frog Design Project Grading Checklist:** check for choice of root name, how well the meaning is reflected in the design, level, status, stamina and value of the new frog species. The top two frogs will be made into 3-D models.

Other Evidence

- Weekly quizzes on vocabulary and root words;
- Oral explanations/discussions during reading, and
- Game formatted reviews (interactive whiteboards).

ESE/ESOL Strategies:

A10 Pacing of lessons

B1 Categorize Vocabulary

B2 Explain Key Concepts

B4 Semantic Feature Analysis

B5 Structural Analysis

B8 Vocabulary with Context Clues

E7 Peer Pair

G9 Rubric

Learning Plan

1. Introduce/review concept of affixes and root words (whiteboard).
2. Research the origin of selected root words (over the course of 6 weeks).
3. Using iPads/iPods, introduce students to Pocket Frogs game. Students will discover how frog levels, status, stamina and value relate to their root name as they play the game and move through the levels.
4. Students will identify and evaluate words that contain taught roots when reading assigned selections.
5. Students will take weekly quizzes on previously taught roots.

Root Word List

These root words are from the *Vocabulary Through Morphemes* program. You can use these, or you can use roots derived from your curriculum vocabulary. There will likely be some overlap.

Greek	**Latin**
Astro	Aqua
Aster	Port
Bio	Rupt
Auto	Script
Homo	Cept
Hydro	Spect
phon	Struct
Phone	Ject
Scope	Dict
Micro	Mort
Macro	Mit
Graph	Flex
Gram	Cred
Photo	Pel
Tele	Vert
Meter	Press
Metry	Tract
Path	
Psych	
Pan	
Zoo	
Chron	
Phobia	
Phobe	

Evaluation and Student Assessment

Name _____

Frog Design Project Grading Checklist

Design Name (3pts)   _____

Root word base   _____

Primary color   _____

Secondary color   _____

Design Symbol (3pts) _____

(Symbol must demonstrate a relationship to the root word)

Design Paragraph (3pts) ____

Includes:

Full name (primary, secondary, root name)   _____

Why you chose that name   _____

Explain your symbol's relationship to the root   _____

Product submitted on time (3pts) _____

Total Points: _____/12   Grade _____

Comments:

_____

_____

_____

_____

Resource List

http://animaldiversity.ummz.umich.edu
This link goes to the online Animal Diversity Web maintained by the University of Michigan. This is an excellent site for understanding the nomenclature used by scientists when naming new species. The frog section is excellent.

http://www.nimblebit.com
This link takes you to the webpage of the Pocket Frog© designers. Their support staff has been excellent.

http://lagniappeartglass.blogspot.com
This is a link to Mrs. Rody's blog about what goes on in the Lagniappe Learning Lab. The link provides information on what works in difficult classrooms.

Use a QR reader on your mobile device to go directly to the blog.

Speakers

Diana Guidry, Natural Resource Specialist II
Natural Resources Planning and Management Division
Room 329-H, 115 South Andrews Avenue, Ft. Lauderdale, Fl 33301
Office: 954-519-0317, Fax: 954-519-1496
www.broward.org/naturalresources/naturescape
    Diana has a personal interest in frogs and participates in the frog count yearly. Her yard is a certified Wildlife Habitat. Please contact her about having someone come and speak to your class.

Audio/visuals (movies, slides, videos)

http://animaldiversity.ummz.umich.edu
This link goes to the online Animal Diversity Web maintained by the University of Michigan. This is an excellent site for understanding the nomenclature used by scientists when naming new species. The frog section is excellent.

http://app.discoveryeducation.com/core:player/view/assetGuid/AC12C1A9-361D-4F8A-8940-B0E35EB5A39A
This is a link to Discovery Education (BEEP) to the 24 minute video and its segments titled: Frogs: Facts and Folklore.

Supplemental materials (suppliers, supplies, prices)

- Tablet/iPad with camera 499.00
- Stylus ………………………………………… 14.99
- iTunes applications ....Free
- Notability© 2.99
- TypeDrawing©...2.99
- MindNode…………………………………………..4.99
- iPhoto©…………………………………………...…9.99
- iMovie©, ...9.99
- Keynote© 9.99
- Dictionary.com app ....Free
- Connector kit for cameras to iPad2©.......................29.00
- VGA adapter or Component AV cable for iPad2© .39.00

The iPad2© device syncs to a mother computer. That computer purchases the applications and downloads the apps to the mobile devices. Apps are purchased once and can be downloaded to several iPad2©. Tablet PCs or Windows/Android mobile devices use some of these same applications. You do not have to use an Apple product.
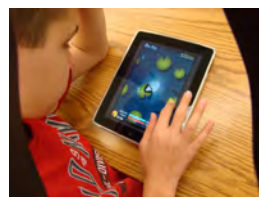
We use the instructional resources listed under the Teacher Portal through BEEP. The rubrics were created using Rubistar. Atomic Learning tutorials are in BEEP.

LCD projectors and screens were used in classrooms that did not have digital interactive whiteboards. The flipcharts/podcasts/slideshows were displayed for whole class instruction and discussions.

Blogspot.com offers free blog space.

www.floridastandards.org Common Core State Standards

Bibliography/Reference

Ebbers, E. M. (2004). Vocabulary through morphemes: Suffixes, prefixes, and roots
for intermediate grades. Longmont, CO: Sopris West Educational Services.

Adapter Grant Suggestions

For a modest investment of around $600.+ , the iPad or tablet becomes a versatile center where your students can work. By connecting the device to a projector and using the display to demonstrate concepts, you will find that students become engaged in lessons that carry a heavy content load. When you apply for the Adapter Grant, adapt this lesson to your students' needs. Please do not say that you are going to do exactly what we did as that is not possible. Adapt the lesson and apply for the grant. Good luck!

Teachers' Work Samples

Mrs. Rody's Frog name: Black callainia Astro

Astro is Latin for *constellation*. My favorite constellation is Ursa Major but Ursa Minor points the way to the North Star, Polaris. Ursa Minor means Little Bear and Polaris means the Polar star. Ship captains used Polaris to navigate the oceans. My frog was a combination of Stellata and Signum. When the right combination of black, purple, and callainia come together, they breed a recessive trait that connects the dots on Signum to form the Ursa Minor constellation and finishes the dipper end with a single star, hence the name Astro.

TypeDrawing© sketch
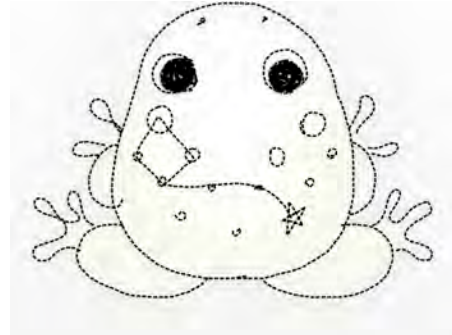
Mrs. Adams' Frog name: Aqua Caelus Aquafortia

My frog is Aqua Caelus Aquafortia. It is from the Latin root words aqua, which means water and fortis, which means strong. I chose a wave to represent my frog because it reflects the powerful nature of water. Waves can be gentle but are most remembered when they demonstrate their strength!

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Mrs. Sally Judd – Tangelo Viola Chron

My frog's name is Chron, deriving from the Greek root meaning time. Throughout the ages, humans have developed ways to measure time. The earliest civilizations used the celestial bodies to measure days, months, seasons, and years. As the need arose to be more precise in measuring time, sundials were used to mark the movement of the sun across the sky. As technology advanced so to did our skills to become more exact in the ability to quantify time. Global standards were developed and now agencies around the world maintain a single uniform system. A simple clock face depicts the concept of time on Chron's back.

