Science Connection

KENTUCKY DEPARTMENT OF EDUCATION

A Collaborative Resource for Teachers **October 2015** Volume 2 Issue 4

In This Issue

Editor's Note

I frequently find myself reading through numerous NGSS posts, tweets and blogs written by teachers, those who have been teaching before man first stepped on the moon to those filled with first year jitters. I marvel at the honest reflections made by these open-minded educators. Many share about lessons that were thoughtfully planned yet fell short of the desired learning outcomes. Other share their enthusiasm over watching students uncover answers to problems and still others reach out for suggestions from colleagues on how to better gather evidence of student mastery. While reading these thoughtful reflections I continue to notice common threads. All of these passionate educators are reaching out to share current thinking. They were not afraid to ask questions, to show curiosity, risk criticism, and admit failure. The authors were openly sharing experiences and their personal reflections. Why? I believe they have found cause to reflect. These authors desired to improve their practice; to push past preconceived notion and complacency in the classroom in order to stretch their minds and their students' minds. They are modeling the exact behaviors we desire for our students. They strive to replace the old ideas and outdated pedagogy with new understanding so that they can better serve today's students. I encourage you to do the same.

Thanks to those of you who have contributed to this month's Science Connection. Your shared understanding of KAS Science standards implementation is fuel that is sure to ignite a fire in colleagues across the state! Wishing you all a wonder-filled fall season!
Christine

It's the Law!

Using the matter and energy crosscutting concept as a tool for analysis

By **Diane Johnson**, Assistant Director of PIMSER

ALL

Susan: *In photosynthesis, [coming in are] CO2, starch or glucose. Coming out is oxygen, water, and energy.*

Ruth: *Well I know that the light makes it [radish plants] grow which gives it like, nutrition, which it gets from the dirt and the water. And it takes in the nutrition into the…photosynthesis also adds to it [sounds unsure]. And it gives off CO2 and that releases off, but it doesn't really add to the weight.*

Mark [explaining the fate of the mass lost by someone on a diet]: *The fat was converted into usable energy and burned by muscle contraction for movement.*

These quotes are from college students who were interviewed about matter inputs, outputs, and exchanges among organisms after instruction and passing a test on the interview topics (Parker, De Los Santos, & Anderson, 2015). Why do so many students' accounts differ from scientific explanations? What do the patterns in students' developing ideas tell us that might help us design more effective instruction?

Science education researchers at Michigan State University have been examining student work samples and conducting

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SEP	DCI	CC
Planning and Carrying out Investigations	LS2B Cycles of matter and energy transfer in ecosystems LS2C Ecosystem dynamics, functioning, and resilience	System and system models

It's the Law! *continued from page 1*

cognitive interviews with elementary, middle, high, and college (science majors, non-majors, pre-service teachers) students for several years in order to develop a learning progression for matter and energy in carbon-transforming processes as well as curricular materials that help students foster a more scientifically accurate understanding of the concepts.

Table 1 summarizes goals for students at each level to explain matter and energy transforming processes (Mohan & Anderson, 2009). Currently, only 10% of high school students typically have a Level 4 understanding, which is commensurate with NGSS. The learning-progression research shows that over 35% of high school students, and therefore probably much of the public, have a Level 2 understanding (Mohan et. al., 2009; Jin & Anderson, 2012). Susan and Ruth's explanations demonstrate Level 2 understanding, while Mark's suggests a Level 3.

Table 1. Carbon Cycle Learning Progression

Level	Enablers or Inputs	Actors and Settings or Systems	Results: Purposes or Products
Level 1. Lower Anchor, elementary starting point	Needs or enablers	Abilities or powers of actors Settings for events	Achieving purposes or goals of actors
Principle-based Level 2. Elementary goal	Different kinds of enables: -materials (solid, liquid, gas) -energy sources -conditions	Abilities of actors plus internal structure (organs, cells) and movement of materials and energy through settings and actors	Material products -gas-gas cycles -growth as matter moving into bodies Energy products
Principle-based Level 3. Middle school goal	Material inputs, distinguishing organic from inorganic materials Forms of energy, including chemical energy (C-C and C-H bonds)	Movement of materials through systems at multiple scales Living systems made of organic materials	Changes in matter obeying conservation laws Transformation and degradation of energy
Level 4. Upper Anchor, high school goal	Material inputs with specific chemical identities Energy inputs	Movement of atoms in molecules through systems at atomic-molecular to large scale socio-ecological systems	Material products tracing atoms between inorganic and organic forms Transformation and degradation of energy

Notice the similarities between the learning progression detailed in Table 1 and the life science progression from Appendix G for the NGSS (2013).

