Fifth International Conference

Quality Growth of Inquiry-Based Science Education Programs

Monterrey, Mexico
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National Science Resources Center
National Academies and Smithsonian

Fifth International Conference

Quality Growth of Inquiry-Based Science Education Programs

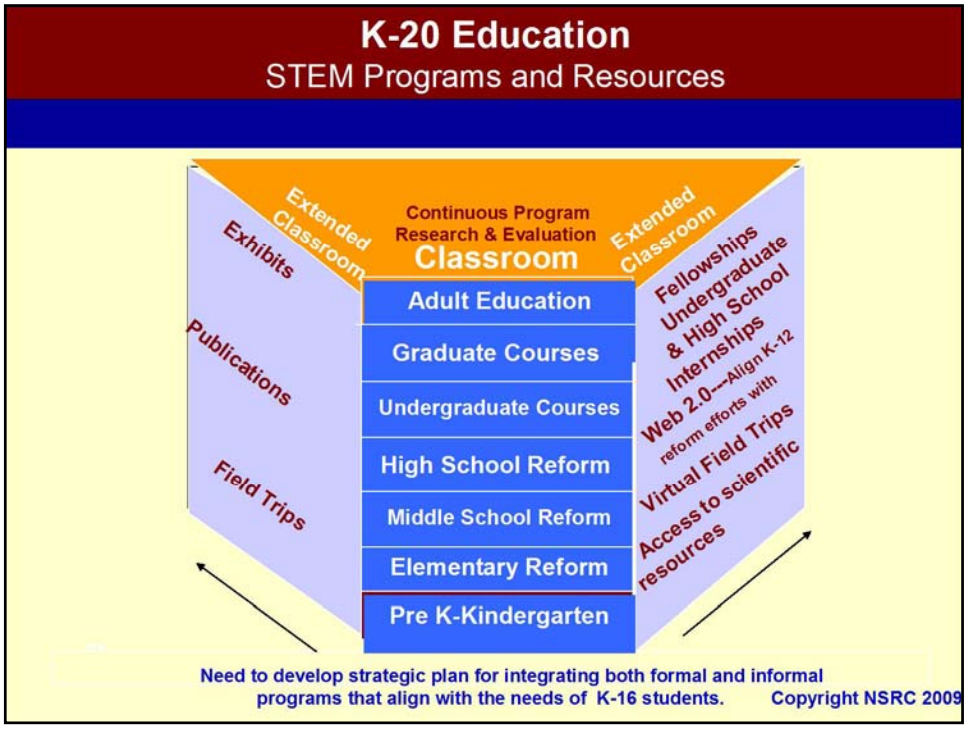
Vision

Expanding Our Vision for Quality Growth

Four considerations for redefining the notion of school and schooling

Expanding Our Vision –

1. Redefine school from place to experience



Expanding Our Vision –

1. **Redefine the notion of school from place to experience**

2. **Redefine the organization of secondary school from time to levels of mastery**

Expanding Our Vision –

1. Redefine the notion of school from place to experience

2. Redefine the organization of secondary school from time to levels of mastery

3. Systematically engage all students every year in authentic research projects, beginning in grade 3

Expanding Our Vision –

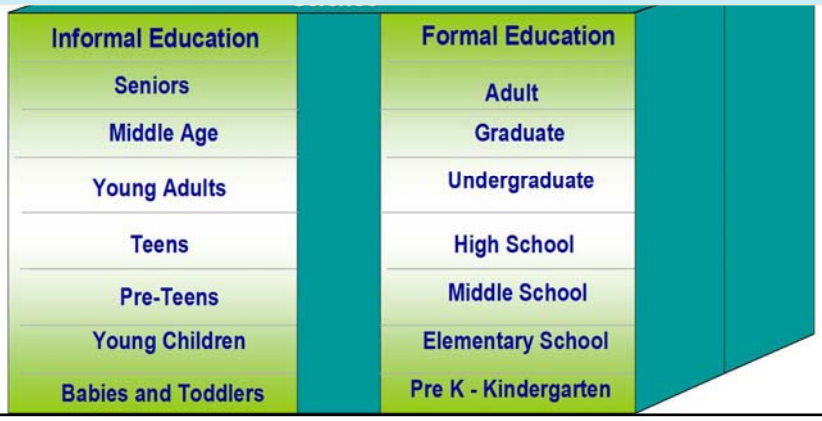
1. Redefine the notion of school from place to experience

2. Redefine the organization of secondary school from time to levels of mastery

3. Systematically engage all students every year in authentic research projects, beginning in grade 3

4. Blur the lines between formal and informal education

Science Education Landscape



Fifth International Conference

Quality Growth of Inquiry-Based Science Education Programs

A Vision for Quality Growth –

Changing the Culture of Science Education

A Vision for Quality Growth – Changing the Culture of Science Education

Social Norm Problems

The transformation of current into effective K-12 science education programs throughout the world is one type of a social norm problem that requires a change in the culture.

