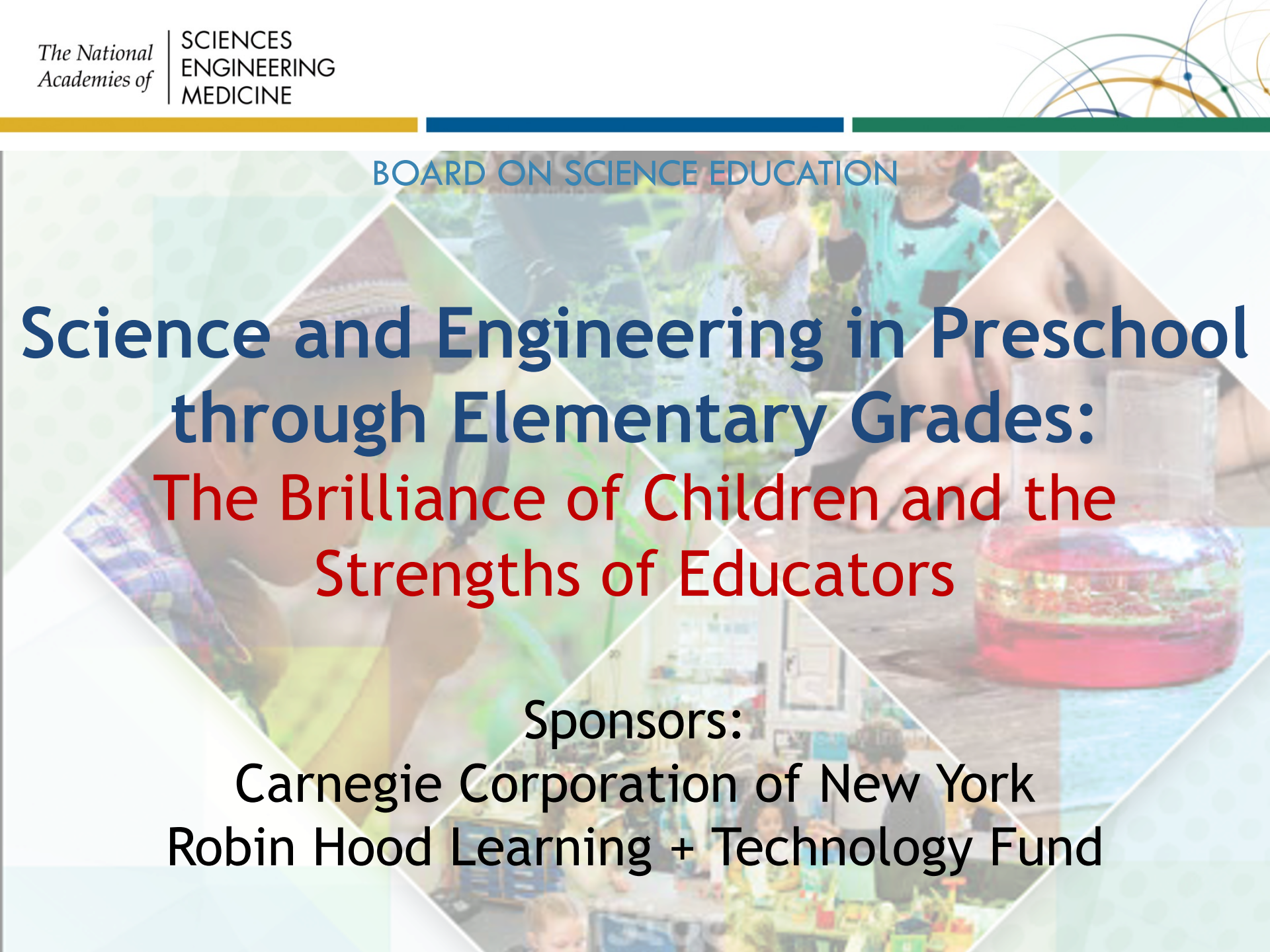


BOARD ON SCIENCE EDUCATION



Science and Engineering in Preschool through Elementary Grades: The Brilliance of Children and the Strengths of Educators

Sponsors:

Carnegie Corporation of New York
Robin Hood Learning + Technology Fund

Charge

Provide guidance on effective approaches to science & engineering instruction in PreK-5 that support success of all students.