Table 2. Life Science Progression

K-2		3-5	6-8	9-12
LS2.B Cycles of matter and energy transfer in ecosystems	[Content found in LS1.C and ESS3.A]	Matter cycles between the air and soil and among organisms as they live and die.	The atoms that make up the organisms in the ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. Food webs model how matter and energy are transferred among producers, consumers, and decomposers as the three groups interact within an ecosystem.	Photosynthesis and cellular respiration provide most of the energy for life processes. Only a fraction of matter consumed at the lower level of a food web is transferred up, resulting in fewer organisms at higher levels. At each link in an ecosystem elements are combined in different ways and matter and energy are conserved. Photosynthesis and cellular respiration are key components of the global carbon cycle.

Animals obtain food they need from plants or other animals. Plants need water and light.

Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.

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Implications for Teaching

What are the implications of these learning progressions for designing learning experiences for students? One of the biggest differences between Levels 3 and 4 is the student's ability to trace matter and energy. Numerous opportunities are provided in the NGSS that foster the use of the energy and matter crosscutting concept other than the cycles of matter and energy transfer in ecosystems. For example, in the 2nd grade, students could utilize Legos, wooden blocks, or modeling clay to explore what happens to the weight and to the pieces (Legos, blocks, clay) when they are rearranged to form different objects. 4th graders explore a range of energy transformations, and 5th graders investigate what happens to weight when substances are heated, cooled, mixed, or undergo a chemical change. By middle school, students determine that substances are made of atoms and that atoms can be rearranged to make new molecules but the total number of atoms doesn't change and neither does the total mass. They trace energy transfer and transformation in a range of systems. Finally, at the high school level, students are examining how the Laws of Thermodynamics account for observations of changes in a system at the atomic level.

Three core instructional challenges in teaching students to use energy as a tool for analyzing carbon-transforming processes have surfaced from the research:

1. understanding the purpose of the concept of energy
2. identifying forms of energy in living systems
3. tracing energy separately from matter (Dauer, Miller, & Anderson, 2014).

"In the Carbon TIME curriculum, currently being developed for middle school and high school students in a partnership among Michigan State University, the National Geographic Society, and the Seattle Public School (http://envlit.educ.msu.edu/publicsite/html/CarbonTIME1415_unit_zip_files.html), explicit instruction about how to use the crosscutting concepts of matter and energy takes the form of rules (ie. Atoms last forever; Atoms can be rearranged to form different molecules; Energy lasts forever) and questions that students are routinely asked as they develop models for the processes they explore (ie. Where are atoms moving?; What is happening to carbon atoms?; What is happening to chemical energy?)". (Parker, De Los Santos, & Anderson, 2015).

The Carbon TIME curriculum treats the principles of conservation of energy and conservation of matter as rules to be followed rather than relying on students to discover these ideas empirically. The rules to follow are embedded in the "Three Question" framework as shown in Table 3 (Dauer, Miller, & Anderson, 2014) and are used to construct explanations from data collected on carbon-transforming processes (e.g., photosynthesis, respiration, decomposition).

