THINKING DIFFERENTLY ABOUT HOW WE TEACH SCIENCE: WHY NIH SHOULD CARE

SCIENCE EDUCATION CONVERSATIONS

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WHY ENGAGE IN CONVERSATIONS ABOUT STEM EDUCATION?

A 21ST CENTURY PERSPECTIVE

- 21st Century Challenges
- Contemporary Initiatives in STEM Education
- Implications for Leadership: A Vision and Plans
- Moving from National Issues to STEM Classrooms

SOCIETAL CHALLENGES FOR THE 21ST CENTURY

1. Environmental quality and the need for responses to global climate change
2. Energy efficiency and adequate responses for a carbon-constrained world
3. Resource use and the need to address conflicts over limited natural resources
4. Natural hazards and the need for mitigation of severe weather, earthquakes, fires, droughts
5. Health maintenance and the need to reduce preventable diseases

EDUCATIONAL CHALLENGES FOR THE 21ST CENTURY

- Achieving Higher Levels of STEM Literacy
- Developing a Deep Technical Workforce
- Sustaining an Advanced R&D Workforce with Increased Numbers and Diversity of Students in STEM Professions

CONTEMPORARY INITIATIVES IN STEM EDUCATION

- Next Generation of Science Standards
- 21st Century Workforce Skills

THE NEXT GENERATION OF SCIENCE STANDARDS

SCIENTIFIC AND ENGINEERING PRACTICES

1. Asking questions [for science] and defining problems [for engineering]
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations [for science] and designing solutions [for engineering]
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

THE NEXT GENERATION OF SCIENCE STANDARDS

DISCIPLINARY CORE IDEAS

Physical Sciences
PS 1: Matter and its interactions
PS 2: Motion and stability: Forces and interactions
PS 3: Energy
PS 4: Waves and their applications in technologies for information transfer

Life Sciences
LS 1: From molecules to organisms: Structures and processes
LS 2: Ecosystems: Interactions, energy, and dynamics
LS 3: Heredity: Inheritance and variation of traits
LS 4: Biological Evolution: Unity and diversity

Earth and Space Sciences
ESS 1: Earth's place in the universe
ESS 2: Earth's systems
ESS 3: Earth and human activity

Engineering, Technology, and the Applications of Science
ETS 1: Engineering design
ETS 2: Links among engineering, technology, science, and society

THE NEXT GENERATION OF SCIENCE STANDARDS

CROSSCUTTING CONCEPTS

Patterns

Cause and Effect: Mechanism and Explanation

Scale, Proportion, and Quantity

Systems and System Models

Energy and Matter: Focus, Cycles, and Conservation

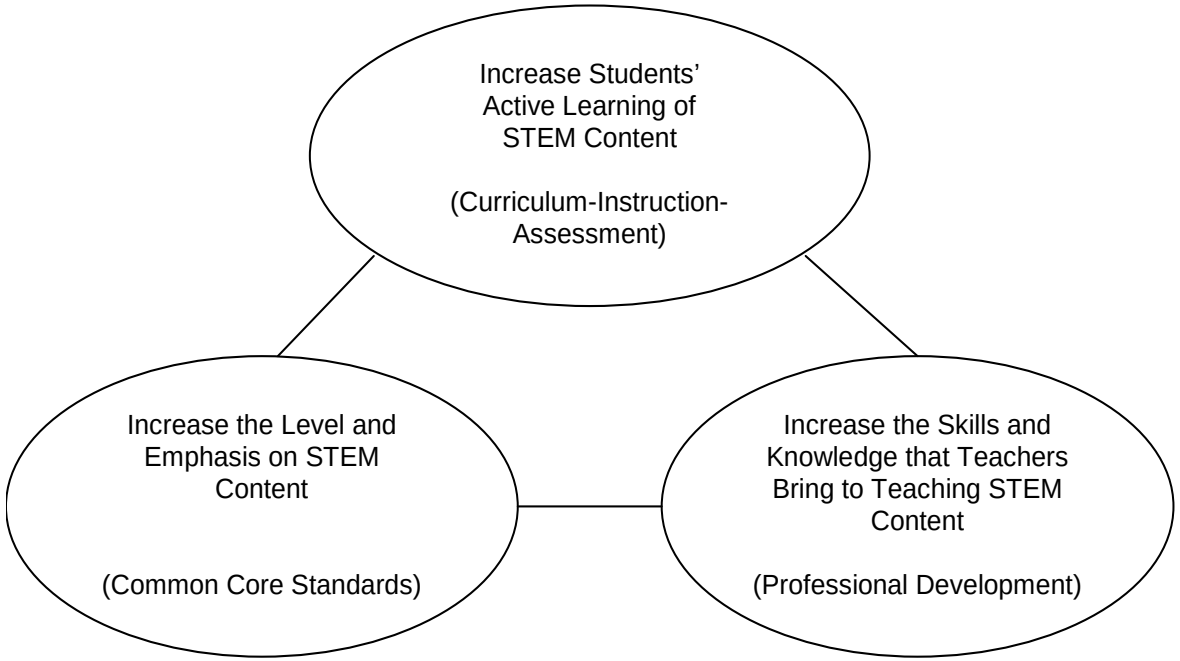
Structure and Function

Stability and Change

21ST CENTURY WORKFORCE SKILLS

- Adaptability
- Complex Communications/Social Skills
- Nonroutine Problem Solving
- Self-management/Self-development
- Systems Thinking

THREE WAYS TO IMPROVE STUDENT LEARNING AT SCALE



Adapted from: Richard Elmore. "Improving the Instructional Core." In City, E., Elmore R., Fiarman, S., & Teite, L. (2009). *Instructional Rounds in Education: A Network Approach to Improving Teaching and Learning.* Cambridge, MA: Harvard Education Press.