Smoking and seat belt use are examples of social norm problems.

Science education, like smoking, is a type of social norm problem that involves "large-numbers and a large-payoff."

Vision for Quality Growth

Changing the Culture – 5 Areas

1. **Leadership**
2. **Expectations of students and learning**
3. **Preparation of teachers for teaching**
4. **Systems of support**
5. **Strategies for growth**

A Vision for Quality Growth

Changing the Culture

1. Leadership

Leadership

Need to create a culture and strategies that science education reform requires the strategic involvement of all stakeholders

Leaders

Who are they?

What do they need to know?

How should they change the culture for transforming K-16 science education programs for all students?

Leaders

Who are they? ….Those who have a stake in education who have leadership skills, passion, persistence, motivation to make a difference, and knowledge about science education research and best practices

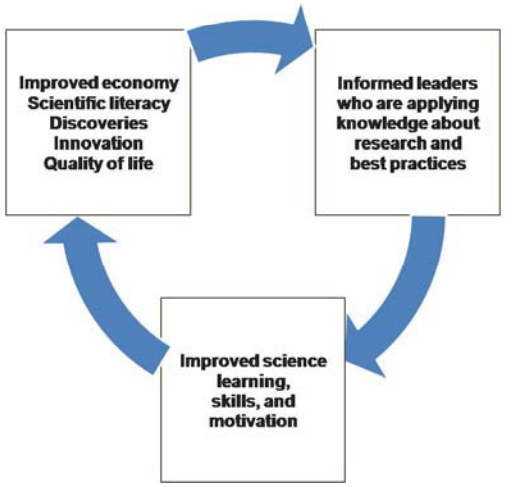
- **Local, State, and National Leaders**
- **Students and Teachers**
- **Parents**
- **Officials representing education,**
- **government, business**

Leadership

Identify and educate a distributive leadership team representing national, state, and local leaders from government, education, business, non-profits,

Select leaders who have the time and motivation to assume responsibility for leading reform in their communities and states.

Leadership Development
Return on Investment



A Vision for Quality Growth

Changing the Culture

2. Expectations of students and learning

K-16 Students

Who they are?

What do they expect from us?

What are they capable of doing?

A Vision of Students Today

http://www.youtube.com/watch?v=dGCJ46vyR9o

A Vision of K-12 Students Today

http://www.youtube.com/watch?v=_A-ZVCjfWf8&NR=1,

Children come to school with rich knowledge of the natural world and an ability to engage in complex reasoning… Too often instructional and curricular approaches currently used in classrooms do not reflect this emerging understanding of children as competent learners who can engage in scientific tasks throughout their schooling

Taking Science to School, National Research Council, 2007

A Vision for Quality Growth

Changing the Culture

3. Preparation and support of teachers

K-16 Teachers

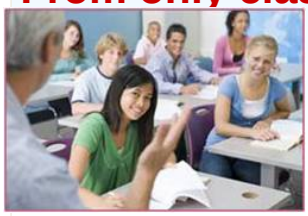
Who they are?

What do they expect from us?

What are they capable of doing?

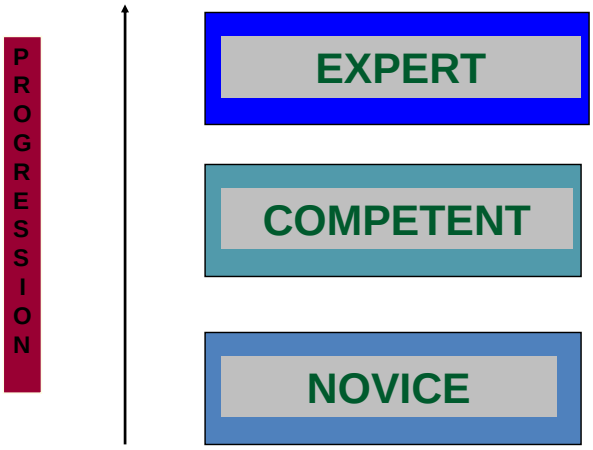
Need to change the culture to have academic institutions, school districts, and other organizations design and implement professional development programs for teachers based on research and promising practices….