Table 3. Three Question Framework

Question	Rules to Follow	Connecting Atoms with Evidence
The Location and Movement **Question: Where are atoms moving?** Where are atoms moving from?	**Atoms last forever** in combustion and living systems All materials (solids, liquids, and gases) are made of atoms	When materials change mass, atoms are moving? When materials move, atoms are moving?
The Carbon Question: What is happening to carbon atoms? What molecules are carbon atoms in before the process? How are the atoms rearranged?	Carbon atoms are bound to other atoms in molecules **Atoms can be rearranged to make new molecules**	The air has carbon atoms in CO2 Organic materials are made of molecules with carbon atoms • Foods • Fuels • Living and dead plants and animals
The Energy Question: What is happening to chemical energy? What forms of energy are involved? How is energy changing from one form to another?	**Energy lasts forever** in combustion and living systems C-C and C-H bonds have more stored chemical energy than C-O and H-O bonds	We can observe indicators of different forms of energy • Organic materials with chemical energy • Light • Heat energy • Motion

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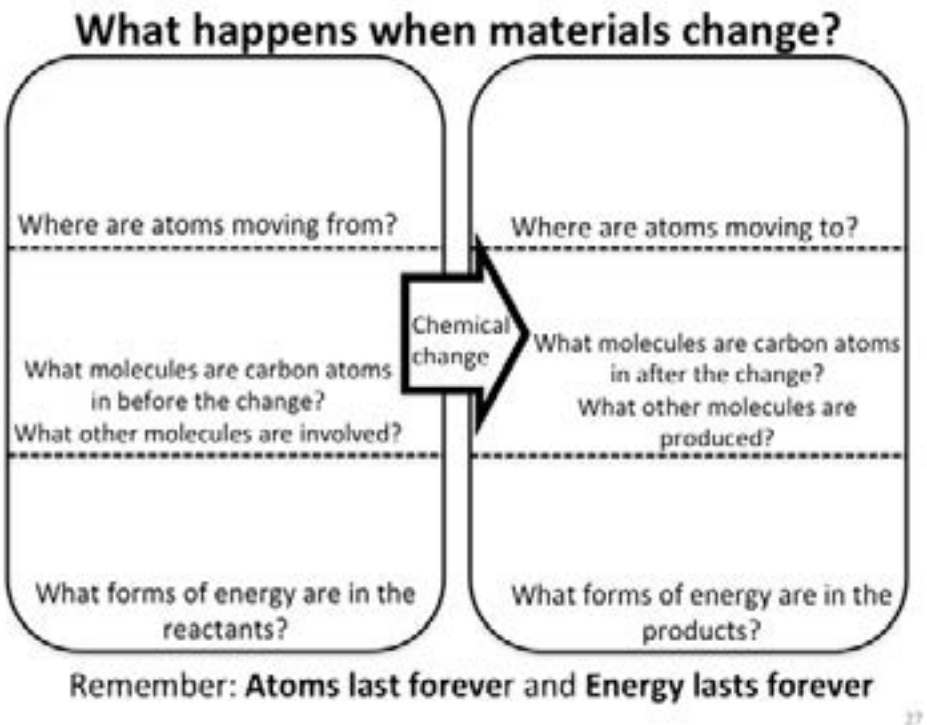
Identifying the forms of energy in living systems can be overwhelming to students. Research on the Carbon TIME curriculum has shown that the benefits of using some simplifications outweigh the 'conceptual' costs. The simplifications include:

1. Limit the treatment of energy to four specific types – chemical, light, work or motion, and heat or thermal energy.
2. Describe chemical energy as "stored" in high-energy molecules with C-C and C-H bonds and "released" when these molecules are oxidized to molecules with lower-energy bonds, C-O and H-O.
3. Define "heat" and "work/motion" as forms of energy. Work is used to designate a range of complex metabolic processes like motion, transport, and biosynthesis. No distinctions are made between heat and thermal energy or "heat energy" and infrared electromagnetic radiation.
4. Describing waste heat as a product of carbon-transforming processes without mentioning entropy (Parker, De Los Santos, & Anderson, 2015).

Conflation of matter and energy is particularly problematic when learning about biological systems when there are chemical changes such as cellular respiration that transform solids and liquids into gases. In these cases, students have difficulty conserving and tracing energy because they fail to conserve matter. Students who readily claim that gases have mass still have trouble believing that gases have enough mass to account for substantial mass changes in living systems (Mohan et al, 2009). So it is easier for students, like Mark, to believe that "fat is transformed into energy when a person exercises and loses weight" than that "a man who exercised and lost 20 pounds breathed out most of that mass in carbon dioxide and water vapor." Instructional aims should be to have students account for matter and energy as separate and enduring entities (Parker, De Los Santos, & Anderson, 2015).

