Science Connection

KENTUCKY DEPARTMENT OF EDUCATION

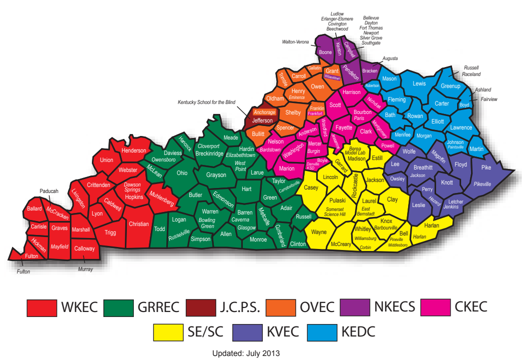
A Collaborative Resource for Teachers **September 2015** Volume 2 Issue 4

In This Issue

Editor's Note

Greetings! Welcome back to another year of developing your understanding of the science standards! Hopefully you are recharged and energized for the year ahead. This summer was packed with professional learning experiences and opportunities to collaborate on lesson planning and unit development at each of the regional cooperatives. Much of this work, as well as science instructional specialists' contact information, can be viewed on the KDE regional network websites listed below as well.

Be sure to check out these resources as well as reach out to your regional specialist for support.



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http://kevincrumpscience.weebly.com/science-network.html (SESC)
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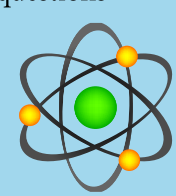
http://ovecsln.weebly.com/
http://nextgenscience.weebly.com/ (KVEC)
http://www.halliebooth.com/science-cadre.html (NKECS)
www.terryrhodes1science.com (CKEC)
http://www.kedcnextgenscience.org/kedc-science-blog

The Science Connection continues to be a resource for Kentucky teachers by Kentucky teachers. Your experiences, ideas and current thinking related to the implementation and assessment of KAS Science is the foundation on which each edition is built. Those who have contributed in the past have grown professionally. Many have stepped up and out of their comfort zone in order to encourage and support you, their Kentucky colleagues, as they further their own understanding of the science standards.. I encourage you to do the same. Further information about the dimensions for each edition is located on the last page of the each newsletter. Please contact me if you have further questions (Christine.duke@education.ky.gov).

Wishing you a fantastic year of learning as you prepare students for their future!
Remember – "Think like a proton and stay positive!"
Christine



NEXT GENERATION SCIENCE STANDARDS

Practice
Developing and Using Models

DCI
ESS 2B
Plate Tectonics and large scale system intercations

Crosscutting Concept
Stability and Change

A 3-D approach to plate tectonics and large-scale systems

By **Sean Elkins,** Instructional Coach, Boone County

HS

Much of underlying scientific knowledge for ESS2B: Plate Tectonics and Large-Scale Systems should be familiar to Kentucky teachers who taught our previous standards, although the distribution of some concepts has shifted between middle and high school. According to the Framework for K-12 Science Education, the content endpoint at the end of grade 12 is: "The radioactive decay of unstable isotopes continually generates new energy within Earth's crust and mantle providing the primary source of the heat that drives mantle convection. Plate tectonics can be viewed as the surface expression of mantle convection."

To assist students in achieving this content endpoint the Kentucky Academic Standards for Science provide high school teachers with three guiding standards:

HS-ESS2-3. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.
HS-ESS2-1. Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features
HS-ESS1-5. Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.

In the case of these standards an organizing phenomenon is essentially 'built-in', since they all are directly related to the concept of plate tectonics and continental drift. The heavy emphasis on Developing and Using Models (SEP) and Stability and Change (CCC) make them natural points of emphasis for this concept.

The challenge is to find a way to make them three-dimensional by incorporating appropriate Science and Engineering Practices and Crosscutting Concepts. The breadth of these standards allows room for multiple approaches. Note, one such approach is shared by BCHS teacher, Taylor Sullivan, in a separate article within this edition (see Modeling Plate Tectonics & Large Scale System Interactions). The choice of an organizing phenomenon and/or driving questions is very teacher and student driven, and a question or phenomenon that is perfect for one class or teacher might not be the best option under different circumstances. Consider the following examples:

Possible organizing phenomena:	Possible driving questions:
• The earth as a system • Plate tectonics/the drifting continents • Earthquakes and volcanoes ("shaking and baking") • Natural disasters • Human behavior/settlement patterns driven by tectonics	• Why does the world map look the way it does? • Do we need to worry about earthquakes and volcanoes? • What keeps the plates in motion? • Just how solid is "solid as a rock"? • How do we know the earth is changing? • How do earth changes affect me?