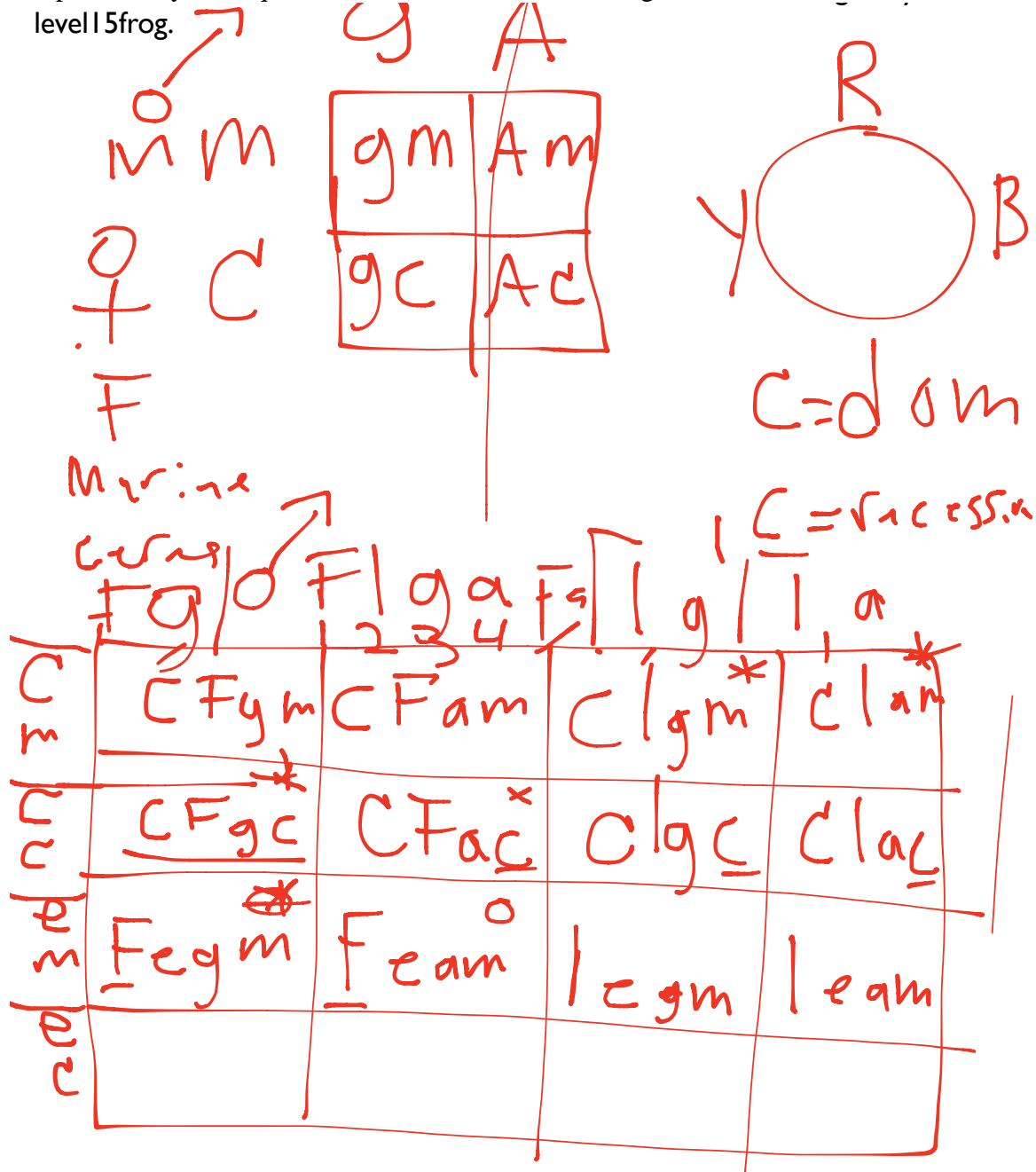My reference was: The National Institute of Standards and Technology (NIST). A Walk Through Time. http://www.nist.gove/pml/general/time/index.cfm.

Student Work Samples

cesti L8
Nimbus

golden-ceres-Teleporte

Michael Banks

Golden ceres Teleporte

My Pocket Frog will be a Golden-ceres-Teleporte. It will have the design of an old style cell phone. It will be golden with a black cell phone, a golden stripe, a Ceres nimbus and lightning on its legs. I chose tele because I thought it would make a cool design for a frog. I chose this root word because as soon as I saw it, a design popped into my head. The design stands for old school telephone for communications. This is a legendary frog. It is the offspring of the Golden-Albeo-Floresco and the Marine-Ceres-Cesti in order to get my level15 frog.

Sample of Dihybrid Square – with some incorrect coding

level15frog.

level15frog.

Mom ♀
g   A
M | gm | Am |
C | gc | Ac |

R
Y   B
C=dom

C=recessive

Marine
corns
♂
Fg

	F g	F g a	a F	g	l	a
Cm	CFgm	CFam	Clgm*	Clam
Cmc	CFgc	CFac×	Clgc	Clac
md e gm	Fegm*	Feam°	legm	leam
ec				

Sample of corrected Dihybrid pairings

Green tingo Microscopi

Dalvin L.
Why I choose micro is because I like science and biology. Science is my favorite subject in school, and I also know a lot about microorganisms and atoms. With a microscope you can see things that are really hard to see with a human eye. The color I pick for my frog is green-tingo; the design I'm going to put on my frog is a microscope.
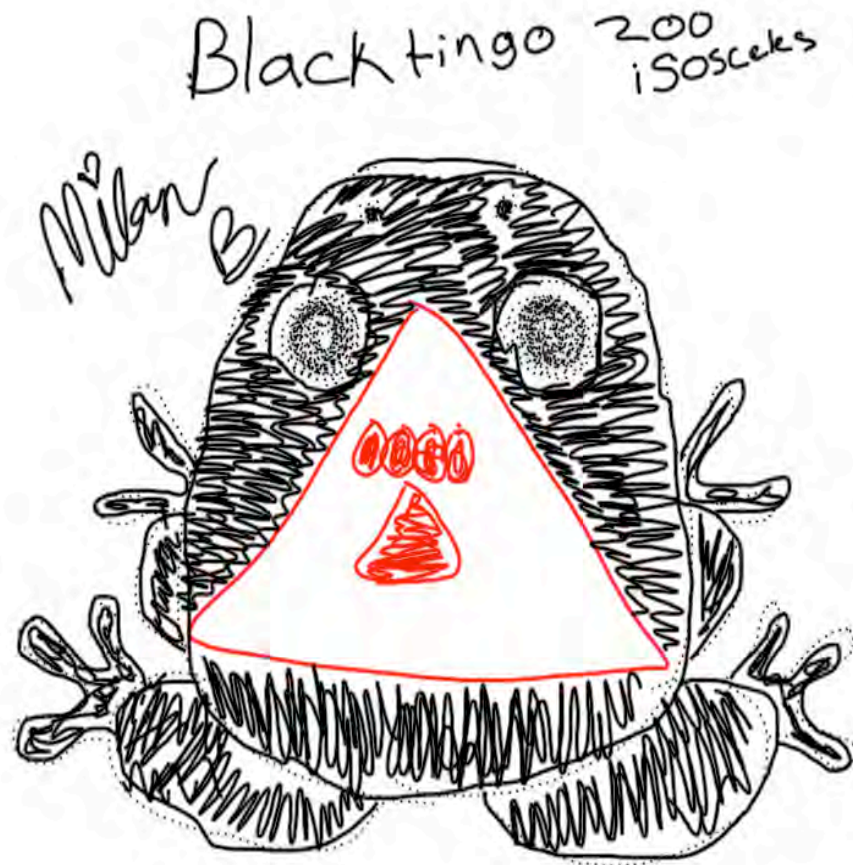
Black tingo Zooisosceles

Milan B.