Another instructional scaffold is the "Matter and Energy Process Tool" (Figure 1), which students use to construct explanations that answer all "Three Questions."

Figure 1. Matter and Energy Process Tool



The process tool is revisited by the students after each investigation and molecular modeling exercise. By the end of the unit, students have developed an account of carbon-transforming processes that traces matter and energy separately through chemical change (Parker, De Los Santos, & Anderson, 2015).

Conclusion

One of the great achievements of science is the recognition that, in any system, certain conserved quantities can change only through transfers into or out of the system. Such laws of conservation provide limits on what can occur in a system, whether human-built or natural…. The supply of energy and of each needed chemical element restricts a system's operation—for

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example, without inputs of energy (sunlight) and matter (carbon dioxide and water), a plant cannot grow. Hence it is very informative to track the transfers of matter and energy within, into, or out of any system under study. (NRC, 2011, p. 94).

The Laws of Conservation of Matter and Energy can be used as valuable tools for analysis of complex biological systems. By making students' thinking visible, researchers have uncovered patterns in thinking from which they have developed a learning progression for carbon-transforming processes. This learning progression provides teachers with a diagnostic tool of student thinking that can be used to inform next steps instructionally. Pinpointing challenges has lead to specific learning supports for students.

The cycling of matter and energy in ecosystems is complex, however, some specific instructional moves have been shown to help more students develop a scientific conception of the process. Rice et al. (2014) have shown that among non–science majors at the college level, when instruction explicitly and consistently uses the tracing of matter and energy as an organizational framework, more students advance to a Level 4 understanding than in classes that use less directed active learning (42% vs. 16%). Using conservation laws as analytical tools and not just additional facts helps students assimilate and evaluate observations and information for a range of biological processes and phenomena – including climate change.

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Energy and Matter: Resources to Consider

By **Simone Parker,** Trigg County High School

ALL

LS2B is one of my favorite Disciplinary Core Ideas (DCI) to study and teach. This is real world science and full of observational and computational activities from developing models to using mathematical representations. At the 5th grade level, students are asked to develop models that will explain how matter moves through an ecosystem from plants to animals to the environment. By the time students reach high school, they move from developing models to using mathematical representations to support claims about cycling of matter and the flow of energy among organisms in an ecosystem. This DCI is a perfect blend of chemistry and biology that reinforces many environmental science topics such as food webs, transformation of energy from light to chemical energy in plants. Students will get to explore how molecules are formed and recombined as matter and energy cycles through an ecosystem. This topic also allows us to demonstrate to students that energy and matter are neither create nor destroyed as it flows through the environment but both are conserved in each transition from matter to energy and back again.

Students should have made observations that organisms get the materials they need to grow and survive from the environment around them at the end of the K-2 grade band, an activity that will help you illustrate this is called Life in a drop of Pond Water. This activity allows students to see a living ecosystem, a pond, and gives the teacher a chance to encourage their students to look around and explore the surroundings. Students are given the opportunity to see the pond on a macro and micro scale. This would also be a great activity to partner with a local high school teacher and allow older students to help the younger students make observations through microscopes.

As students transition to the intermediate level, an emphasis should be placed on the living and nonliving

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factors that help the matter and energy cycle through the environment. An activity that brings nonliving (abiotic) factors with experimentation and observation would be The Cycle of Matter. In this activity, students are able to observe a model of the water cycle, discuss characteristics of cycles and review conservation of matter in chemical reactions and in digesting food. Then, students read a story tracing the path of carbon and oxygen atoms as they change form and move in a cycle. Finally, students compare and contrast the cycle of matter with the flow of energy.

Middle school age students should be familiar with developing models that will show how energy and matter become transferred between producers, consumers and decomposers as they cycle through an ecosystem. There are a few activities that will help your students understand this concept better. Energy Flows, Understanding Climate Change, and Science of Energy will help your students understand photosynthesis, carbon, nitrogen, and water cycles, and how energy flows in and out of the biosphere with respect to the life science standards.