Teachers are fortunate that a great deal of instructional resources and materials already exist that support instruction of the disciplinary core ideas of ESS2B. Countless websites, videos, simulations, and textbooks contain a wealth of information regarding plate tectonics, earthquake and volcanic relationships and more. An internet search will reveal a plethora of good instructional resources that could be used even in an extensive unit, so no effort will be made to identify such resources here.

What an internet search or textbook chapter on plate tectonics will not demonstrate is a 3D approach to instruction that incorporates the SEP and CCC in an authentic way. This proves to be a great challenge when implementing these standards as they were intended to be learned.

The expanded explanations for the SEP and CCC contained in Appendices F and G of the NGSS give us clues to help imagine how those core ideas unfold in the classroom. Our task is to give those ideas the appropriate context for the core ideas they address. Listed below are some selected descriptors from the two Appendices with a few suggested approaches to addressing them within the context of ESS2B. Please note that these suggestions vary in complexity and time required, and in many cases they could be combined into one larger student task rather than as the separate tasks outlined below. Also, note that not every detail point from the appendices is addressed.

Developing and Using Models (Science and Engineering Practices)	
Detail from Appendix F	**Possible implementation idea**
Evaluate merits and limitations of two different models of the same proposed tool, process, mechanism, or system in order to select or revise a model that best fits the evidence or design criteria.	Students, as either individuals or groups, develop a variety of models of convection within the earth, and then evaluate them for accuracy and completeness.
Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.	Students create a flow chart that tracks matter through multiple convective cycles and different rock types.
Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena, and move flexibly between model types based on merits and limitations.	Students create virtual, physical, and/or text-based models of the same phenomenon and use them in combination to explain a phenomenon.
Develop a complex model that allows for manipulation and testing of a proposed process or system.	Students develop a physical model with a changeable variable to explain an observed phenomenon such as magnetic sea-floor striping, ocean trenches, etc.
Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.	Students create a 'speedometer of change' and classify various earth changes according to their temporal scales (fast, slow, etc.) then merge this with a similar classification of their spatial scales to catalog the variety of earth changes that are possible. Students create a cause and effect matrix linking earth system changes with their causes. Students create a "me map" showing possible impacts various earth system changes/interactions might have on their lives.

Stability and Change (Crosscutting Concept)	
Detail from Appendix G	**Possible implementation idea**
Much of science deals with constructing explanations of how things change and how they remain stable.	Students construct an explanation of the stability differences of various earth features, such as explaining why continental centers tend to be more stable than coastlines
Change and rates of change can be quantified and modeled over very short or very long periods. Some system changes are irreversible.	Students research a variety of tectonically influenced landforms and make predictions of their longevity based on known rates of change. Students classify rates of change for various landforms and earth system phenomena: see 'speedometer of change' task above.
Feedback (negative or positive) can stabilize or destabilize a system.	Students model isostatic rebound as a stabilizing mechanism

In order to be truly three dimensional, teachers need to resist the very natural urge to simply select tasks from a list like the one above and teach each separately. Three-dimensional learning attempts to address all dimensions simultaneously, rather than addressing them sequentially.