From only classroom to applications



experiences + classroom discussions + research

Development of Expertise



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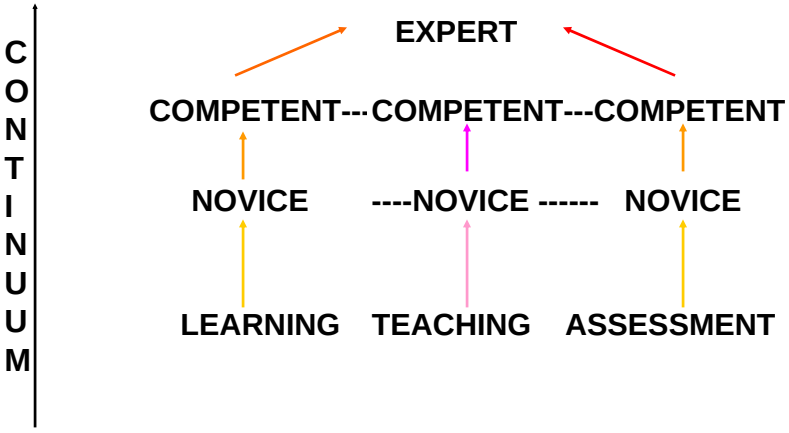
Pre-service and In-service Programs

Need for Differentiated Professional Development Programs



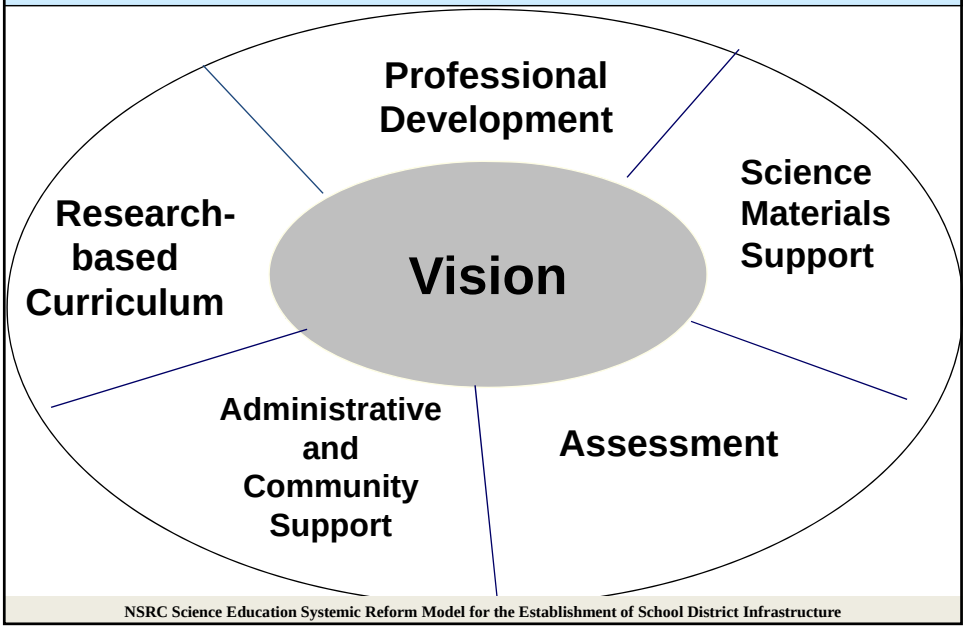
Seamless Pre-service and In-service Programs