I named my frog black-tingo zoo isosceles. My design is a triangle and a paw print. This stands for living being and animal. I choose the name because it's unique. The root word is zoo. This explains the design for the paw print. I named it isosceles because the triangle of life and the word zoo stands for life.

Klara f. Photoflorous

Royal anurm Photoflorous

Klara C.
My frog's name is called photoflurous. The name is a mixture of the Greek and Latin. It comes from the Latin root word florus. The Greek root word photo means light and florus means flowered. The frog will have a flower representing blossom meaning florus, and a sun representing photo meaning light.

Incomplete Designs
Included because they showed creativity but did not finish the project.

Glass Coles Asterenenge
Jeremiah
B.

Beige caelus Hyarotaxises

Blue Chrome Bioluminescent

Glass Fleximuscle
Picea

Untitled
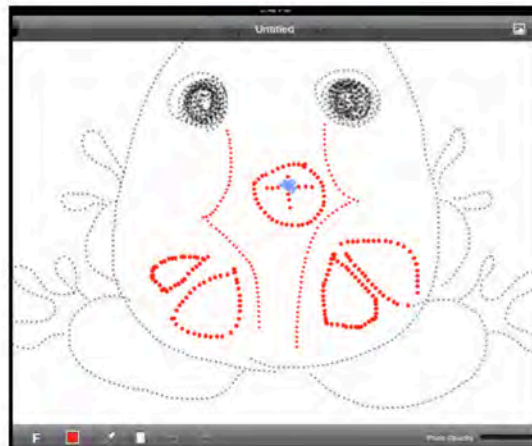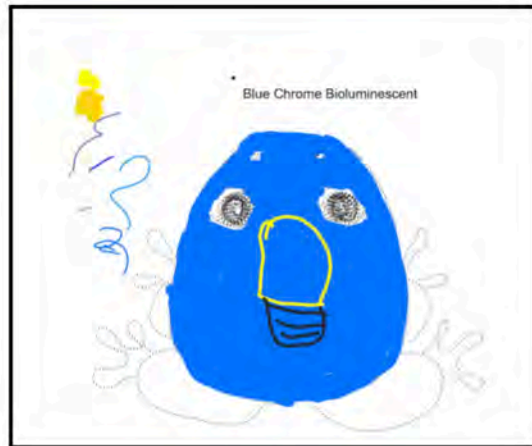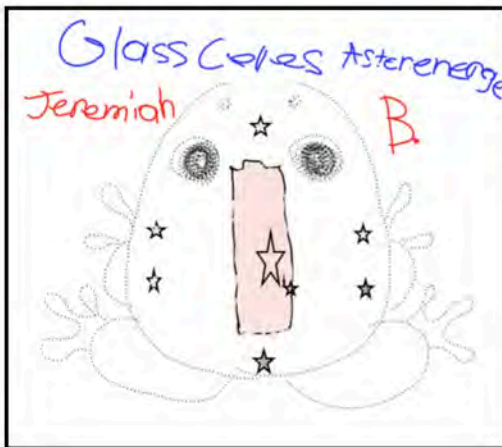
Pocket Frog

My Frogs name is a lime prunie homogen
The reason for I picked the name is
because the lime is the color of the front
part of the frog and back sides and the
purpleish prunie for the back of it it's a blood/a
Deep plum purple that goes well with the lime,
homejeans stands for some, some as the back
side patters of the frog are same = homo

The lime Prunie
homo jean.

Root word(Flex)muscle
Primary color(Glass)
Secondary color(Picea)

The reson I Picked the word Flex
is becuse I came up witha cool name. The
name of my frog is flex muscle. The reson
I picked that name is bechase I like a
strong frog. The picter is going af a man
flexing

Challenge or Extension Materials

The disseminators fully realize that not all Adapters will be teaching remedial reading courses. We are including some materials that can challenge those students in Biology, Zoology, or Environmental Sciences as well as students in a gaming course. Not to leave out the elementary students, we are including some lessons on colors and how the frogs use color to determine dominant and recessive traits. Using the frogs and their offspring is a great visual way to create Punnet squares and carry the inherited traits into dihybrid squares. **These are copied directly "as is" from their respective websites**. We did not correct their spelling or grammar.

http://lauraspector.hubpages.com/hub/Color-Theory-Made-Easy---Childrens-Art-Project

Art Lessons for Kids - Color Theory Made Easy

by Laura Spector 266 Followers
A sample project using water soluble oil pastels.
This is the template I used to begin the project.

Students Hard At Work Learning Color Theory
A Cool Way to Make a Hot Project!

I've been teaching oil painting classes for about six years now. Every student has their strengths, but one thing that most of them have in common is they get stumped when it comes to which colors to use.

This is a great project for both reminding adults and teaching children about the basic principles of color theory. Not only is there an immediate example of warm and cool colors, there is also a very good exercise in learning complimentary colors!

First of all, since we don't have a color wheel in front of us, I'll just go ahead and explain that all colors come from the *Primary colors,* which are: **Red, Blue** and **Yellow.**

When artists talk about *Complimentary Colors,* they are talking about the opposite colors to the Primary Colors. Complimentary colors also exist exactly opposite of one another on a color wheel.

Here are the complimentary colors:

Red and Green Blue and Orange Yellow and Violet

One way to remember the three sets of compliments is to to try to remember a theme of where you've seen them before: Red and Green remind me of Christmas. Blue and Orange remind me of the colors of a sports team. And, Yellow and Violet remind me of a Wizard's hat - a purple hat with yellow moons and stars. How are complimentary colors used? Artists use compliments for several

different reasons. One thing they use them for is to make **Pop Art.** When using only complimentary colors in a painting, the colors tend to *POP* right off the canvas! Another way to use them, is as a shadow color. For example, if you have a red cup, instead of using grey or black for the shadow, try using a dark green. If you use the complimentary color as the shadow (and make it a little darker by adding a tiny bit of black to the color- especially with paints), it makes the whole work of art a little more interesting.

The other aspect of this project is to learn **Warm** and **Cool** colors. Warm colors are generally colors that are associated with things that are warm: The sun, ovens, summertime, overheated cars, sweaters and exercising. Cool colors remind us of things that are cool: Swimming pools, snow, ice tea, rainy days, the sea and a breeze. Warm and cool colors are helpful to remember when you're trying to figure out what colors to paint or color your picture.

What you'll need to make your Color Theory Project:
A white sheet of paper with concentric circles on it. I made mine in iweb. You can make one in Photoshop or Adobe InDesign, or any other program that allows you to make circles. If you don't have a computer, try using a compass instead. If you're working with little children, try to make the rings a little bit bigger than you would for older kids.
* When I create this project for a class, I make one template and photocopy it.
A pencil
Colors. I have used oil pastel, watercolor pencils, acrylic paint, watercolors, water soluble oil pastels and crayons. Any of these will work well, as long as you get solid, strong colors. Using materials that will be opaque will make the project more fun to look at after its done. If you use materials that require water, you may want a thicker paper to start with.

How to Make Your Hot Hand Cool:
Outline your hand on top of the concentric circles. *If you have tiny hands and want a challenge, you can outline two hands!*
Start with your background Cool colors: Blue, Violet and Green. Count out the stripes to make sure you don't miss any. I usually make a mark inside each stripe so I don't lose track of which color I'm using.
After you finish your background, take out your Warm colors: Red, Orange and Yellow. Match up the colors to their compliments and fill them in. Don't forget little shapes of the fingers that may overlap into two different colors!
This is a great project to keep "handy" when you're ready to move on to more difficult coloring or painting projects. If you would like to preserve it, I would recommend framing it. Or, if you want to store it, store it flat with a clean sheet of white paper on top of it to prevent smearing.
A variation on this project is to use Colored Pencils with older students.
And, remember: Art, like any other skill is a practice which gets better each time you do it!
If you liked this project, check out Color Theory Made Easy - Monochromatic Colors!