In the case of ESS2B, one way to move toward 3D learning would be to use the creation of a change model to drive the acquisition of the disciplinary core ideas rather than the more traditional approach of using the model to assess learning after the fact. A focus on two driving question such as "How do we know the earth is changing?" and "How do earth changes impact me?" would allow bits of new content knowledge (the 'traditional' learning) to be viewed through the lens of both the SEP (modeling) and the CCC (classifying the stability of the change/feature) in a meaningful and authentic way. Rather than the traditional list of terms and definitions given at the beginning of a unit, students would build their understanding as they progress toward an understanding of the earth system as a whole. Constructing such a model would probably begin with something as simple as a map of the continents and would eventually culminate with the creation of one or more of the models (or more likely a combination) detailed above. A possible student organizer (with some sample

A 3D approach to plate tectonics continued to page 4

A 3D approach to plate tectonics continued from page 3
responses) to guide them in this thinking along the way is below:

Feature/landform/ system	Description or cause	Speed	Stability	Impact on me?
Earthquake	Usually two tectonic plates colliding, especially near the edges of continents. Some mid-continent earthquakes happen, but much less often and they aren't as well explained.	Instantaneous	Stable for a while, then instantly unstable. Unpredictable	Depends entirely on where I live. Here in KY I'm a long way from the plate boundary.
Volcano	Hot spot (islands) or subduction boundary (most). Magma rises to the surface through convection	Varies. Some eruptions a continuous while others are dormant for long periods of time between eruptions	Varies. Depends on the source. Hawaii is pretty stable, Mt. St. Helens is obviously not.	Possible global cooling from ash clouds caused by massive eruptions, otherwise none.
Convection	The process of…	Very slow	Has been going on for millions …	The root cause of all tectonic 'stuff'…

One important consideration in planning for ESS2B is understanding the nature of modeling. The natural inclination is to think of a physical model when discussing models in science, but some phenomena are more conducive to physical modeling than others. We use models because we cannot bring the real thing into the classroom, and the size and speed of the phenomena addressed by ESS2B are often large, slow, and complex. Much of the modeling done within this context will likely be conceptual modeling through diagrams, flow charts, illustrations, and similar media. Building accurate physical models is a worthwhile goal, but it may not be the place to start due to both logistical, material and time constraints.

It is important to remember that the ultimate goal in planning for 3D learning is to provide a coherent and rich classroom experience for your students. Making such a profound change in your instructional approach is not easy, so give yourself permission to experiment and take 'baby steps' as needed. Note, 3D learning is not built in a day.

Modeling plate tectonics & large scale system interactions

By **Taylor Sullivan**, Science Teacher, Boone County High School taylor.sullivan@boone.kyschools.us

HS

As a believer in progress to improve student success, I have thoroughly enjoyed immersing myself in the NGSS as a venue for moving student thinking and learning forward. The biggest takeaway I have from jumping in with implementation of the KAS for Science is that teachers, myself included, do not need to throw out everything that we have done in the past. Instead, we can take previously used lessons and revise them to focus on "phenomena driven 3-dimensional learning." My Boone County High School colleagues and I at set out to do exactly that this past year. The following is a brief example on how we made progress towards implementation of NGSS with the familiar unit related to plate tectonics.

Our first task was to identify the "phenomenon" that corresponded with the ESS Plate Tectonic bundle developed by our district (available here). Plate tectonics in of themselves are phenomenon, but we wanted to address a common crosscutting theme of change over time. So, we settled on the ages of different regions of crustal rocks. Our driving question became, "How can we explain, using evidence, the different ages of crustal rock around the world?" Next, following the Understanding by Design process emphasized in our district, we planned the assessment/performance task. This collaborative work resulted in the following prompt: ***"Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks."***

Working backwards, we then hit the "books" and found experiences for students that would build understanding as well as allow for successful completion of the performance task. We also pulled out the old favorites: Oreo cookie plate tectonic model, convection fluid model kits, paper seafloor spreading model, and some practice on radiometric dating and magnetic pole switching. Because we were familiar with these lesson ideas, we used them as starting places to construct a student-centered quest designed to elicit understanding of the different ages of crustal rock.

What made this year different was students were doing the thinking and explaining. In the past students were

Modeling plate tectonics continued to page 5

Modeling plate tectonics continued from page 4
given the Oreo model of plate tectonics and as well as an explanation of the phenomena it modeled. Having shifted our instructional practices to reflect the vision of the NGSS, we gave students the model and then asked **them** to evaluate the model for its limitations and merits, which directly reflects components of the Science and Engineering practices. Having delved deeper into why plates move, students improved upon provided models for convection using the same criteria for evaluating models as before. (Old convection kit materials were available for student use as they improved upon stationary diagram models and technology animation models. Without explicit directions to the kits provided, students used the materials in similar and different ways to illustrate convection currents. Students then engaged in another dimension of the standards by addressing how the convection currents and the plate tectonics observed in their models connected (CCC Cause and Effect).