A Vision for Quality Growth

Changing the Culture

4. Systems of support

Need Systems' Approach for Quality and Sustainable Programs

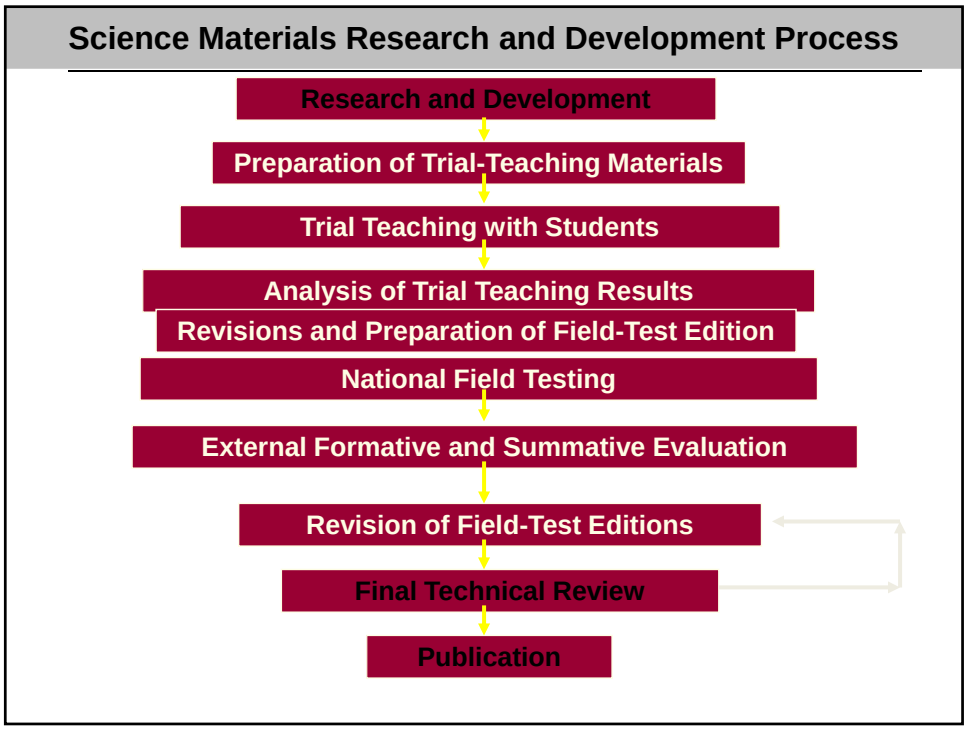


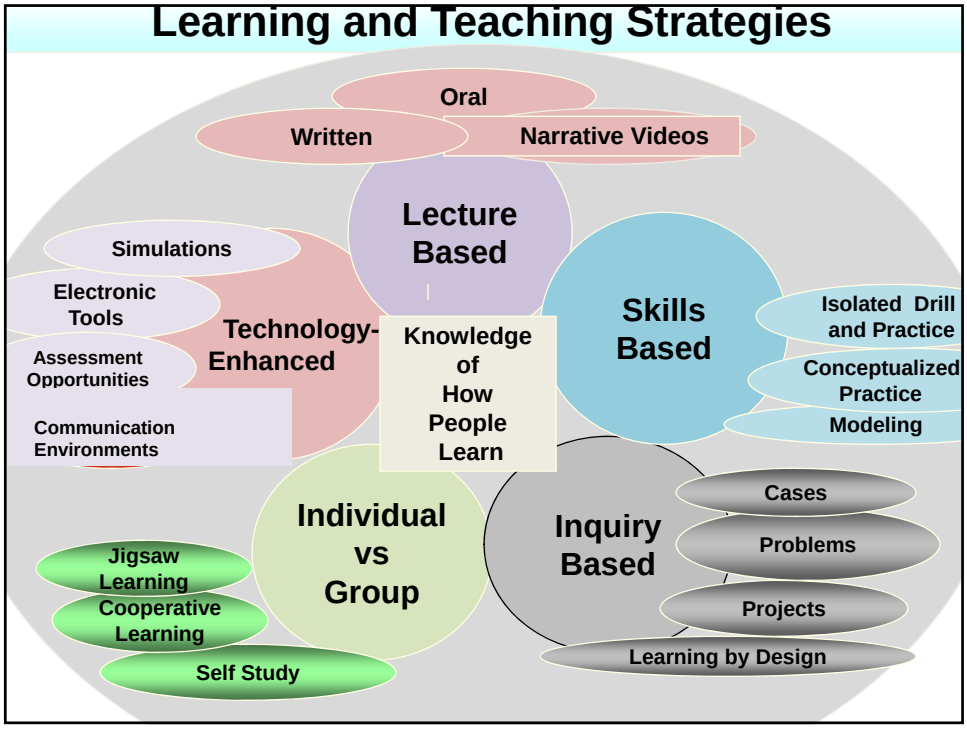
NSRC Science Education Systemic Reform Model for the Establishment of School District Infrastructure

Research-based Curriculum

Culture associated with instructional materials

National and state policies and district curriculum programs need to value and systemically use instructional materials produced using rigorous research and development processes





2009 Science and Technology Concepts Program New Learning Framework				
	Life Sciences	Earth Sciences	Physical Sciences	
			Chemistry	Physics
Theme	Life on Earth	Earth's Dynamic Systems	Matter and Change	Energy in Our World
K	To be developed			
K-1	Observing and Comparing Organisms	Observing Weather	Comparing Solids and Liquids	Comparing and Measuring
2-3	Investigating the Life Cycles of Butterflies and Other Animals	Researching Rocks and Minerals	Exploring Changes	Balancing and Weighing
	Researching Plant Growth and Development and Interdependence	Investigating Soils	Using Chemical Tests	Understanding Sound
4-5	Studying Animal Diversity	Studying the Interaction of Land and Water	Understanding Food Chemistry	Investigating Electric Circuits
	Exploring Microworlds	Investigating Ecosystems	Investigating Floating and Sinking	Studying Motion and Design
Secondary	Investigating Digestion and Motion	Understanding Atmospheric and Oceanic Processes	Exploring the Properties of Matter	Experimenting with Forces and Motion
	Exploring Respiration and Circulation	Researching the Sun-Earth-Moon System	Experimenting with Mixtures, Compounds, and Elements	Working with Motors and Simple Machines
	Investigating Biodiversity and Interdependence	Exploring Planetary Systems	New unit to be developed	Investigating Circuit Design
	Studying the Development and Reproduction of Organisms	Exploring Plate Tectonics	New unit to be developed	Exploring the Nature of Light
	New unit to be developed	New unit to be developed	New unit to be developed	Discovering Electrical Systems