By the end of the 12 th grade, student should be able to expand on the initial concept of food webs from middle school and now describe how the chemical elements move through the food web and in and out of the air, water, and soil through biogeochemical cycles.

Students will be asked to use mathematical representations to support claims for the cycling of matter and energy among organisms in an ecosystem. In the three-part activity, Cycling of Matter & Energy Flow, student groups will simulate the flow of energy through a food chain. Cups with a small hole in the bottom are used to represent organisms in the food chain, and water represents the energy. Students move energy through the food chain relay-style, and calculate the amount of energy lost at each step. Next, Students will construct a food web consisting of organisms from the chaparral or rainforest biome. Each organism in the food web is equipped with information about its population, biomass, and energy contribution within a specific ecosystem. After the food web has been built, students use this information to calculate and create a pyramid of numbers, biomass pyramid, and energy pyramid for the ecosystem. And then students will investigate how the food we consume, and therefore the energy we consume, impacts our health and can lead to obesity. Our diet should work to maintain a balance between the energy we consume, the energy we use, and the energy we store. When our diet is imbalanced, our weight and overall health can fluctuate.

These are just some suggested resources. Please remember that these activities are not perfectly aligned to the NGSS but would be a great starting place for you to begin developing your units and making modifications to make sure that students engage in 3D learning. In order to better uncover the actual alignment of these resources and any others that claim to be "NGSS Aligned", consider using the EQuiP Rubric developed by ACHIEVE found here. This tool has been invaluable to me as I continue to sort out materials that meet the intent of the NGSS.

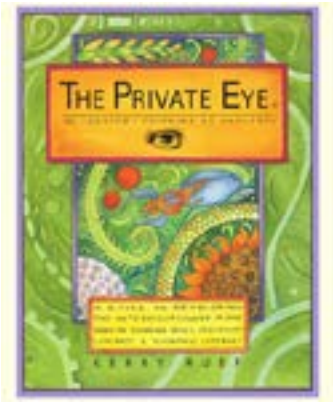
KCAS Connections

A Private Eye on the Crosscutting Concepts

By **Ellen Sears**, KDE consultant, Division of Program Standards

ALL

In March 2000 I attended the NSTA National Conference in Orlando. Looking down a long hallway I noticed artwork displayed on easels and ventured down to take a closer look. I was always looking for connections between the arts and sciences, and I was curious to learn more about the lessons that produced such striking images. That was my first experience with The Private Eye Project; a learning process that utilizes jeweler's loupes. The Private Eye process was designed to look closely, think by analogy, change scale and theorize. It pairs careful observation with three questions:



What does it remind me of?
What else does it remind me of?
Why is it like that?

Shortly after my initial encounter with The Private Eye I purchase sets of loupes for my classroom and began using them to supplement classroom routine. Handheld lenses, magnifiers and microscopes were always available to students. The loupe became another tool available to the students. The three questions supported conversations around our observations, to understand the form that followed the function and our use

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of synectics.

Fast-forward 15 years. Dr. Stephen Pruitt gave a keynote speech at the NSTA National conference in Chicago, March 2015. In his keynote, Pruitt shared the Top 10 things he learned from his work with states on NGSS adoption and implementation. Number six '***Crosscutting Concepts are still "The Third Dimension***". Dr. Pruitt stated that Crosscutting Concepts are the most misunderstood and most powerful dimension, yet he was worried that in 10 years he would "write a book called The Lost Dimension" about the Crosscutting Concepts.

Why should Dr. Pruitt worry? Perhaps because "if the instructional materials don't elicit the student to actually talk about patterns, or cause and effect or scale, proportion and quantity, the kids aren't using it". Hence they are not experiencing dimensional learning, which is the aim of the Next Generation Science Standards.