These are some books I recommend:

1. The Art of Teaching Art to Children: In School and at Home
Amazon Price: $9.17 List Price: $17.00

2. The Art Book for Children, Book Two
Amazon Price: $12.64 List Price: $19.95

3. Eye for Color, An
Amazon Price: $9.98 List Price: $35.00
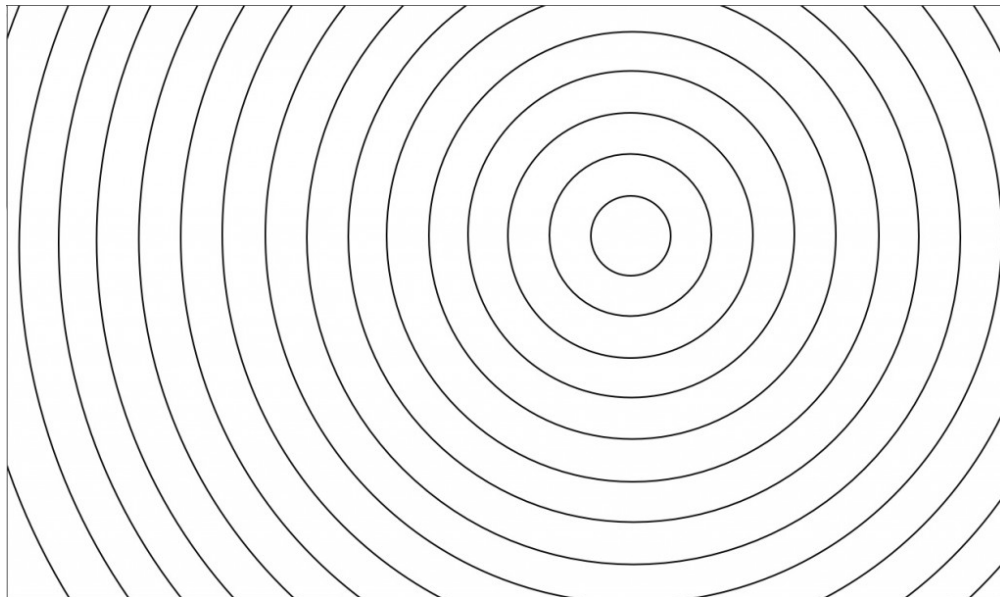
4. The Artist's Way Workbook
The Artists Way Workbook is my favorite art book for adults!
Amazon Price: $8.88 List Price: $18.95
This Hub was last updated on November 9, 2010

L. S. template

Sample Student Work

Enchanted Learning

This url takes you to one of Enchanted Learning's many pages packed full of information on color: Color Mixing and the Color Wheel.

Eric Carle

Notes for Parents and Teachers on using *Hello, Red Fox* with children

Message From Eric Carle
Looking Long Enough Reveals the "Magic"
Looking at *Hello, Red Fox*
Looking Together - Sharing *Hello, Red Fox* with Children
How Artists Paint Color Subtractive Primaries and Complementary Colors
The Colors of the Rainbow: Sir Isaac Newton's Discovery How the Eyes See
Color Additive Primaries

Message From Eric Carle

"Over the years I have demonstrated to young children the basics of color theory developed by Johann Wolfgang von Goethe. I ask them to tell me what the opposite of black is.

'White!' the children shout.

'What is the opposite of red?' I ask.

The children seem bewildered. How can red, or any other color, have an opposite color?

Even very young children are fascinated when I then demonstrate that, yes, red has an opposite color.

My book is not required for a demonstration. All you need is a well-lighted white background and a brightly colored object—let's say a red glove. The glove can be real or cut from a red piece of paper.

Place the red glove on the white background. Ask the children not to move their eyes, as they stare at the red glove and count to ten. All this should be done quietly and peacefully.

Then remove the red glove, but not before the children have promised that they will keep their eyes on the spot where the red glove had been but no longer is. Slowly and faintly a green glove will appear and then disappear. Green is the opposite, or complementary, color of red.

Some children believe this is magic, a trick or an illusion. I tell the children that it is not, that something is taking place between the eye and the brain. My optometrist, Dr. Grossman, tells me it is called "simultaneous contrast after-image."

Looking Long Enough Reveals the "Magic"

Recognizing and understanding complementary colors is a task that can both fascinate and frustrate children of all ages. Author-artist Eric Carle is the ideal person to lighten up the learning process. **Hello, Red Fox** is a delightfully simple and funny story that lets his readers in on an artist's secret: Look at things long enough and all will be revealed to you.

Carle's gentle explanation is correct. But there is also a bit of magic at work here. In creating **Hello, Red Fox,** Carle has made more than a book about understanding Goethe's color wheel. He has subtly, slyly, and generously invited his readers to take an artist's view of a story. With a bit of patience, you and your children will be amazed at what you can see!

Looking at *Hello, Red Fox*

In *Hello, Red Fox,* Eric Carle uses his own vivid collage illustrations to demonstrate the concept of complementary colors.

Little Frog invites Red Fox, Purple Butterfly, Orange Cat, Green Snake, Yellow Bird, Blue Fish, and White Dog with Black Spots to his birthday party. But when the guests arrive, Mama Frog is confused. Red Fox is green, Purple Butterfly is yellow, Orange Cat is blue, Green Snake is red, Yellow Bird is purple, Blue Fish is orange, and White Dog with Black Spots is black with white spots! Little Frog says Mama didn't look at his friends long enough. And sure enough, when the reader stares at the guests and then at the white facing pages, the animals show their true colors.

Hello, Red Fox has something for everyone. Preschoolers will enjoy the sweet and simple birthday story, and young and old alike will enjoy the challenge of trying to see the opposite colors. An author's note and endpapers featuring Goethe's color wheel will intrigue art and history lovers. And educators will marvel at the diversity of questions—on topics ranging from art to science—that this seemingly simple story provokes.

Looking Together - Sharing *Hello, Red Fox* with Children

1. Hold up the book and read the title aloud. Ask if something about the cover illustration is
surprising (Red Fox is green). What do your children hope that the book will explain?

2. Open the cover of the book and ask children to describe the image in the endpaper. What do artists call this bright circle? (A color wheel) Read the information about Goethe and his theory of complementary colors. Note that Goethe places complementary colors opposite from each other on the color wheel. Why might complementary colors be important to the story? Turn the page to begin finding out. [Note: For younger readers, you may want to read the story at least once before presenting Goethe's color wheel and biographical information.]

3. As each child sees the complementary color images on the white pages throughout the story, ask him or her to describe the colors and shapes which come into view. [Note that every color is reflected back as its complement.]

4. After the story has been read and enjoyed, review (or present) Goethe's color wheel. Can your children help to prove that Goethe's complementary color wheel enables us to predict the color we will see on each white page after viewing the image on the page before? Without reading the text, page through *Hello, Red Fox* again. Stop at the illustration of the fox. Ask students to name the animal, then to describe the color of the illustration: green. Next, find green on the color wheel and draw your finger straight through the center of the wheel until you touch the complementary color on the opposite side: red. What is the animal's name? Red Fox.

5. Have the children test their conclusion by again staring at the image, then moving their eyes to the white page as instructed at the beginning of the story. Is a red fox what they see? Yes! Repeat this exercise for the butterfly, cat, snake, bird, fish, and flower. Have the children rest their eyes between each animal.

Johann Wolfgang von Goethe (1749 - 1832)

German poet, novelist, and philosopher, also developed a color theory.