Professional Development

Use research-based instructional materials as the component to drive reform of professional development of teachers and obtain gains in student achievement

Assessment

Materials Support

Administrative and Community Support

Culture of science in the school curriculum by school administrators and policy makers

Need to change the culture in order that science is seen as a core subject in the school curriculum and as a strategy for inspiring a love for learning, including writing, reading, and mathematics

A Vision for Quality Growth

Changing the Culture

5. Strategies for Growth

Quality Growth of Inquiry-Based Science Programs

……

Require informed leadership using strategic, systemic, sustainable, and scaleable strategies

Growth Principle 1

Approach Science Education Reform as a Social Norm Problem

Problems are analogous to many health issues that require long- term and complex strategies

Growth Principle 2

Study Research and Promising Practices

Inform theory of action with research
studies and promising practices primarily from the reports and studies of the National Research Council

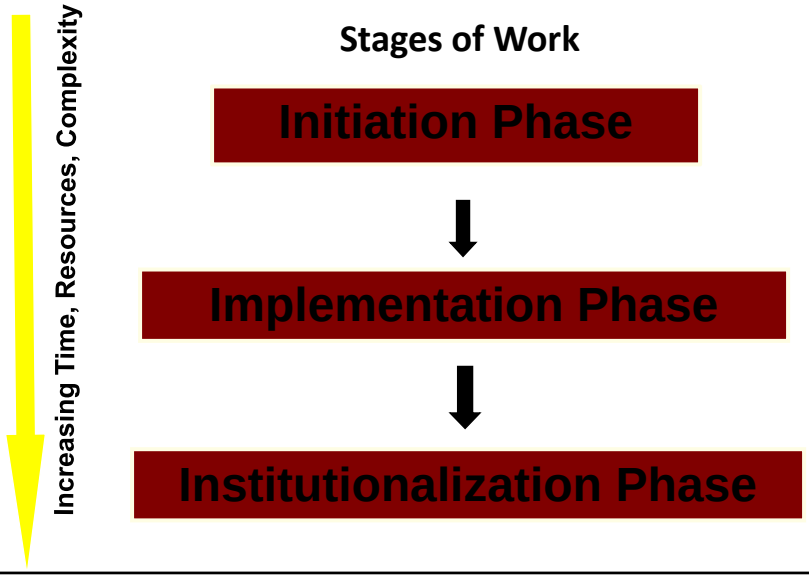
Growth Principle 3

Adopt a Process for Introducing An Innovation or Intervention into A System

Work will never be finished !

Growth Principle 3

Process for Introduction an Innovation into the System

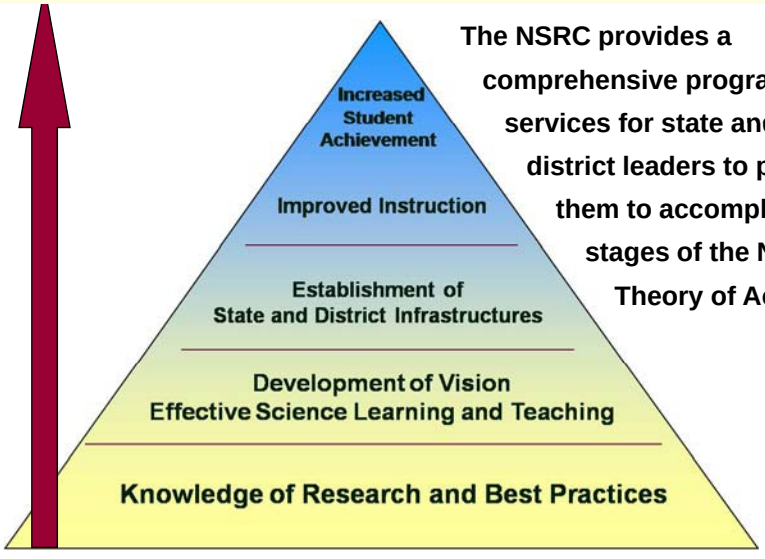


Growth Principle 4

Develop A "Theory of Action"

Employ a theory of action based on new vision of science learning and teaching informed by research and promising practices

Need Theory of Action



The NSRC provides a comprehensive program of services for state and school district leaders to prepare them to accomplish the stages of the NSRC Theory of Action

National Science Resources Center©

Growth Principle 5

Start with Districts and Move to States as Units of Change

Growth Principle 6

Build Awareness

Spend time annually educating officials representing education, government and business about a new vision and the infrastructure needed to support it

Growth Principle 7

Conduct SWOT Analysis…..

