**Pennsylvania Science Framework**

**November 9, 2015**

The Pennsylvania Science Curriculum Framework located in the SAS Science Learning Community was developed by over 300 individuals across the commonwealth. This included K-12 teachers, science content specialists, and curriculum developers. Individuals were from every part of Pennsylvania, representing rural, suburban, and urban regions. Multiple resources were used in the development of the framework to ensure that the best thinking of science education was incorporated in the framework. The Pennsylvania Science Framework is an additional tool available for the development of K-12 science curricula.

Science has not been at the forefront of many school districts’ curricular efforts. This document is one tool that schools can utilize in developing high quality science curriculum that will be aligned with science programs. The framework is intended to help focus curricular efforts, enable the alignment with multiple documents currently available on the PDE website, and help make informed decisions regarding the teaching and learning of science in our classrooms.

This document utilizes the Three Dimensional Learning model throughout the document. The dimensions include Unifying Themes, Inquiry, and Content. The competencies are specifically written to incorporate the Three Dimensions. This is a shift from previous documents where each was delineated separately and never integrated. Unifying Themes and Inquiry must be taught in conjunction with the science content. Students must be actively involved in the learning of content in science through Inquiry. Explanations of science phenomena must include Unifying Themes as part of the explanation, and data/evidence is directly connected with the learning experience. This is important for multiple reasons. Three Dimensional teaching and learning . . .

* Develops meaning and understanding for the student
* Maintains a focus on understanding and application as opposed to memorization of facts devoid of context
* Makes connections between and among concepts/content
* Will increase PSSA scores since 50% of the Fourth and Eighth Grade Science PSSA revolves around the Nature of Science
* Makes connections with other content areas
* Focuses and makes curriculum coherent, K-12
* Scientific explanations require evidence to support the explanation
* Utilizes Unifying Themes to explain and predict
* Makes the assumption that students have learned previous material
* Prepares students for college and career readiness

By having students explain/describe their learning through Unifying Themes and Inquiry, this framework significantly raises the rigor of learning. This framework does not expect students to learn science content in isolation, there is an expectation of making meaning through Unifying Themes. While it raises rigor, it also provides a context for which learning can take place.

There are a number of items that must be kept in mind in the development of a coherent K-12 science curriculum. This document is an attempt to bring clarity and consistency in developing curriculum and programs for use in classrooms. At the current time, there are approximately 17 documents on the PDE website that focus on K-12 science. The PA Science Framework focuses the teaching of learning in light of current research. Please keep in mind the following:

* The Fourth Grade and Eighth Grade Science PSSA Exams are based upon the 2007 Assessment Anchors and Eligible Content.
* The Fourth Grade and Eighth Grade Science PSSA Assessment Anchors and Eligible Content are based upon the 2002 Academic Standards for Science and Technology Education, which is part of Chapter 4.
* The Fourth Grade and Eighth Grade Science PSSA includes 50% Inquiry and the Nature of Science while the remaining 50% equally covers Physical Science, Life Science, and Earth and Space Science.
* The alignment of the framework to the Assessment Anchors and Eligible Content utilizes only the Fourth Grade and Eighth Grade Assessment Anchors and Eligible Content, which is consistent with the PSSA Science Assessments.
* The competencies are written to incorporate Inquiry and Unifying Themes. Subsequent documents will further expand on Inquiry and Unifying Themes in grade bands.
* The Biology Keystone Exam is based upon the 2011 Biology Assessment Anchors and Eligible Content, which is based on the 2010 SAS Voluntary Science Standards.
* This is a science framework, so it will not address all the items in the Environment & Ecology Standards or the Technology and Engineering Standards. There are items that cut across all three areas and that is a document that needs to be created.

Multiple documents were utilized in the development and writing of the PA Science Framework. These included the following: 2002 Pennsylvania Academic Standards for Science and Technology, SAS Voluntary Science Standards, *Project 2061 Benchmarks for Science Literacy, National Science Education Standards*, *A Framework for K-12 Science Education*, and the *Next Generation Science Standards*. The writers of the framework utilized the best thinking to date in regards to the teaching and learning of science. The organization of the Pennsylvania Science Framework is organized around Big Ideas which is consistent with *A Framework for K-12 Science Education.* This organization permits school districts to develop a coherent and focused curriculum for school districts to ensure that their students are college and career ready.

Due to multiple documents that are currently available and utilized in Pennsylvania to develop science curricula at all levels, the framework is aligned to the 2002 Academic Standards, SAS Voluntary Standards, and the Assessment Anchors and Eligible Content. It is our hope that the framework is one additional tool that will enable districts to enter into curriculum development at multiple points and minimize confusion. This is not a curriculum, but a framework to guide curriculum development.

Separate documents focusing on Inquiry and Unifying Themes will be added at a later date. It is important to note that the Nature of Science is embedded within the competencies in the framework. This is direction as to how science is to be both taught and learned in classrooms across the commonwealth. Within the Fourth and Eighth Grade Science PSSA, the Nature of Science consists of 50% of the exams. To not implement Unifying Themes and Inquiry within the science curriculum for schools, we are setting our students up for failure. The Nature of Science is also a component in the Biology Keystone Exam.

The framework is structured by grade level. The topics for each grade level are similar to programs that districts will be implementing over the coming years, which will make it simpler for both curriculum development and program adoption. Topics within grade levels progress conceptually, which enables higher level thinking and exploring topics in greater depth. This is not to dictate that which is to be taught at individual grade levels, but to be a guide. The important endpoints for districts to remember are at grades four and eight, at which point the Science PSSA is administered. Therefore, the topics taught at grades two and three are not as important as it is to cover the material prior to the Science PSSA. There is flexibility within grade levels for school districts. However, over the next several years, text books and programs will reflect the current structure within the PA Science Framework. The only caution is to ensure that the sequence of concepts is appropriate.

International studies and research in teaching and learning demonstrate the need to focus on fewer topics in greater depth. The PA Science Framework utilizes this research in progressing conceptually throughout the grade levels as opposed to focusing on small bits and pieces of content. Overall, the United States introduces topics earlier and maintains them in the curricula longer than other higher scoring countries. This framework takes into account this problem to enable curricula to be focused conceptually. For students to achieve the competencies, there are additional learnings that may necessary, which will be delineated within the curricula that schools develop. A task in developing science curricula is to address all the content and competencies necessary for students to attain the competencies listed.

Lastly, the PA Science Framework will continually be a work in progress and your comments are more than welcome. Too often documents become static and outdated. It is our hope this document will be a living document to continually reflect current research in the teaching and learning of science, as well as current knowledge of science. It is not intended to be all inclusive, but as a framework to begin limiting and focusing content for students to learn. For our students to be successful, all students must be taught science at every grade level. Individual school districts will be able to utilize this framework to determine how best to meet the Pennsylvania Academic Standards and the Assessment Anchors/Eligible Content to ensure that our students will become scientific literate citizens of Pennsylvania.