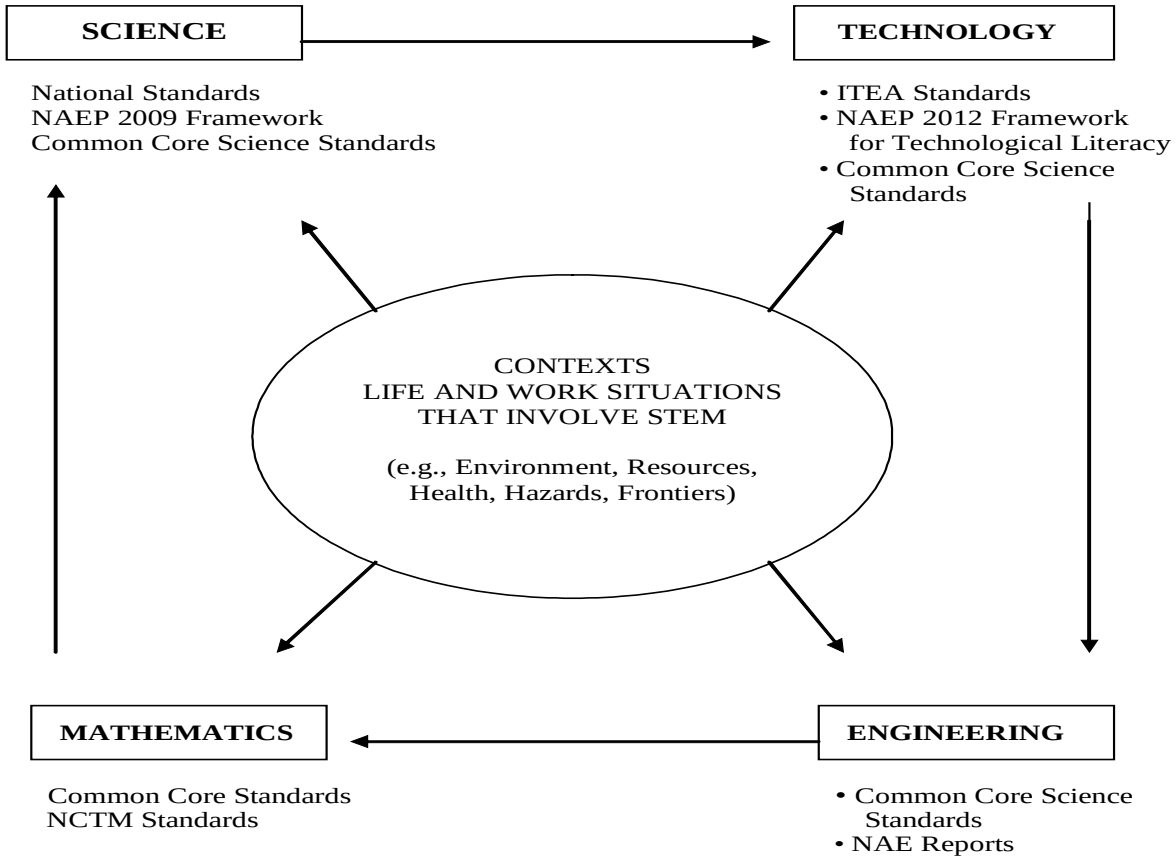
FROM NATIONAL ISSUES TO STEM CLASSROOMS

NATIONAL ISSUE	**HEALTH**
EDUCATION THEME	MAINTENANCE OF PERSONAL HEALTH – PREVENTION OF DISEASE
ADVANCING STEM EDUCATION GOAL	DEVELOP STUDENTS' UNDERSTANDING AND ABILITIES IN 4 AREAS OF PERSONAL HEALTH ▪Predictive ▪Preventive ▪Personalized ▪Participatory
IMPLEMENTATION STRATEGY FOR INSTRUCTIONAL CORE	▪Include Health as a Context for STEM Programs ▪Provide Engaging Health-Related Tasks for Students ▪Use Replacement Units as the Basis for Developing Teachers' Knowledge and Skills

EXAMPLES OF CONTEXTS FOR INSTRUCTIONAL UNITS

CONTEXT	**PERSONAL** **(Elementary School)**	**SOCIAL** **(Middle School)**	**GLOBAL** **(High School)**
HEALTH	Maintenance of health, accidents, nutrition, diet	Social transmission of disease, food choices, community health Genetic basis of disease	Epidemics, spread of infectious disease Biochemical specifics of ailments STEM cells and treatment of diseases such as Parkinson's, liver failure, and diabetes

DESIGN FOR EXEMPLARY INSTRUCTIONAL UNITS



TOPICS FOR THE CONVERSATION

- Understanding “Superbugs” (e.g., Antibiotic Resistance)
- Understanding Individual, Community, and Global Health
- Integrated (i.e., STEM) Approaches to Health
- Health Decisions and Quantitative Literacy

IDEAS FOR THE CONVERSATION

- Systems Thinking
- Chronic Low-intensity Influences
- Ethics and Health-related Decisions
- Nature of Science in Health Contexts

WHAT IS DIFFERENT ABOUT THE WAY WE TEACH SCIENCE?

CONCLUSION