Periodically identify strengths, weaknesses, opportunities and threats of a community, state, and region

Growth Principle 8

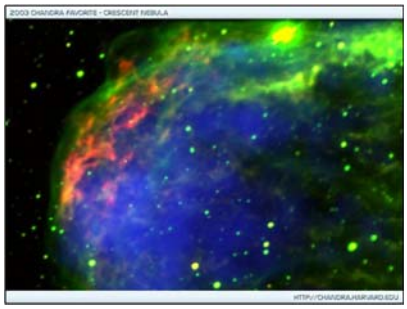
Develop Five-Year Strategic Plans

Develop strategic business plans with states and districts that have measurable goals

Growth Principle 9

Initiate Reform

Start with few areas that have the highest potential for success and to build capacity in regions



Growth Principle 10

Work to create a "proof of concept"

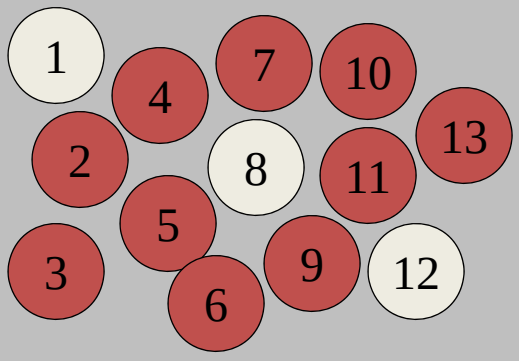
Start with a pilot in one place to develop a proof of concept that will become the demonstration site(s) and then scale to other areas

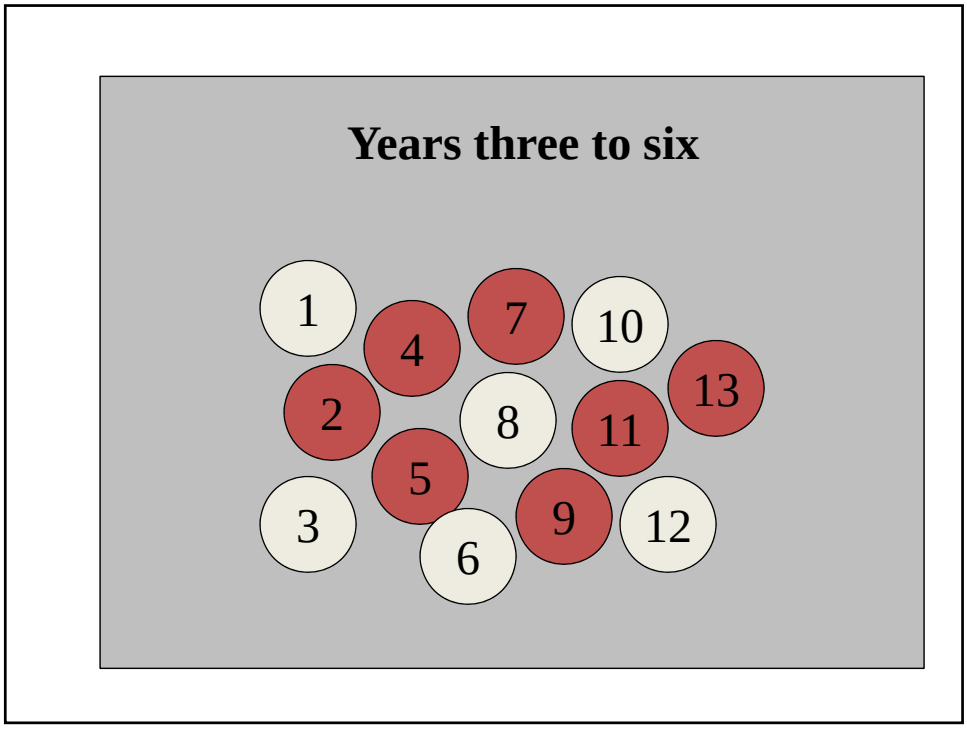
Growth Principle 11

Phase work

Phase expansion carefully over time to ensure you are building robust regional infrastructures for systematically supporting students, teachers, schools, and communities