Students engaged in other experiences that addressed geologic time, relative dating, and radiometric dating. They tracked their understanding of the phenomenon using a concept map which served as a tool for constructing their explanation and evaluating evidence; plate tectonics and the movement of crust explains the age of crustal rocks. Students then plotted their understanding and filled out a claim, evidence, and reasoning graphic organizer (Go to Age of Crustal Rocks at http://education.ky.gov/curriculum/conpro/science/Pages/Science-Newsletter-Activities.aspx)

The result of our work served to boost the confidence of both students and our group! We realized that simple shift in our instruction and focus on explaining phenomenon made 3-dimensional learning possible and student understanding of the content improve.

Scientific argumentation – as a lesson introductory tool

By **Chris Bentley**, KVEC Instructional Specialist

MS

Shifting focus from traditional instruction to Next Generation inquiry

Teachers making the transition to Next Generation Science Standards from traditional approaches are confronted with the problem of how to facilitate discovery of content. One of the greatest misconceptions traditional educators have is that scientific content must be presented before students engage in activities with this content.

While there is truth in the fact developing understanding for scientific content is a priority, it is the idea of presentation that differs with the use of science and engineering practices as represented in the NGSS.

"How do I allow students to "discover" content? Don't they need direct instruction to know something before they can do something with it?", a question posed to KDE Instructional SpecialistChris Bentley. In response to this question, Bentley engaged the teacher and her colleagues using the following scenario that examines a possible introduction of a 6th grade science unit focused on plate tectonics (6-ESS2-3), in which traditional instructional practice was revised to support the vision of the Framework for K-12 Science.

Students who demonstrate understanding can:
Analyze and interpret date on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. **MS-ESS2-3**

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Analyzing and Interpreting Data Analyzing date 6-8 builds on K-5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. • Analyze and interpret data to provide evidence for phenomena. ***Connections to Nature of Science*** **Scientific Knowledge is Open to Revision in Light of New Evidence** • Science findings are frequently revised and/or reinterpreted based on new evidence.	**ESS1.C: The History of Planet Earth** • Tectonic processes continually generate new ocean sea floor at ridges and destroy old sea floor at trenches. (HS.ESS1.C GBE), (secondary) **ESS2.B: Plate Tectonics and Large-Scale System Interactions** • Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart.	**Patterns** • Patterns in rates of change and other numerical relationships can provide information about natural systems.

Consider a Traditional Science Classroom lesson:

Students are presented content leading them to conclusions that the continents have, over the last 250 million years,

Scientific argumentation continued to page 6

changed location, forming the landscape we see on Earth today. Evidence of Plate Tectonics is presented as content already organized from the textbook.

Now consider a Next Generation Science Classroom example:

Students are presented with the claim that all continents were once connected as a giant landmass. Through the process of ***argumentation***, the students are assigned the task of **gathering** the necessary evidence to support or refute this claim, and will sift through the content that the traditional classroom would normally spoon-feed them. The teacher provides assistance as needed. Now, there is intent to their work. The students are engaged in a purposeful activity with a goal in mind.

Reasoning with the evidence to determine if the evidence supports or refutes the claim is next. Once the evidence is obtained, students attempt to connect the evidence to the validity of the claim. This is the point that allows students to internalize the content. It is not enough to remember facts. One must scrutinize the facts for correlation, cause and effect relationships, patterns, and reliability.

Students work in small group using systematic, controlled discussions in which they defend or justify the evidence to support or refute the claim. Students will see similarities to their own conclusions, or more importantly, the differences to their own work and thinking. More questions arise, and more gathering and reasoning will ensue.

Communicating happens through scientific argumentation, conclusions based on the evidence and reasoning of that evidence. Reflections and journal writings capture the student thoughts about the learning process. Students construct an evidence based scientific argument detailing the findings from their investigations.