- learning experiences prior to entering school
- promising instructional approaches
- integration of science & engineering with other subjects
- role of curriculum & instructional materials
- professional learning opportunities
- policies & practices at the national, state, & local levels
- gaps in the current research base



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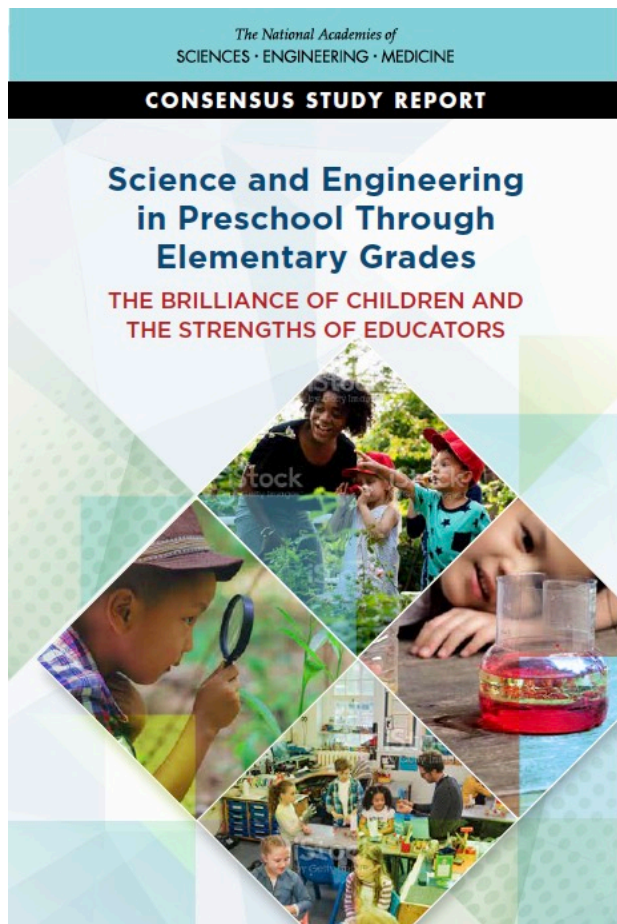
Program Officer

HEIDI SCHWEINGRUBER

Director, Board on Science Education



Report



- Systems and Structures (Ch 2)
- Contextual Nature of Learning (Ch 3)
- Developing Proficiency (Ch 4)
- Learning Environments & Instructional Practices (Ch 5)
- Integrating Across Domains (Ch 6)
- Curriculum & Instructional Materials (Ch 7)
- Supporting Educators (Ch 8)
- Transformative Leadership (Ch 9)

Why science and engineering for all children?

- **Oriented to the future**

- Solid foundation (enthusiasm & knowledge) for later success
- Become informed decision-makers
- Access to high-paying STEM-related jobs
- Involvement of broader range of identities and backgrounds

- **Oriented to the present**

- Deserve to experience wonder of science and satisfaction of engineering
- Children deeply curious about the world
- Opportunities to ask and answer authentic questions and solve real-world problems that are important to them