Years one to three




Years three to six
1
4
7
10
13
2
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3
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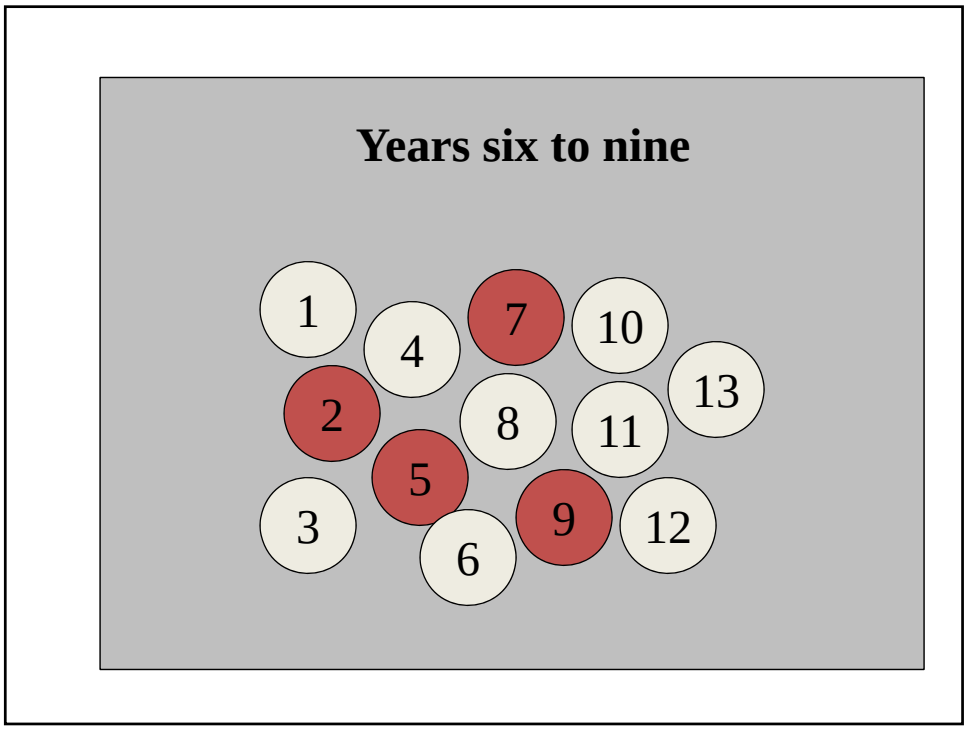
12
6


Years six to nine
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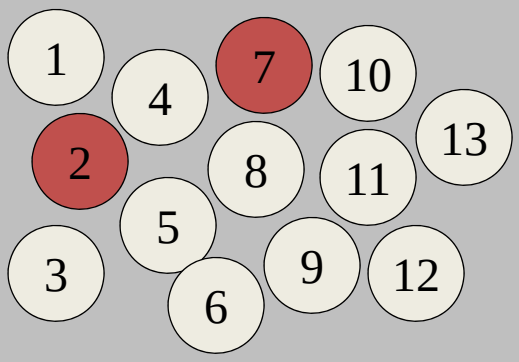
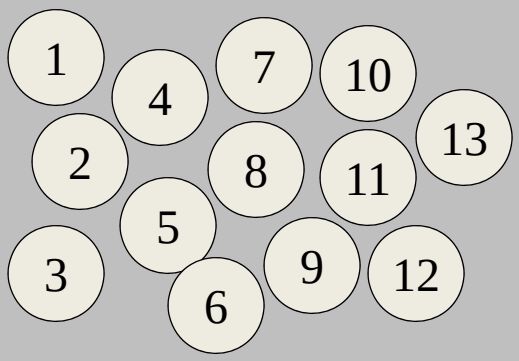
6

Years nine to twelve



Years twelve and ….



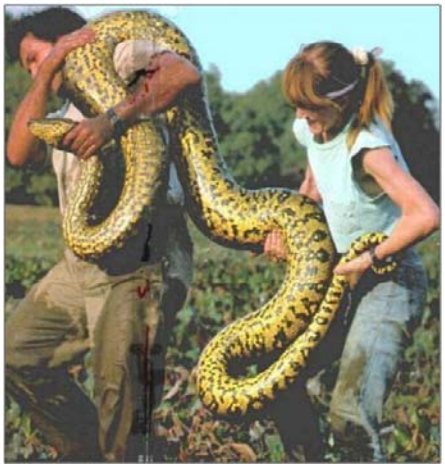
Growth Principle 12

Leverage resources

Leverage resources through strategic partnerships with corporations, academic institutions, museums, and other organizations

Growth Principle 13

Build Capacity to Ensure Sustainability



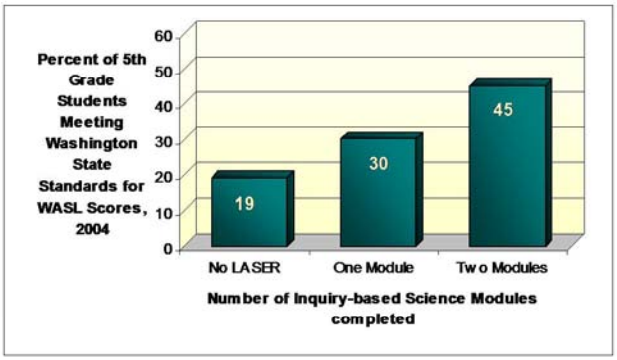
Growth Principle 14

Develop Systems for Evaluating Work and Documenting Progress Annually

Evidence of Impact

Working with districts representing 30% of the U.S. student population, (19 million students) as well as numerous countries, resulting in significant gains in student achievement in states where we have worked for a decade or longer