Generating expectations from an idea, theory, or claim:

Note, at first it might seem strange to generate expectations about something that happened long ago, but in fact, it is no different from generating expectations based on any other hypothesis or theory. The key is to remember that we are figuring out what we would expect to observe today, if a particular event had happened in the past.

http://undsci.berkeley.edu/article/howscienceworks_07

Now consider how this lesson might unfold in the classroom. Click here to continue reading.

To be linked rather than placed in page layout.

The teacher shows a globe or a Google Earth photo of the Earth to the class and asks students to observe and provide analysis on the shape of the coastlines of the continents.

"They appear to fit together."

Once this observation occurred, students are ready to engage in the lesson.

The lesson begins by constructing a research question. The obvious question deals with why the continents look like they fit together.

The Research Question: "Why do the coastlines of most continents appear as though they would fit together like pieces of a jigsaw puzzle?"

The claim will attempt to provide a scientifically plausible answer to the research question. Students can make their own claims, but I recommend using the claim with some historical context. Remember, in this introductory example students are concerned with generating expectations from the claim not necessarily generating the claim itself.

The Claim:

The Theory of Continental Drift first proposed by Alfred Wegener concluded that all of the continents on Earth were once connected some 250 million years ago in a super-continent he named Pangaea.

After the claim is made students are arranged in small groups and asked to propose IF/THEN statements. The statements will drive the gathering of information (fossil record -ie; coal in Antarctica, glacial moraines, similar species on different continents, etc). The more IF/THEN statements the students record the better to collect information. The teacher should ensure that they are scientifically reasonable.

Proposed expectations: The key is to remember that we are figuring out what we would expect to observe today, if a particular event had happened in the past.

If all of the continents were once connected, **then** one would expect to find the following evidence to support this claim:

1.____

2.____

3.____

Communication: Students engage in a Round-Robin discussion with other groups to provides them the opportunity to expand their idea base. One member of the group will stay behind to present their group data and the other members travel throughout the room visiting the other groups to question and learn about other IF/THEN statements they may not have exposed. When they return to their group new ideas and thoughts are shared.

Next, list all of the IF/THEN statements on poster paper allowing for students to discuss observations related to the statements. Students then form research groups based on interest where they will extend their learning. Lastly, students will provide new information in varying forms of presentation to the class.

NEXT GENERATION SCIENCE STANDARDS

KCAS Connections

Using models to understand stability and change in early childhood

By **Sonia Michael,** Berea Early Childhood Regional Training Center

Early Childhood Education

Helping children learn to use pictures or other reproductions to represent their experiences supports their emerging understanding of the how the use of models can explain the world around them. Children also learn that models allow them to experiment with different solutions to problems (National Research Council, 2012). There are multiple opportunities within the early childhood classroom for children to develop and use models, an essential practice for science and engineering. Models in early childhood may consist of pictures or concrete representations that children create. For example, a child may create a city or a zoo in the block area to represent their knowledge and experience or draw a picture of their home or family in the art area (Neill, 2008).

Young children begin to develop an understanding that change may occur slowly or rapidly, and that different forces play a role in change as well as stability (National Research Council, 2012). Children may explore the concept of stability through activities such as creating block structures. As children create block structures, they experiment with ways to make the structure more stable (Neill, 2008). Young children learn about change through activities such as planting seeds and observing and documenting the growth of the plant (Edson, 2013).

A typical early childhood experience that provides an excellent opportunity to incorporate both the practice of developing and using models and the concept of stability and change is the nature walk. A nature walk might grow out of children's interest in plants or animals, or could be introduced by the teacher to address specific learning outcomes. To effectively reinforce the practice of using models within the nature walk experience, adults in the classroom may introduce the idea of using a map to find different elements along the walk. Adults may model how children can draw a map and create an initial plan for the walk. During the nature walk, adults can facilitate children's conversations and observations regarding different physical features on the walk. Upon returning to the classroom, adults can facilitate the children's development of a group map or individual maps indicating the physical features from the walk. To emphasize the understanding of change, the group might take another walk several weeks later and create another map to indicate any changes that have occurred.