How Artists Paint Color Subtractive Primaries and Complementary Colors

Most people first learn about colors from an artist's point of view. Artists create colors by mixing paints, or pigments, of red, yellow, and blue. These are the three colors we most often think of as the primary colors. More accurately, they are called primaries of pigment, or the subtractive primaries, because when you mix all three together in equal amounts, the result is black. The complement of any subtractive primary can be created by blending the other two primary colors. For example, the complement of blue is orange, or a blend of yellow and red. Or, taking it the opposite way, the complement of green is neither of its components (yellow and blue), but the sole remaining primary color: red. On Goethe's color wheel, each primary color is sandwiched between the complements of the other two subtractive primaries.

Color Wheel Soup (for younger children)
Materials: Water; paper cups; spoons; cornstarch or flour; red, yellow, and blue food coloring.
Activity: Have children help you stir together two tablespoons cornstarch or flour and four tablespoons water in each of three cups. Add several drops of food coloring to each cup to make yellow, red, and blue "soup." Have students look at the color wheel. Which colors have they made? What other colors do they need to make up all the colors of the color wheel (orange, purple, green)? The color wheel can tell us how to mix these colors. To make orange, blend the two colors which sit on either side of it on the color wheel (red and yellow). Spoon equal amounts of red and yellow "soup" into a clean cup and stir to make a smooth orange color. What does the color wheel tell children they will get if they mix yellow and blue (green)? Make a soup to prove it. Repeat for purple. Allow children to further experiment with their color "soups."

Draw Your Own Color Wheel (for older children)
[Note to parents and teachers of young children: You can create the outline for the color wheel as described below or by tracing the outline from the color wheel in **Hello, Red Fox,** and then have the children color in the colors.]
Materials: White paper; red, orange, yellow, blue, green, and purple crayons or felt-tip pens; a pencil; a compass; a protractor.
Activity: Have students use the compass to draw a large circle on the white paper. Then, keeping the point of the compass in the same place, draw a smaller circle inside the large one. Use the protractor to measure out 60-degree intervals around the "wheel" and draw lines to divide it into six equal sections. Finally, without looking at the **Hello, Red Fox** endpapers, have students use what they have learned above to correctly fill in the six spaces on their own color wheels.
Did you know...? Many artists and artistic movements, especially around the turn of the last century, included special theories about light and color. Learn more about Vincent Van Gogh, Georges Seurat, Paul Cezanne, Piet Mondrian, Wassily Kandinsky, Paul Klee, Fauvism, Impressionism, Post-impressionism (particularly pointillism), and De Stijl (architecture).

The Colors of the Rainbow: Sir Isaac Newton's Discovery
Sir Isaac Newton is considered to be one of the greatest scientists of all time. Early in his career, he became interested in the study of optics. Newton suspected that colors occur because sunlight is a combination of different colors of light, and that various interferences cause colors to appear by separating the sunlight into its different components. To prove this, he used a special type of prism to "split" a sunbeam into its component colors—red, orange, yellow, green, blue, indigo, and violet—the colors of the rainbow.

Today, scientists call these colors "the spectrum of visible light"light that the human eye can see. Visible light is only a small part of the total energy spectrum known as the electromagnetic field, which also contains shorter waves (infrared, radar, radio) and longer waves (ultraviolet, X-rays, gamma rays) invisible to the human eye.

Making Newton's Rainbow (for all ages)

Materials: A prism; a large glass bowl of water; a sheet of white paper; a hand-held mirror.

Activity 1: Hold the prism in a window so that the sun shines through and is diffracted into a rainbow of colors. Ask the children to describe what they see. [Note: the many surfaces of the prism "bend" the light rays coming from the sun to reveal all the different colors we can see.]

Activity 2: Can a bowl of water reveal a rainbow? Place the bowl on a table in direct sunlight. Hold the white paper between the bowl and the window. Position the mirror on the side of the bowl away from the window and adjust it until it reflects sunlight through the water, making a rainbow appear on the paper. Ask children to describe the colors they see. What is the shape of this rainbow? Can the mirror be moved to change the rainbow's shape? [Note: The water-mirror rainbow is more primitive than the prism rainbow and may reveal an unusual shape and/or less than seven colors.] Compare the water rainbow to the prism rainbow.

Did you know...? In the sky, a rainbow is the reflection of sunlight through millions of lingering raindrops. The angle at which sunlight enters the raindrops affects the rainbow's appearance. The higher the sun is in the sky, the closer to the ground the rainbow appears to be. When the sun is higher than 42 degrees above the horizon, the rainbow is invisible to eyes on Earth.

Sir Isaac Newton (1642-1727) English mathematician and physicist

How the Eyes See Color Additive Primaries

The human eye sees colors in a slightly different way than artists mix them. For the eye to perceive color, there must first be light. The eye has just three receptors for colored light—red, green, and blue—that send messages to the brain so that we can perceive over a million shades of color. These three receptor colors are called the additive primaries of light, because when light composed of these three colors is mixed in equal amounts, the eye perceives white (black is perceived by the eye as the absence of any of these colors of light.) How does this explain your eyes' experience in *Hello, Red Fox?* The red pigment of Eric Carle's collage of the red heart absorbs all the light waves coming from the sun except for the red waves.

The red waves are reflected back into the eye and excite the red receptors, sending a message to your brain that "this color is red." Staring at the red heart for several seconds "tires out" the brain's color receptors for red, and they stop responding well. Normally light bounced from a white surface reflects all colors, but when you shift your gaze to a white page at this moment, the red receptors are too tired to react to the red portion of the light bouncing up from the white paper. What you "see" is white light with the red receptors' message subtracted, or the response of your "well-rested" green and blue receptors: a situation your brain defines as green. This sounds complicated, but to scientists it is only a general outline. Researchers are still trying to figure out many details about the way we see and interpret color.

Curiosity Cards (for younger children)
Materials: White paper; colored crayons.
Activity: Give each child a sheet of white paper and ask him or her to fold it in half, greeting- card style. Along the top edge of the card's cover, help each child to write the question "Can you see the color/animal?" Have him or her choose an animal and a color (red, orange, yellow, green, blue, or purple). Have the children open their cards. To the left of the fold, ask them to draw their chosen animals in their selected color and write "Look at this for ten seconds" below the illustration. Next, have children draw a small black dot in the center of the paper to the right of the fold with the caption "Then look at this dot." [Note: For very young children, you may want to
prepare folded, captioned cards in advance of the activity. The black dot is not required, it merely facilitates the eye to focus.] Have classmates exchange cards and try the after-imaging experiment.

Colorful Shadows (for older children)
Materials: Three flashlights; red, green, and blue cellophane; rubber bands or tape; a white wall.
Activity: Affix a different color of cellophane completely over the lens of each of the three flashlights, securing them with the rubber bands or tape. Have three children stand side by side and shine the red, green, and blue lights on the white wall, working together until all three lights focus on one point. The light on the wall should appear white. Hold a small, opaque object, such as a ruler, in front of the lights until three distinctly colored shadows appear. Remove the ruler and turn off the blue flashlight. When the ruler is replaced, the color of the white surface will change to yellow while the shadows become red and green. Try some different shadow-objects and flashlight on-off combinations.

Did you know…? Our understanding of the way the human eye sees color is put to use every day. Hospital walls are often painted green to help disguise the green afterimage doctors and nurses see after looking at red blood.

Pictures in magazines and books are created using millions of tiny dots in only four colors (cyan, magenta, yellow, and black): the brain combines the receptors' color messages from various arrangements of these dots to perceive any color you can imagine.

Notes for parents and teachers was prepared by Stasia Ward Kehoe. Stasia is a freelance writer specializing in the interests of young readers. She holds a master's degree in Performance Studies from New York University and teaches musical theater to elementary school students in Rye, New York.