The Private Eye Project, jeweler's loupes and the 3 questions are instructional materials and practices that can support the competencies and dispositions needed to take the students to the Third Dimension such as the making of predictive inferences

hypothesizing, constructing explanations and thinking in analogies. With either pen and paper journals or loupes coupled with digital resources it is possible to collect evidence of student work to assess growth as well document the conversations students are having in relations to their understanding of the concepts. As the ***About*** page explains, "The Private Eye is a program about the drama and wonder of looking closely at the world, thinking by analogy, changing scale and theorizing. Designed to develop critical thinking skills, creativity and scientific literacy - across subjects - it's based on a simple set of tools that produce gifted results."

You can read more about The Private Eye in this Microscopy Today's May 2015 issue (starts page 52). It includes classroom scenes, the methodology in a nutshell, and supporting research.

To evaluate the Private Eye Project for your classroom use, research how other teachers are incorporating it into their classrooms. Identify the end goal of bringing it into your classroom. How does is complement your existing classroom environment, curriculum and goals. How could enhance or transform learning in your classroom? What are some of the current practices that can be changed or improved through the use of the loupes and The Private Eye?

This is a simple overview of the Private Eye that asks and answers the question 'Why?', The November edition of the Science Connection we will take a classroom look at the 'How?" as well as share some classroom experiences from the STEAM Academy teachers who have embraced the process and the use of the loupes in their classrooms.

Inquiring Minds Want to Know: Science Can Be Infused Into Preschool Programs

By **Tracey Ezell,** IECE Teacher at Thelma B. Johnson Early Learning Center Henderson, KY
Ginger Ashby, Early Childhood Consultant,
Aleisha Sheridan, Principal
Technical assistance from **Rhea Isenberg**, Media Specialist

Early Childhood Education

Overview. Toddlers and preschoolers are clearly some of the most inquisitive and curious creatures educators confront. The next to question, explore, examine, and contemplate is what they are wired to do. These investigation urges provide a platform for building a strong science infrastructure for, the inquiring minds of preschoolers. Early childhood educators can frame the inquiries, excitement, and zeal to provide quality science understanding. By introducing scientific terminology, thoughtfully, and willfully creating learning environments across settings, and planning for intentional interactions through scientifically based activities and long term project based learning, facilitators provide the necessary opportunities for preschoolers to probe and determine solutions for themselves.

Although current Next Generation Science Standards (NGSS) are written for grades K-12 and some topics may see too

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complicated for younger students, these standards can be used to drive curriculum, instruction, planning, and material selections that are developmentally appropriate. Using the NGGS framework, the development of the idea that animal behavior helps young animals survive can be taught and explored at the preschool level. To present and engage young learners in the discussion of this topic the following materials and lesson could be used: Opossum Lesson Plan

> Disciplinary Core Idea from NGSS LS1.B Growth and Development of Organisms
> *Adult plants and animals can have young. In many kinds of animals, parents and offspring themselves engage in behaviors that help the offspring survive.

1. **Animal behavior (PK-K)**. As with most new learning this initial activity lays the foundation for the remainder of the unit. The learning target for this activity is for students to understand that opossums are nocturnal animals. There are several critical pieces of information that students will need in order to better understand this unique animal. It will be important to discuss nocturnal activity and how most opossums are more active at night, as they sleep in a den or burrow during the day. Students will also need to know that opossums have very weak eyesight, making it imperative that they use another sense, their sense of smell, to be able to find food and to help protect them. Another important piece will be discussing opossum habitat, making sure to emphasize that opossums are very adaptable and can live almost anywhere, including urban and rural areas where people live. Opossum Activity Day 1
2. **Using senses (PK-K)**. This activity will prove to be very enjoyable for young students as they solve "mysteries" using only their sense of smell. Understanding and identifying the 5 senses is a learning concept that we reinforce many times during the early years. The learning target for this activity helps to do just that, as students become aware of the importance of the sense of smell to an opossum's survival. This activity also provides an opportunity to encourage language development through describing the smells with words such as sweet, sour, strong, pungent, etc. Opossum Activity and Day 2
3. **Measurement (PK-1)**. The learning target for this activity is for students to be able to measure using nonstandard units. In my experience, this is one of the most exciting and intriguing things young students engage in in the classroom. Once they learn to measure using nonstandard units, they will want to measure everything, all the time. This particular activity also introduces the concepts of prediction and estimation. This will be very insightful to you as the teacher, as you will be able to see where your very young students stand in their sense of number development. Technology will also be utilized as students are able to record their predictions and actual answers on the Smart Board recording sheet (link shown in lesson plan.) Opossum Activity and Day 3
4. **Caring for offspring (PK-1)**. This activity allows students to compare animal behavior with human behavior, as well as that of other animals. The major learning target is to know why it is important for mothers to take care of their babies. Being able to simulate that experience, on a smaller scale, will also provide students with real world learning and knowledge about the responsibilities a mother carries. This will provide connections to experiences in their own lives and will, hopefully, begin to instill social values and improve the ability to sustain social relationships as they understand more about the characteristics of living things. Opossum Activity and Day 4