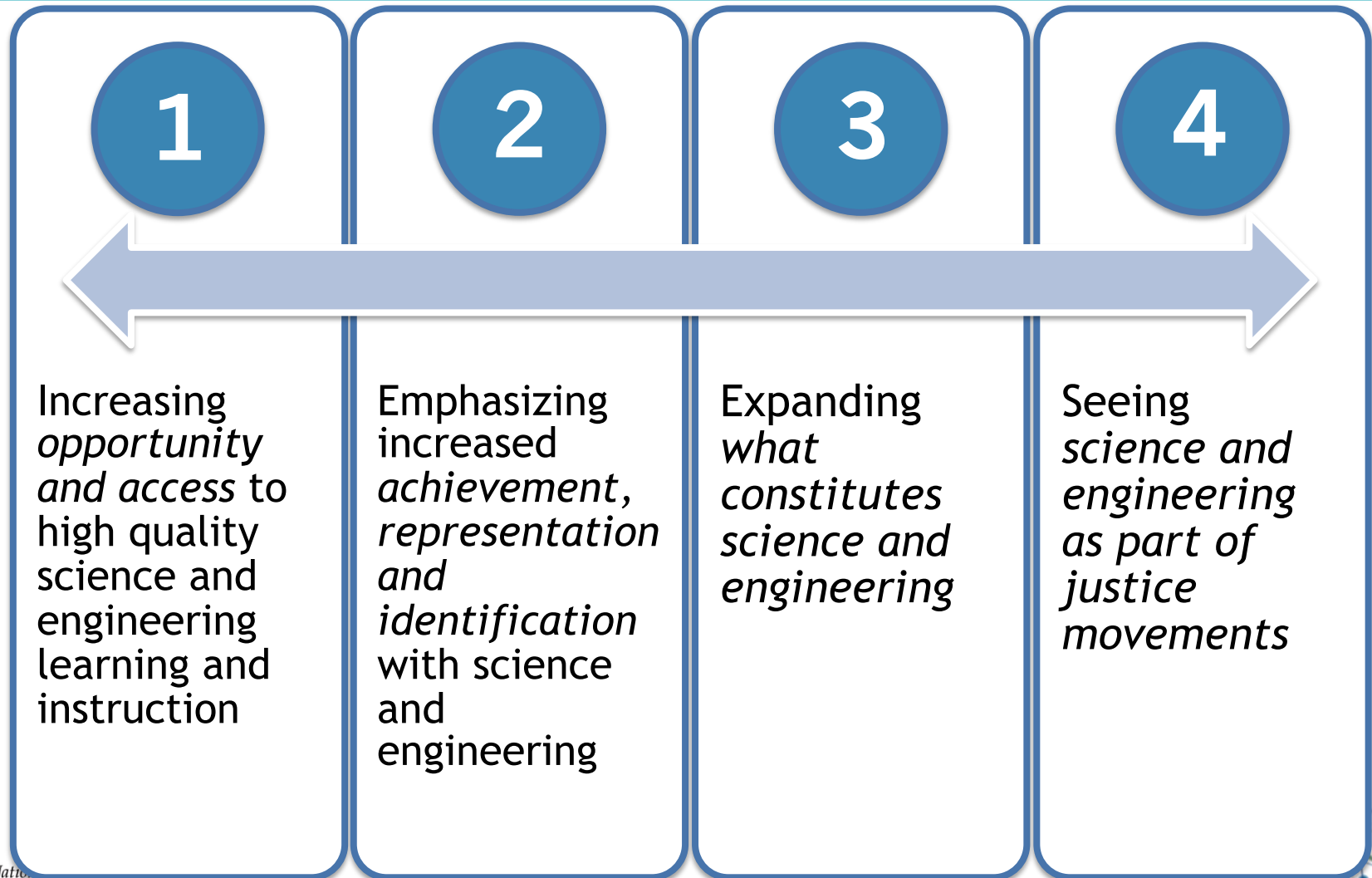


The Committee's Commitments

- Acknowledge that **science & engineering are not neutral**
 - Situated within complex historicized system
 - Antiracism & justice central elements of educational system that works to redress social inequities and oppressions.
- **Recognize strengths** of children, communities, & educators
 - Use asset-based language in describing these actors & settings
 - Attend to how learning environments could draw on, build, and attend to these strengths and needs.
- **Hold vision** for science & engineering learning as **intentionally combining** science & engineering practices, disciplinary core ideas, crosscutting concepts, identities, & interests.



Four Approaches for Equity and Justice



Approach #1: Increasing Opportunity and Access

Description

- Shift forms of instruction & classroom norms to improve learning.
- Provide supplemental experiences for historically under-represented communities.
- Increase presence & distribution of high-quality science/engineering curriculum.
- Increase presence of well-prepared teachers.

Possible Pitfalls

- Leaves dominant forms of science/engineering untouched.
- Leaves historicized ways that Eurocentric science/engineering have been used as tools of oppression invisible.

Forms of Learning & Design

- Barriers to participation removed (technology access, accommodations for learning disabilities &/or learning differences, differentiation, etc.).

Role of Teachers, Teacher Ed, and PD

- Teachers see science “achievement gaps” as “opportunity gaps”.
- Teachers work to increase opportunities especially for children of color to engage with science/engineering.

Role of Curricular Materials

- Translated into multiple languages.
- Use multiple modalities (text, audio) for children to access information.
- Use phenomena & design challenges to motivate children to engage in science/engineering practices.



Approach #1: Increasing Opportunity and Access

Description

- Increase presence & distribution of high-quality science/engineering curriculum.

Possible Pitfalls

- Leaves dominant forms of science/engineering untouched.

Example: Forms of Learning & Design

- Barriers to participation removed (technology access, accommodations for learning disabilities &/or learning differences, differentiation, etc.)

Example: Teachers, Teacher Ed, and PD

- Teachers see science “achievement gaps” as “opportunity gaps”

Example: Curricular Materials

- Use multiple modalities (text, audio) for children to access information.



Approach #2:

Achievement, Representation, & Identification

Description

- Improve learners' achievement in school science by generating interest & fostering connections to classroom disciplines.
- Attend to affective aspects of learning to promote personal relevance & invite learners' identities into learning environment.

Possible Pitfalls

- Leaves dominant forms of science/engineering untouched.
- Leaves historicized ways that Eurocentric science/engineering have been used as tools of oppression invisible.
- Can lead to static notions of "culture" or "cultural essentialization."
- Leaves door open for deficit-based perspectives that try to remediate learners &/or their communities.
- Strategies might privilege only achievement or only identity, rather than both.

Forms of Learning & Design

- Children apply science/engineering concepts to their everyday lives.
- Children have choices for conducting investigations & designs.

Role of Teachers, Teacher Ed, and PD

Teachers learn ways to

- increase representation of "who does science/engineering" to include range of historically marginalized groups, across gender, learning disabilities &/or learning differences, & linguistic & cultural background
- to connect science/engineering learning with children's interests & identities.