MindNode© Map of Base Frogs Inherited Traits

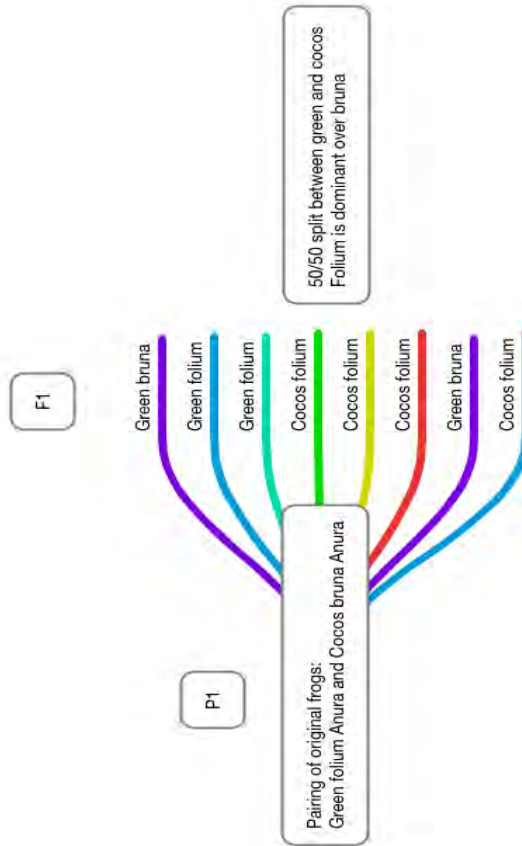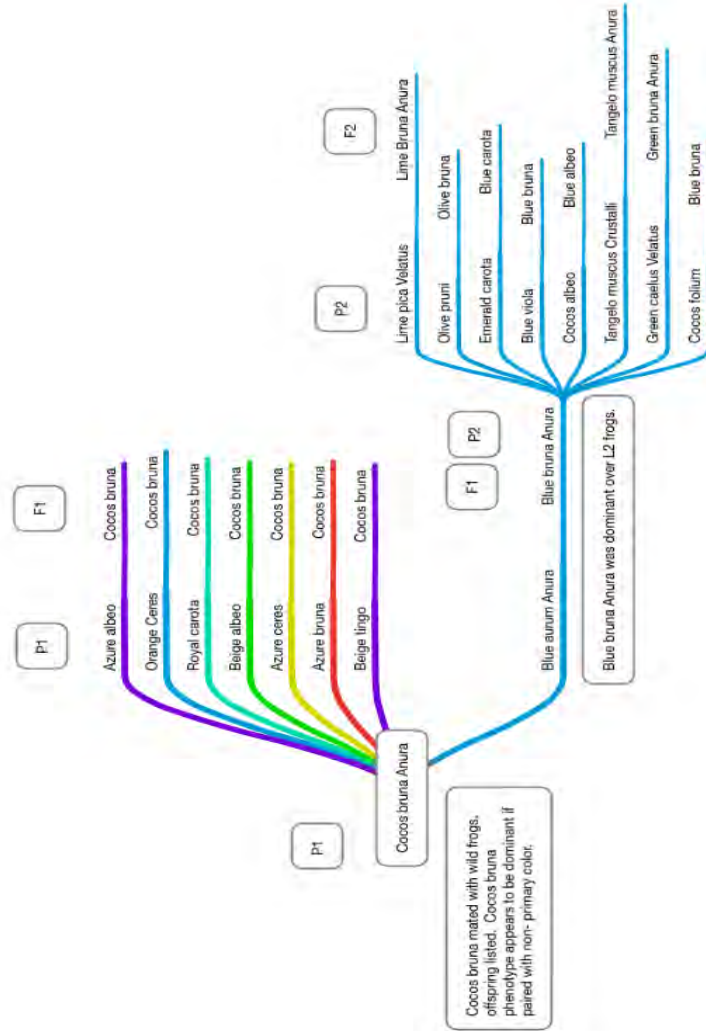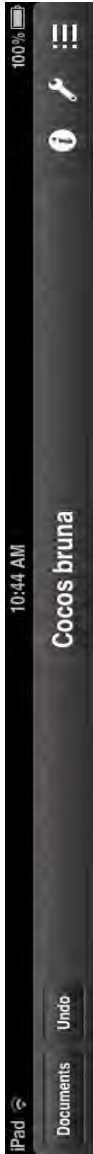We used this application to document the offspring of various pairings in order to determine dominant (phenotype) and recessive (geneotype) traits.

P1 / F1

P1	F1
Azure albeo	Cocos bruna
Orange Ceres	Cocos bruna
Royal carota	Cocos bruna
Beige albeo	Cocos bruna
Azure ceres	Cocos bruna
Azure bruna	Cocos bruna
Beige tingo	Cocos bruna

P1: Cocos bruna Anura

Cocos bruna mated with wild frogs, offspring listed. Cocos bruna phenotype appears to be dominant if paired with non- primary color.

Blue aurum Anura — Blue bruna Anura

Blue bruna Anura was dominant over L2 frogs.

P2 / F2

P2	F2
Lime pica Velatus	Lime Bruna Anura
Olive pruni	Olive bruna
Emerald carota	Blue carota
Blue viola	Blue bruna
Cocos albeo	Blue albeo
Tangelo muscus Crustalli	Tangelo muscus Anura
Green caelus Velatus	Green bruna Anura
Cocos folium	Blue bruna

P1 / F1

P1	F1
Maroon carota	Green folium
Black muscus	Green muscus
Olive tingo	Green tingo
Violet bruna	Green bruna
Royal carota	Green folium
Purple viola	Green viola

P1: Green folium Anura

Green folium Anura mated with wild frogs, offspring listed. Green base phenotype appears dominant as base color except when mated with L2 frog, Black base. Secondary color, folium, appeared in 50% of offspring. Only 1 offspring was not Anura.

Black viola crustalli — Black folium Crustalli

Crustalli appears dominant over Anura. Folium appears dominant over all except Ceres.

P2 / F2

P2	F2
Tangelo carota Anura	Black folium Crustalli
Beige picea Anura	Black folium Crustalli
Lime Ceres Anura	Lime Ceres Crustalli
Orange albeo Anura	Black folium Crustalli

Blue bruna Velatus — Blue folium Velatus

Velatus 50% of offspring. Folium is recessive except to white.

P3 / F3

P3	F3
Aqua viola Anura	Blue viola Anura
Green carota Anura	Green carota Anura
Orange Ceres Velatus	Orange Ceres Velatus
Blue Ceres Anura	Blue Ceres Velatus
Aqua muscus Velatus	Aqua muscus Velatus
White albeo Anura	Blue folium Anura
Emerald viola Anura	Emerald viola Velatus
Beige muscus Anura	Beige muscus Anura

Lime bruna Crustalli	Limie folium Crustalli
Pink picea Anura	Black folium Crustalli
Red callaina Anura	Red folium Crustalli

Olive folium crustalli — Green folium Anura

F1

P1	F1
	Green bruna
	Green folium
	Green folium
	Cocos folium
	Cocos folium
	Cocos folium
	Green bruna
	Cocos folium

P1: Pairing of original frogs: Green folium Anura and Cocos bruna Anura

50/50 split between green and cocos Folium is dominant over bruna

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P1 – Pairing of Green folium and Cocos bruna Anura

Green bruna
Green folium
Green folium
Cocos folium
Cocos folium
Cocos folium
Green bruna
Cocos folium