In bringing the unit to a close, the students will participate in a culminating activity in which a class book will be created. Each student will draw a picture of something learned from the unit. Then, the students will either dictate or write about their picture, providing as many details as possible. This gives students the opportunity to show what they have learned and gives you, as the teacher, the opportunity to reinforce, reteach, and reflect. Opossum Culminating and Extension

Professional Learning Opportunities

The Kentucky NEED Project (www.need.org) is pleased to announce the fall energy education workshop schedule. There is NO CHARGE to attend, but space is limited, so early registration is encouraged. Our workshops include:

✓ Grade-level appropriate energy activities and curriculum that support the Kentucky Academic Standards in Science and other disciplines.

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✓FREE Science of Energy kit for each school represented by *two or more* teachers.
✓Curriculum materials to teach about energy and energy resources, including electricity and energy efficiency.
✓Continental breakfast and lunch are provided.
✓Substitute reimbursement (limit of four teachers per school).

For workshop details and registration information, please click on the locations below. If you have any questions,please direct them to kreagor@need.org.

Date	Location	City
10/14/15	Pine Mountain State Resort Park	Pineville, KY
10/15/15	Morehead Conference Center	Morehead, KY
10/20/15	Georgetown Conference Center	Georgetown, KY
10/22/15	Carroll Knicely Center	Bowling Green, KY
10/27/15	Hampton Inn Downtown	Owensboro, KY
10/27/15	The Blair Center at Southside Elementary	Shelbyville, KY
10/29/15	All Occasions Event Center	Campbellsville, KY
11/5/15	Madisonville Community College	Madisonville, KY
11/12/15	KY Community and Technology College System	Maysville, KY

2015 KSTA Conference

"Think Different to Teach Different"
Implementing Kentucky's Core Academic Standards for Science

The 43rd annual conference on science education in Kentucky will be held in Lexington on November 5, 6 and 7. We'll meet again at the Lexington Hyatt and Convention Center with three days of professional development, networking and examination of instructional materials. The implementation of new science standards is a continuing challenge that creates a strong need to provide support for classroom science teachers through research-based materials, pedagogical techniques and curricular approaches. This year's meeting will offer workshops, "make and take" sessions and presentations by science education leaders in our state and from around the country.

Keynote speaker, Dr. Joe Krajcik from Michigan State University is a lead author of NGSS and a recognized expert in the field of Project-based Learning. Our conference program on Friday and Saturday will offer over 100 sessions that address issues faced by teachers in all grade levels from primary through high school. Presenters include university faculty, department of education personnel and master teachers.

The pre-conference program on Thursday will feature a six hour workshop on developing standards-based units presented by the PIMSER office at U.K., as well as some 3 hour workshops that will provide teachers with a chance to prepare materials that can be taken back to their schools and put to use right away.

Registration forms or online registration can be accessed on our website HERE.

Fourth Grade Teachers!

Are you aware of this new program? You may bring your students to Land Between The Lakes' Woodlands Nature Station and Homeplace 1850 Farm for free!