Across the state, many preschool teachers have participated in the development of Standards Based Units of Study through the Early Learning Leadership Networks (ELLNs) which are facilitated through the Early Childhood Regional Training Centers. Preschool teachers in Casey County constructed a standards based unit that incorporated nature walks to allow children to observe different types of trees and to observe change in the trees over time. Multiple Kentucky Early Childhood Standards were addressed within the unit including early math (measurement and patterning), literacy (listening and observing), and science (exploring, questioning, and using tools). Preschool teachers in Whitley County also incorporated nature walks as an element within a standards based unit in which they were studying gardens. Children explored plants, and the role that weather and insects play in plant growth and change. Kentucky Early Childhood Standards addressed within this unit included science (using tools), math (measurement and sorting), and literacy (listening and observing).

There are many opportunities within the early childhood classroom to support children's emerging understanding of science practices and concepts. High quality science activities in early childhood build on children's prior experiences, encourage questioning and exploration, and support children's ability to document experiences and share them with others (Worth & Grollman, 2003). For more information about embedding science within the standards based curriculum, contact your Early Childhood Regional Training Center (http://education.ky.gov/curriculum/conpro/prim-pre/Pages/Early-Childhood-Regional-Training-Centers.aspx).

Be in the Know

Why does STEAM generate interest and excitement from a wide range of stakeholders?

Why add the "A" to STEM?

What is STEAM? More importantly, "What is STEAM education?"

In early July, 33 elementary teachers from across the state met in Murray, Kentucky, to participate in the first Kentucky Department of Education STEAM Academy, in partnership with The Kentucky Center for the Performing Arts. Sixteen Kentucky schools attended, bringing a team comprised of an arts teacher and a STEM subject teacher. Working together, these teams began to answer the questions above.

The week began with the teachers uncovering surprising, yet clear, commonalities among our Kentucky Academic Standards (literacy, math, science and the arts). With this foundation, they were poised to explore a transdisciplinary approach to teaching and learning. Dr. John Nash, University of Kentucky College of Education, kicked off Monday's session by illustrating how design thinking can be an extremely effective educational approach. From then on, the week's experiences incorporated design thinking, not only as a focus of learning experiences, but also as a planning tool. The academy facilitators used design thinking to plan the week, and the participants learned how to use design thinking to plan for their students.

After developing an appreciation for the power of a growth mindset, based on the work of Carol Dweck, participants began to explore the idea of creativity – what it is, why they value it, and how to develop creative behaviors in their students. The daily activities were anchored to the five creative behaviors identified Christen Clayton's research: associating, questioning, observing, networking and experimenting. Exploration with jeweler's loupes, appreciating the power of observation, and learning about synectics helped to exercise the creative muscle. Presentations and performances by artists Jeffrey Jamner, Matthew Karr, and Graciela Perrone provided "insight as to why they do what they do, and gave us something to strive for as teachers, to guide our students to that place, where they can be super creative, but also know the WHY behind it." (quote from Academy participant.)

Our shared experiences during the week helped participants develop answers to their questions about STEAM as an educational approach. Enthusiasm was high for simple strategies that will help them shift their instruction to develop more creative, thoughtful, and independent learners in their classrooms. And the learning continues: We have created an online community that will work throughout the school year to further the understanding of STEAM education, as we identify, develop and implement resources for instruction and assessment, and gather evidence of student success.

For more information contact:
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Ellen.sears@education.ky.gov
Christine.duke@education.ky.gov
JJAMNER@kentuckycenter.org

NGSS NOW

Did you know that Achieve sends "10 things you need to know about the NGSS this month (and a Science fact" directly to your inbox at the start of each month? To receive these monthly newsletters, sign up at http://www.nextgenscience.org/newsletter-signup.

CIITS Update

CIITS Professional Learning Resources Relocated

CIITS professional learning resources have been relocated from PowerSource to a Google training site located here. This site is more user friendly and allows KDE to manage the training materials in a manner to meet Kentucky educator's needs. You can access these materials by clicking on "New CIITS Professional Learning Resources" on the left side of the CIITS homepage.