F1

P1

Pairing of original frogs:
Green folium Anura and Cocos bruna Anura

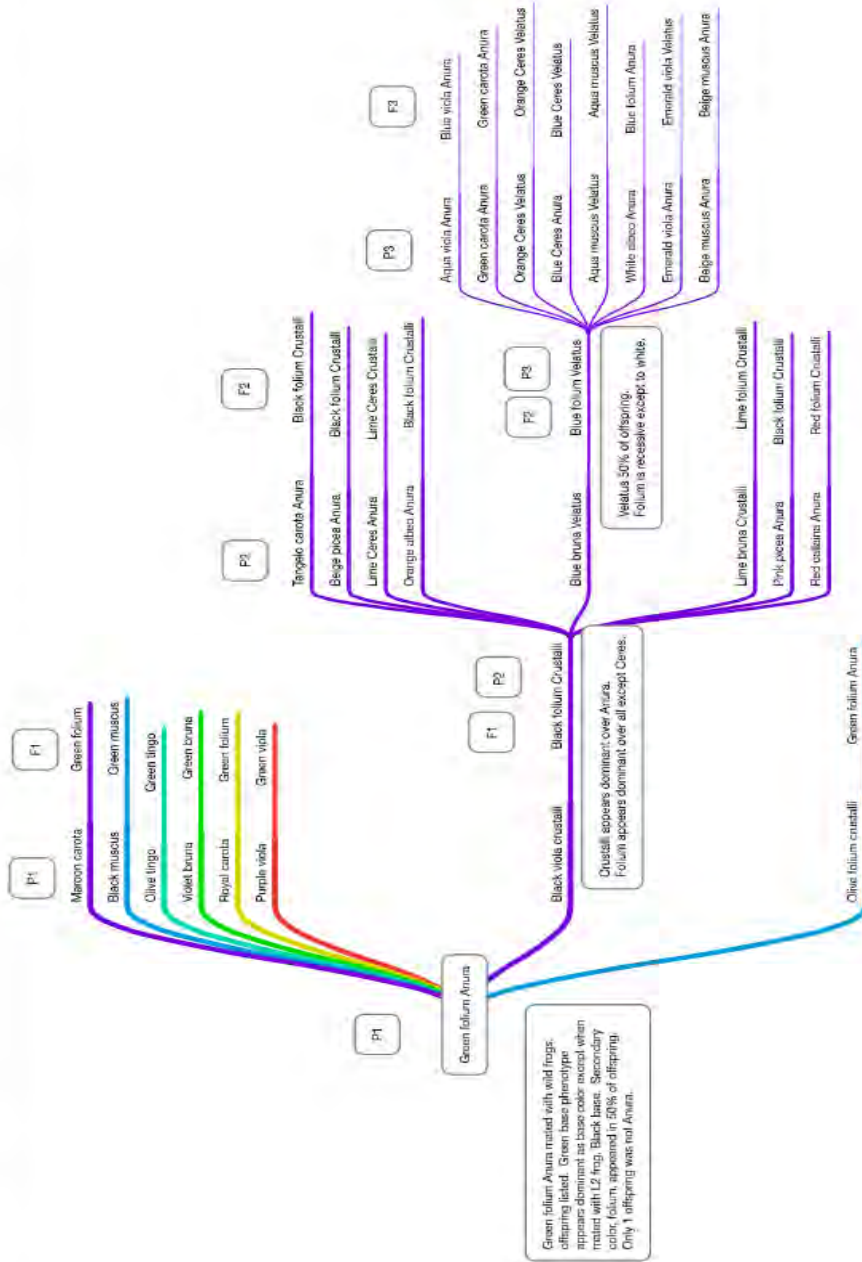50/50 split between green and cocos
Folium is dominant over bruna

# P1and P2 Pairing of Cocos bruna Anura with Wild Frogs from Pond

P1, P2 and P3 Pairings of Green folium Anura with Wild Frogs from Pond

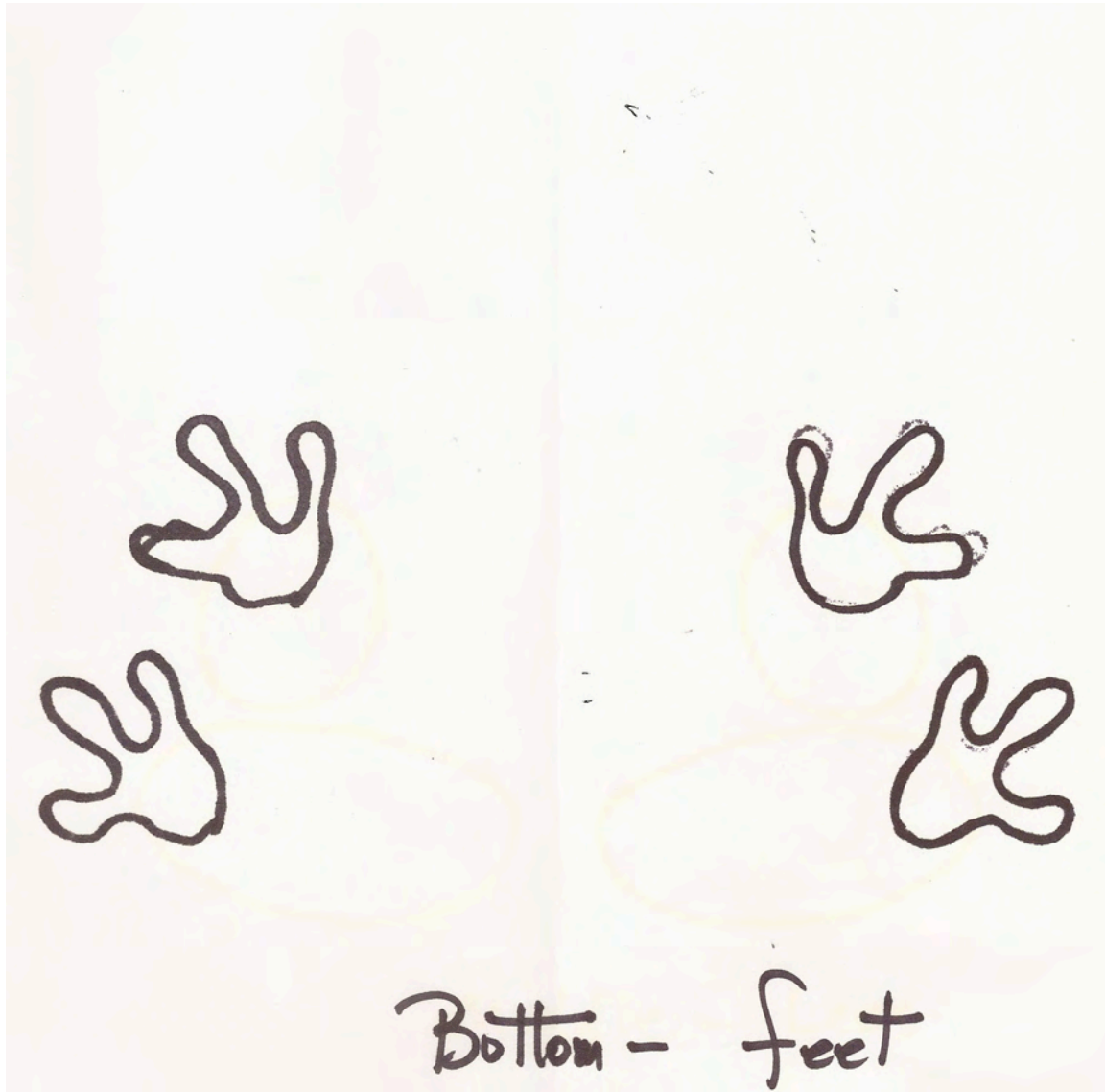# Paper Pattern for Frog Cut-Outs

For elementary students or students who would not be making 2D or 3D models, cutting out the paper patterns, coloring and gluing still allows them to make a representative model to be used in their presentations.

