Science/STEM Internal Audit Update

Technology & Engineering Education Association of Pennsylvania

pennsylvania DEPARTMENT OF EDUCATION

NEXT GENERATION SCIENCE STANDARDS For States, By States

CSTEACHERS.ORG COMPUTER SCIENCE TEACHERS ASSOCIATION

Science Technology Engineering Math

What STEM Is	What STEM is not
Preparation for tomorrow's careers	A fad
Designing and solving problems	Following directions
Ongoing	Only event-based
Integrated	Isolated

SDHT Curriculum Review Cycle	2016-17	2017-18	2018-19	2019-20	2020-21
K12 ELA K-12 Reading	Audit	Develop	Implement 1	Implement 2 Monitor 1	Monitor 2
K-12 Science K-12 ART	Adjust and Align	Audit	Develop	Implement 1	Implement 2 Monitor 1
K-12 Social Studies K-12 HPE	Adjust and Align	Adjust and Align	Audit	Develop	Implement 1

Who is the Audit Team?

Elementary Teachers

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Who is the Audit Team?

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Curriculum Audit Cycle - Science STEM

Curriculum Baseline

- Background reading and preparation by audit team
- Standards identified

Internal Analysis

- Current curriculum and resource evaluation using
  - PA Science Standards (Science)
  - Next Generation Science Standards (NGSS Science and Engineering)
  - K-12 Computer Science Standards (Technology)
  - PA Technology Standards (Technology and Engineering)
  - Teacher survey
- Data Analysis - survey results, test results, enrollment, recommendation criteria
- Standards Gap Analysis - What are we teaching? What is missing? What needs to change?

PA Academic Standards for Science and Technology and Engineering Education

- Biological Sciences
  - Organisms and Cells
  - Genetics
  - Evolution
- Physical Sciences
  - Chemistry
  - Physics
- Earth and Space Sciences
  - Earth Structures, Processes and Cycles
  - Origin and Evolution of the Universe

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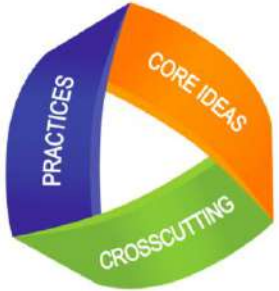
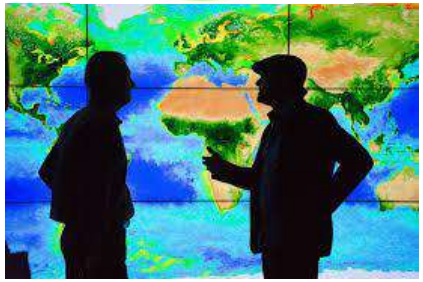
Next Generation Science Standards

National Academy of Science, National Science Teachers Association, and American Association for the Advancement of Science





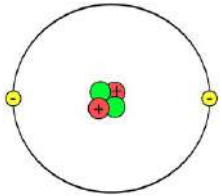
Structure and Properties of Matter

2nd Grade

- Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

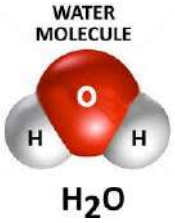
5th Grade

- Develop a model to describe that matter is made of particles too small to be seen.



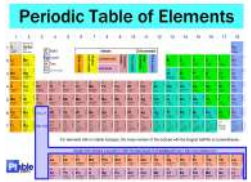
Middle School

- Develop models to describe the atomic composition of simple molecules and extended structures.



High School

- Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.