1. Go to www.everykidinapark.gov
2. Click on the "Educators" box top right
3. Download the activities and do them with your students
4. Fill in the information in order to download paper passes for each student that has completed the activities.
5. Call Land Between The Lakes at 270-924-2020 to make reservation for your class

NGSS Short Courses
Presented by PIMSER

- Experience activities as a learner and discuss implications for best practice and highly effective teaching with other professionals
- Strengthen grade-level specific understanding of content and/or science and engineering practices
- Examine misconceptions and naïve conceptions and learn how to design experiences to help students change these misconceptions
- Leave each session with examples, resources, and unit outlines to implement the NGSS

Course - $125 each	Grade Levels	Date
Waves	1 & 4	September 30
Life Science	K & 2	October 19
Life Science	1 & 4	October 20
Life Science	3 & 5	October 21
Planning and Carrying Out Investigations	K-5	October 27
Engineering Design Process	K-5	November 13
Earth Systems	2 & 4	November 17
Constructing Explanations and Engaging in Argument from Evidence	4-8	December 1
Developing Units Aligned to the NGSS	K-12	December 3

Complete details, including session descriptions and registration, available at www.uky.edu/pimser

The July 1-11, 2016 Educator Academy in the Amazon Rainforest of Peru is a cross-curricular professional development workshop for K-12 formal and informal educators to learn and use:

- **21st Century Instruction**: 5E Lesson Design ~ Inquiry-Based Exploration ~ STEM
- **Inquiry Protocols & Resources**: Project Learning Tree ~ Cornell Lab of Ornithology ~ & More!
- **Global and Cultural Perspectives**: Service Learning ~ Sustainability ~ Global Education

Join Al Stenstrup, Project Learning Tree; Lilly Briggs, Cornell Lab of Ornithology; Dr. David Pearson, Wildlife Travellers' Guide to Peru; along with scientists Dr. Steve Madigosky, Widener University; and Randy Morgan, Curator/Entomologist, Cincinnati Zoo as you:

- Participate in **citizen science projects** and **inquiry based field studies** on a 1/4-mile **Rainforest Canopy Walkway** in one of the most biologically diverse environments on the planet.
- Spend **a day in an Amazon village** as you **explore the complexities of sustainability** and the role of education in creating a sustainable future for Amazon children.
- **Work with fellow educators** to explore strategies for using the Amazon as a vehicle for incorporating STEM education, inquiry-based learning, and sustainability science education into your classroom.

PLT Certification, BirdSleuth resources and 50 Arizona State University PD Hours included. Academic Credit and Machu Picchu Extension optional. **$1000 scholarship deadline February 1, 2016. Program cost is $1375 + air for scholarship recipients.** Space is limited! Register early to secure your spot!

Nominations Sought for First Emperor Science Award

PBS LearningMedia and Stand Up To Cancer (SU2C) have officially announced the call for applications for the inaugural year of The Emperor Science Award program.

The Emperor Science Award program is an initiative designed to encourage high school students to explore careers in science, specifically cancer research and care, and empower students to become the next generation of cancer and health researchers. PBS LearningMedia and SU2C will award 100 students each year, for at least three years, with an opportunity to work alongside an esteemed scientist on a rewarding multi-week cancer research project.

The award program was inspired by the Ken Burns' documentary CANCER: THE EMPEROR OF ALL MALADIES, and is open to students in grades 10 and 11 who have a strong scientific interest, especially in cancer research and care. Entries will be accepted from now through November 1. For specific entry rules and to enter, go to emperorscienceaward.com.

Collaboration and Connections:

The Science Connections Newsletter offers a forum for science professionals across Kentucky to collaborate and share classroom experiences. You are encouraged to share instructional strategies, resources, and lessons that you have learned with colleagues across the state (Can serve as evidence of professional growth). Note that your entries should relate to one, or all, of the topics for the next month as noted below or relate to formative assessment of the KAS for Science. All submissions are due by the 15th of the month prior to publication.

Below are the upcoming SCN focus dimensions:

	Science and Engineering Practice	Disciplinary Core	Crosscutting Concept
November	Asking Questions and defining problems	PS3C Relationship between energy and forces PS3D energy in chemical processes and everyday life	Energy and Matter
December	Constructing Explanations and Designing Solutions	LS1C Organization of Energy Flow and Matter in Organisms	Cause and Effect

E-mail your contributions to christine.duke@education.ky.gov. Thank you!