Top - body

Middle — Legs

Bottom - feet
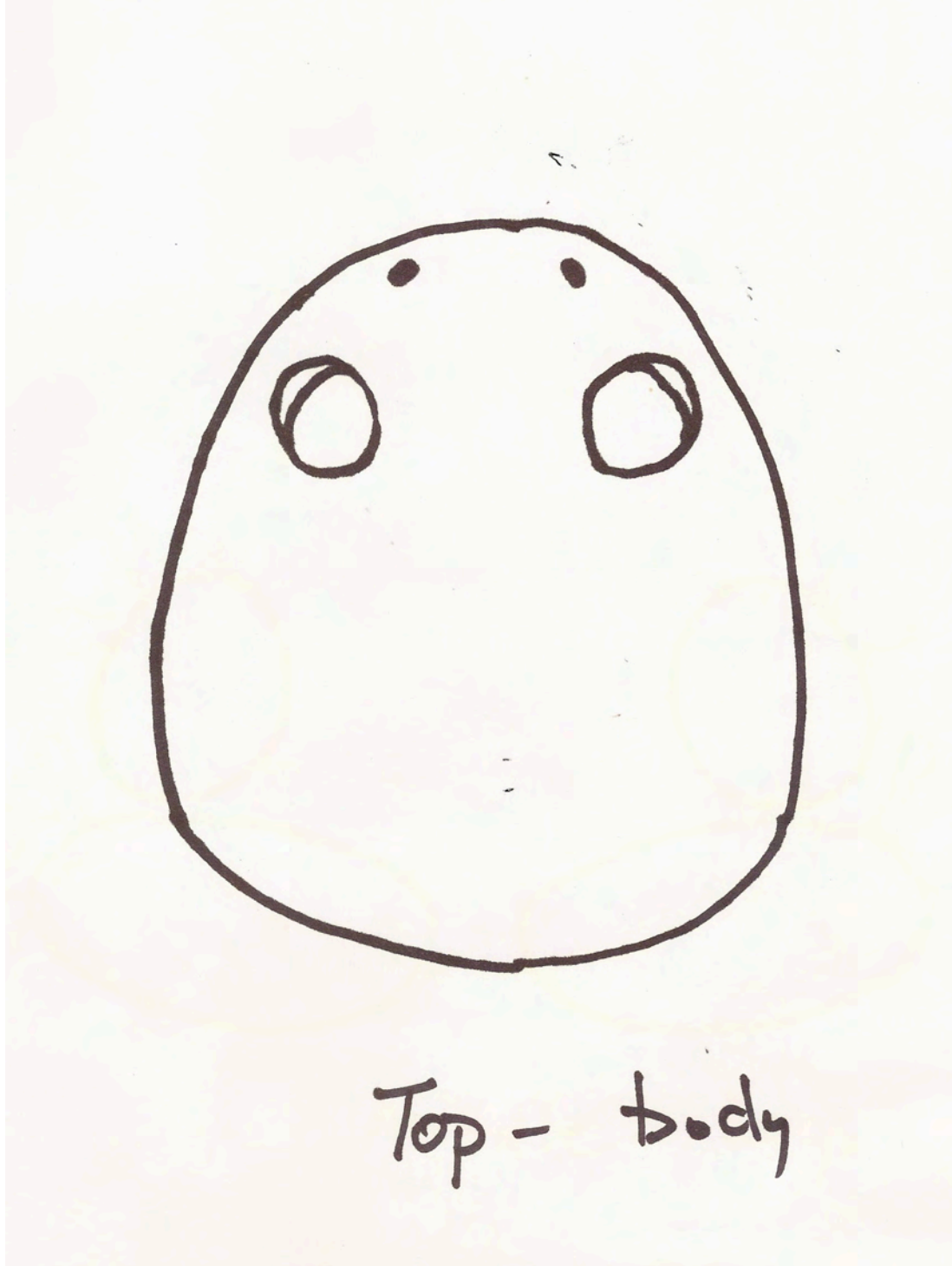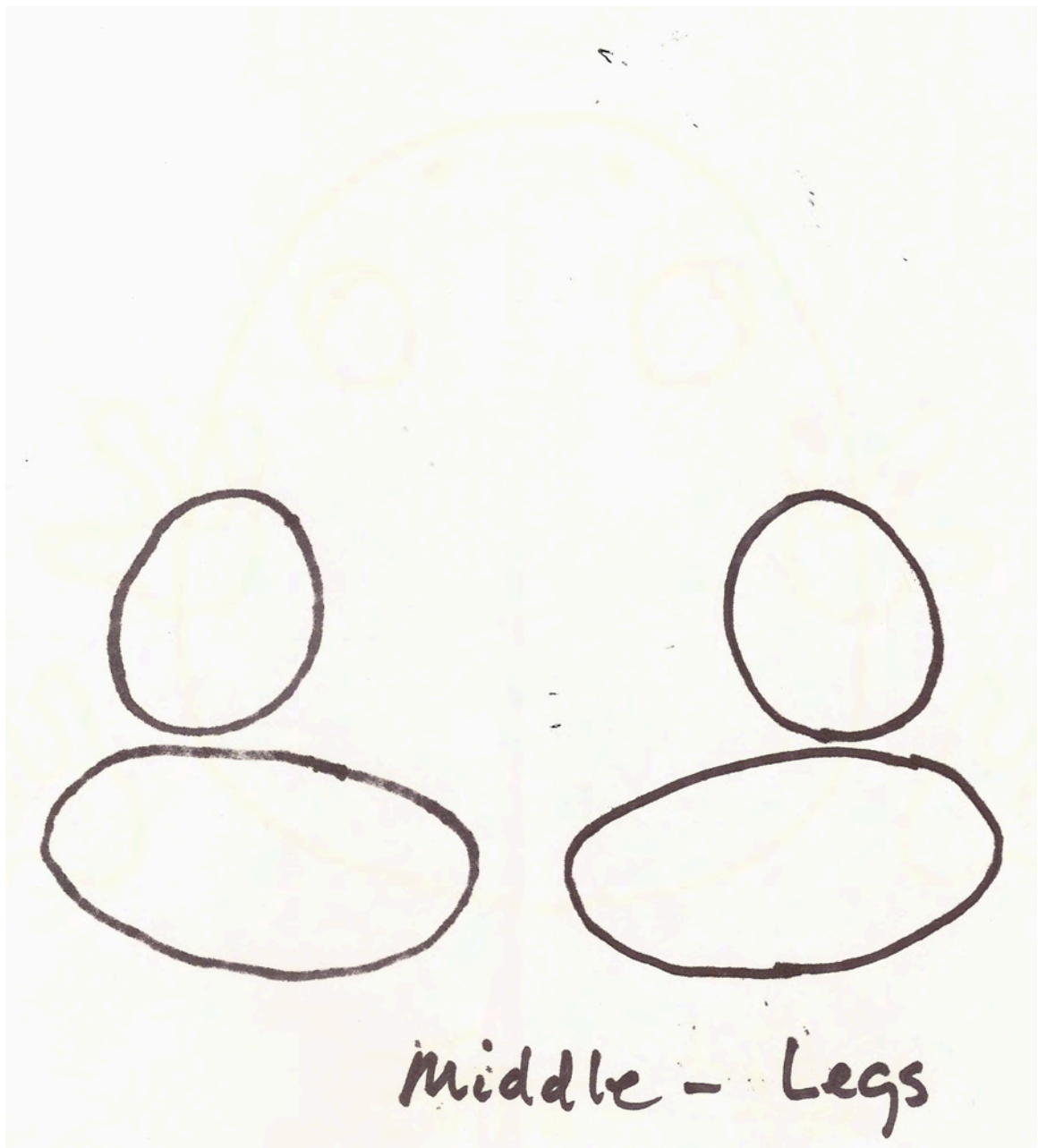
On behalf of Mrs. Adams' and Mrs. Rody's students, we want to thank you for your interest in our project and trust that you will find a reason to make use of it in your classroom. Because STEM has become the new buzz-word this year, projects that can tie in the basic skills of reading and writing while blending in the science, math and technology in order to create or engineer a new species of gaming frog means that we get to play while we learn. Have fun!