Computer Science

- Computing Systems
- Networks and the Internet
- Data and Analysis
- Algorithms and Programming
- Impacts of Computing

PA Technology and Engineering Education

- Scope of Technology
- Technology and Society
- Technology and Engineering Design
- Abilities for a Technological World
- The Designed World

What the audit looks like:

N	Discipline	SubDiscipline	Grade Level	Standard	Statement	IPS	CHEM	BIO- ACADEMIC	IPS yes/no	Chem yes/no	Bio yes/no	Physics
138	Physical Science	Matter and its Interactions	High School	HS-PS1-1	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. [Clarification Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen.] [Assessment Boundary: Assessment is limited to main group elements. Assessment does not include quantitative understanding of ionization energy beyond relative trends.]	no	Chapter 6-9,11. Mystery of the Periodic Table Activity, Reactivity of Metals SR lab, Shapes of molecules POGIL, Bonding WebQuest, Formative and summative assessments	Weak- discussion of valence electrons as they relate to bonding	no	yes	yes	AP-1/2

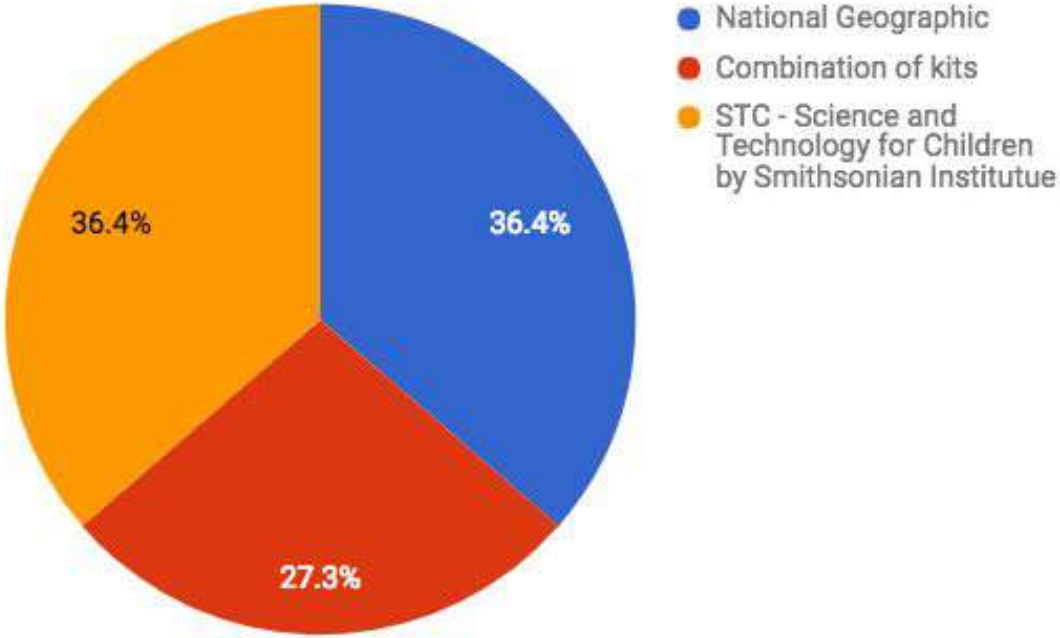
Initial Audit Findings

Science/STEM Findings - Elementary

Standards Gap Analysis - Science	PA Standards for Science-aligned NGSS Standards-gaps exist
Standards Gap Analysis - Technology	Computer Science Standards
Standards Gap Analysis - Engineering	NGSS-gaps exist Engineering Practices
Teacher Input	Hands on, newer kits, engineering, professional development
Performance Data	PA avg. % prof/adv = 74.5; SDHT avg of schools = 92.9% prof/adv

Elementary Resources Example

Which Resource do you use to teach your 2nd grade unit on solids, liquids and gases?