CIITS Report Bank Update

The third-party standardized assessment reports listed below have been updated in the CIITS report bank:

- 2014-15 Discovery Education Assessment (DEA)
- STAR (through 6/1/2015)
- MAP (through 4/15/2015)

Note: KDE is no longer contracting with Edivation (formerly known as PD 360).This connection has been removed from CIITS.

Professional Learning Opportunities

PIMSER Fall 2015
Science Professional Learning

The Partnership Institute for Math and Science Education Reform (PIMSER) continues to provide quality training and support for improvements in science education that is responsive to your the needs at all levels. PIMSER has developed numerous short courses to support you throughout the 2015-16 school year. These short courses are designed to strengthen grade-level specific content understanding and/or understanding of science and engineering practices at the designated grade bands. All sessions will examine misconceptions and naïve conceptions that might hinder concept and practice development, and participants will learn how to design experiences to help students develop a more accurate scientific understanding. Participants will experience activities as a learner that promote concept and practice understanding, and discuss implications for best practice and highly effective teaching with other professionals. Teachers will leave each session with examples, resources, and a deepened understanding of how to implement the NGSS." (Pimser) Specific information related to the specific short courses including dates and fees can be found here.

Make plans to visit the Living Arts and Science Center for a "Brain Science Night" on Thursday, Oct. 1st, 6-8 p.m.

On the first Thursday of every month the LASC invites local artists or scientists to come and show visitors a little of what they do. Mark your calendars and prepare to "Brainstorm" with University of Kentucky neuroscientists as you experience a close-up view of REAL human and animal brains and spinal cords! Test your senses and participate in a variety of vision and sensory activities!

More information on this event as well as a host of other classes, workshops and afterschool activities, go to The Living Arts and Science Center home page.

KAEE

The Kentucky Association for Environmental Education (KAEE) in partnership with the Kentucky Environmental Education Council (KEEC) and the Kentucky Department of Education (KDE) are providing small grants of $2,250 to support schools that commit to pilot projects. These projects will support and advance environmental literacy and environment based education in the state through the implementation of the Kentucky Environmental Literacy Plan (KELP) http://keec.ky.gov/Documents/KELP/KELP.pdf. For information relating to this grant opportunity please contact Ashley Hoffman, Executive Director, KAEE at director@kaee.org or you can download the full Request for Proposals at http://kaee.org/about-2/announcements/. The deadline to apply is September 18, 2015.

Kentucky Association for Environmental Education is hosting their 39th annual conference at Jenny Wiley State Park in Prestonsburg, Kentucky, on Sept. 11-12, with additional pre- and post-conference options. Fun networking and social times are planned too!

This year's theme is Full STEAM Ahead! This is an excellent professional development opportunity for formal or non-formal educators who teach science, technology, arts and agriculture, and math. Visit www.kaee.org/conference for more information!

Show your support for environmental education in Kentucky

Apply for the new "Let's Go Outside" specialty license plate

Applications for the plate, which will support the programs of the Kentucky Environmental Education Council, are available at keec.ky.gov/LetsGoOutside. In order to make the plate available across Kentucky, KEEC needs 900 applications accompanied by a ***$25 check***. The $25 will be credited toward the applicant's future registration fee for the plate.

In addition to encouraging Kentuckians to experience the outdoors, the license plates will be mobile advertisements for the importance of EE in Kentucky. KEEC hopes that each of us, in addition to applying for it ourselves, will share the announcement with friends and family and encourage them to apply.

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. 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. Below are the upcoming SCN focus dimensions:

	Science and Engineering Practice	Disciplinary Core	**Crosscutting Concept**
October	Planning and Carrying out Investigations	LS2B Cycles of matter and energy transfers in ecosystems LS2C Ecosystem dynamics, functioning, and resilience	**System and System models**
Novemeber	Asking Questions and defining problems	PS3C Relationship between energy and forces PS3D energy in chemical processes and everyday life	Energy and Matter

Please send your contributions to christine.duke@education.ky.gov.

All submissions are needed by the 15th of the month prior to publication.

If you want to subscribe to KYK12SCI or others LISTSERV for the Kentucky K-12 Science Teachers, go to http://www.coe. uky.edu/lists/kylists.php. Please share this link with your colleagues.