Washington State Systemic Reform



- > 70% of the students are served by LASER
- State-wide, self-sustaining Materials Resource Center
- Strong links with higher education and the business community

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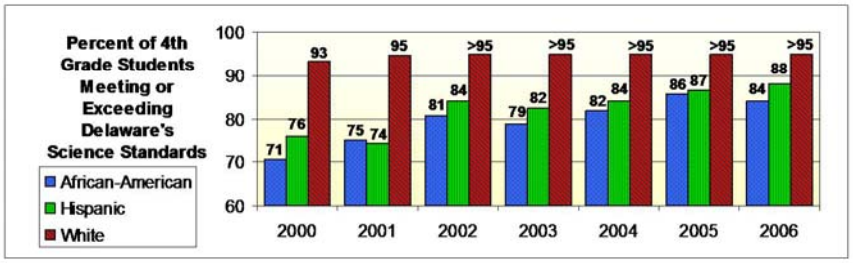
Delaware Systemic Reform



- Research-based K-12 science curriculum
- Comprehensive, on-going professional development for all science teachers
- State-wide, self-sustaining Materials Resource Center
- Strong links with higher education and the business community

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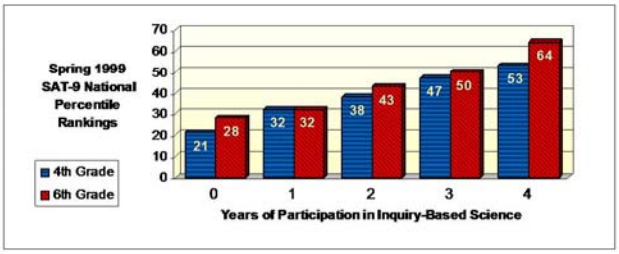
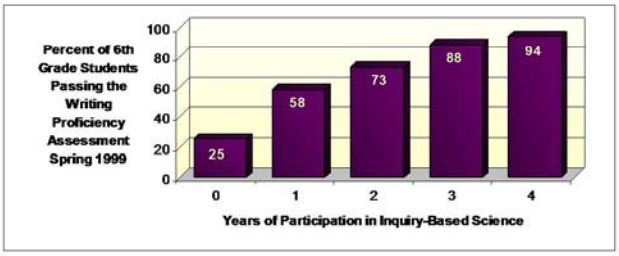
El Centro, California
Elementary Science Education Reform





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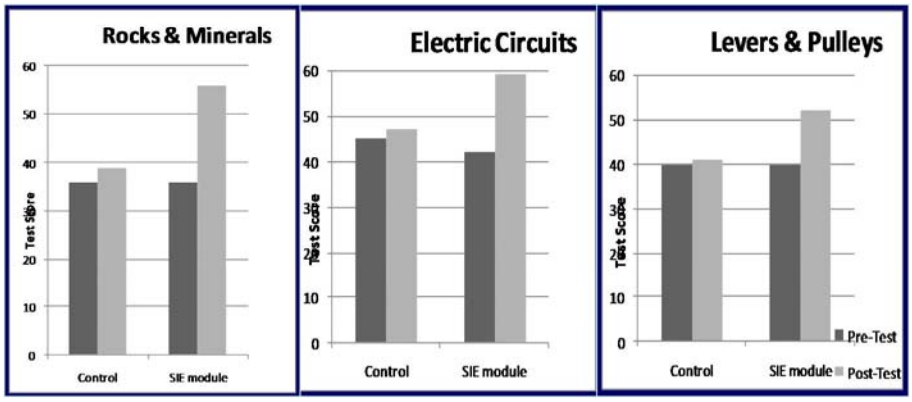
Pennsylvania
Elementary Science Reform

Student Subject Area Achievement: Control Group v. Students Using Module



Growth Principle 15

Celebrate and Communicate Work and Progress Annually

The Anatomy of Innovation

A map of the organization energy during any major transition program.

Hewlett* Packard

A Vision for Quality Growth

Changing the Culture – 5 Areas

1. Leadership
2. Expectations of students and learning
3. Preparation of teachers for teaching
4. Systems of support
5. Strategies for growth

Sources

Business-Higher Education Forum, bhef.com

Business Roundtable, businessroundtable.org

Education Trust, edtrust.org

National Science Foundation, nsf.gov

Public Agenda, publicagenda.org

National Science Resources Center

www.nsrconline.org

Thank you

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Questions ?????