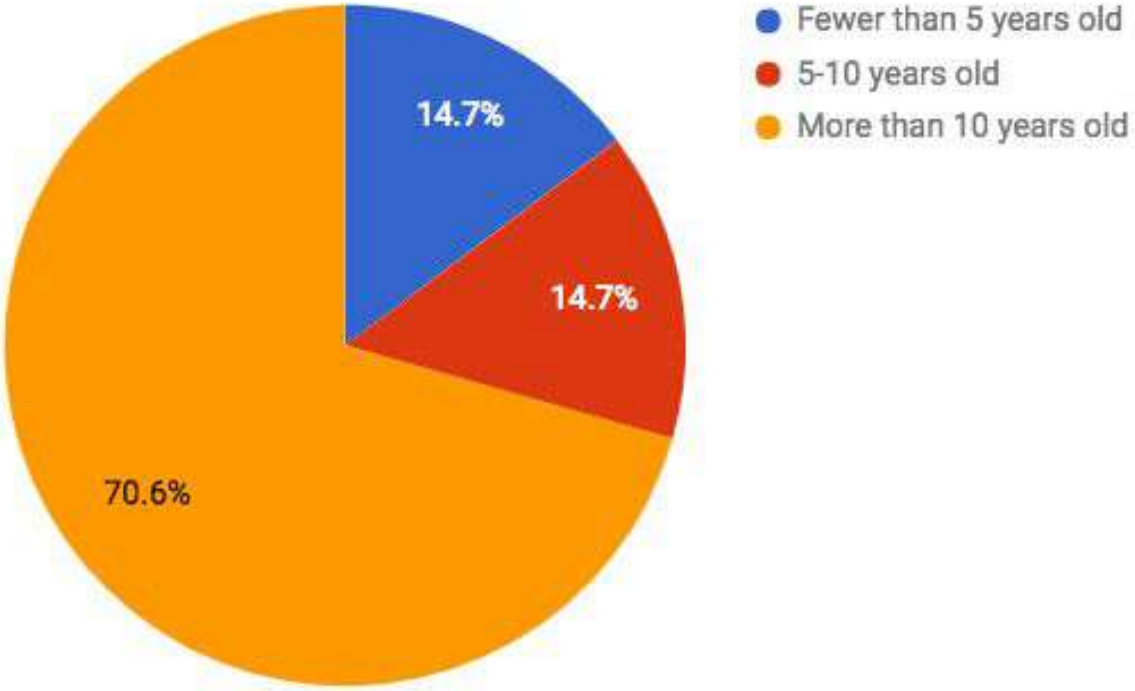
Science STEM findings - Secondary

Standards Gap Analysis - Science	PA Standards for Science-aligned NGSS Standards-gaps exist Earth and Space Science Engineering Practices
Standards Gap Analysis - Technology	Computer Science Standards-gaps exist Coding
Standards Gap Analysis - Engineering	PA Academic Standards for Technology and Engineering Education-partially aligned in electives NGSS-gaps exist Engineering Practices

Science STEM Findings - Secondary

Teacher Input	Textbooks, Engineering, Computer Science Offerings
Performance Data	Keystone: 2017 State % adv/prof=63.4; SDHT % adv/prof = 81.6 PSSA: 2017 State % adv/prof = 52.7; SDHT % adv/prof = 77.7
Enrollment Data	Generally representative of overall population

Secondary Science Materials



Next Steps - Curriculum Audit Cycle

Internal Analysis

- Continue Reviewing Standards and Curriculum

External Analysis

- Science Advisory Group - meeting with several local scientists and engineers to discuss expectations at collegiate level
- Visiting, Interviewing, Surveying or Conducting Site Visits of high-performing schools focusing on the strengths of that curriculum related to Science, Technology, and/or Computer Science.
- Parent Survey & Analysis
- Student Survey/Focus Group & Analysis
- Empirical research & best practices via national associations

Experts' best guess about the combination of traits that will guarantee rewarding employment in tomorrow's economy…

Elite-level technical abilities

The probing mind of a scientist

And a deft human touch

Herold, Benjamin. "The Future of Work Is Uncertain, Schools Should Worry Now."*Education Week*, 9 Oct. 2017, www.edweek.org/ew/articles/2017/09/27/the-future-of-work-is-uncertain-schools.html.