Role of Curricular Materials

- Include representations of scientists/engineers of color & children of color doing science/engineering
- Encourage children to tie their cultural & linguistic backgrounds to science/engineering concepts.



Approach #2:

Achievement, Representation, & Identification

Description

- Attend to affective aspects of learning to promote personal relevance & invite learners' identities into learning environment.

Possible Pitfalls

- Can lead to static notions of “culture” or “cultural essentialization.”
- Leaves door open for deficit-based perspectives that try to remediate learners &/or their communities.

Example: Forms of Learning & Design

- Children have choices for conducting investigations & designs.

Example: Teachers, Teacher Ed, and PD

- Teachers learn ways to connect science/ engineering learning with children's interests & identities.

Example: Curricular Materials

- Include representations of scientists/engineers of color & children of color doing science/ engineering



Approach #3:

What Counts as Science & Engineering

Description

- Seeks to examine & reframe who does science, what counts as science, & in what contexts—& how they might be productively leveraged in science/engineering learning environments.
- Curriculum & instruction allow for, invite, & build on learners' & families' diverse sensemaking & cultural & linguistic resources.
- Accounting for heterogeneous understandings of natural & designed world can expand what constitutes science/ engineering. Broader view supports more children, & bolsters science/engineering as disciplines.

Possible Pitfalls

- Not necessarily connected to larger social movement to upend systemic oppression.
- Unlikely to change larger structures of science/engineering professional practices.
- If not adopted as part of a larger structural change, can allow mismatch with how children are evaluated & assessed, which may leave minoritized children at disadvantage.

Forms of Learning & Design

- Family knowledge & practices regularly invited & incorporated into emerging classroom knowledge.
- Children conduct investigations including data collection from both natural or designed world & community interviews with elders.
- Learning environment accepts multiple forms of expressing sensemaking—from quantitative measurements to embodied descriptions.

Role of Teachers, Teacher Ed, and PD

- Teachers learn to see & respond to richness in children's sensemaking, even if it does not reflect fully formed canonical science ideas, or "look and sound" like Eurocentric (& white, middle-class) science/engineering norms or language
- Teachers recognize & build on the values & ways of knowing & being of their children & their communities, & integrate them into their teaching.

Role of Curricular Materials

- Make Eurocentric science/engineering norms & practices explicit; space made for multiple ways of knowing, being, & valuing
- Designed to be flexible so educators can adapt to address local socio-ecological phenomena & needs/goals of their children's communities
- Support students & their families in examining their relationships with natural world.



Approach #3:

What Counts as Science & Engineering

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Example: Teachers, Teacher Ed, and PD

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Example: Curricular Materials

- Designed to be flexible so educators can adapt to address local socio-ecological phenomena & needs/goals of their children's communities



Approach #4:

Part of Justice Movements

Description

- Offers new possibilities for understanding relationship between science, equity, & justice. Starts with prioritizing social movements that address communities' needs & goals, & then finds ways for science/engineering to support progress toward those projects.
- Examining power & historicity can support learning about relationships between human communities & more-than-human communities across time periods.

Possible Pitfalls

- More proximal learning goals of approaches to equity 1-3 might be eclipsed.
- Justice movements may not intersect with classroom activities.
- Current assessment tools & practices may not take into account systemic barriers or historicized relationships with assessments.

Forms of Learning & Design

- Children learn about connection between natural world & human actions & decision making.
- Children investigate how Black, Indigenous, & other communities of color experience disproportionate effects of food deserts, natural hazards, & environmental pollution.

Role of Teachers, Teacher Ed, and PD

- Teachers recognize connection between own power & positionality, Western or Eurocentric science/engineering, & children's & families' engagement in science/engineering
- Teachers learn about connections among science phenomenon/engineering design, local or global instances of phenomenon/design, & implications for communities.

Role of Curricular Materials

- Invite children to ask/answer their own questions about community-relevant issues & make decisions for ethical futures
- Invite children, families, & teachers to examine issues from historicized lenses, & understand how contemporary scientific practices or concepts may have deep roots in racist or other oppressive histories.



Approach #4:

Part of Justice Movements

Description

- Starts with prioritizing social movements that address communities' needs & goals, & then finds ways for science/engineering to support progress toward those projects.

Possible Pitfalls

- Current assessment tools & practices may not take into account systemic barriers or historicized relationships with assessments.

Example: Forms of Learning & Design

- Children investigate how Black, Indigenous, & other communities of color experience disparate effects of food deserts, natural hazards, & environmental pollution.

Example: Teachers, Teacher Ed, and PD

- Teachers learn about connections among science phenomenon/engineering design, local or global instances of phenomenon/design, & implications for communities.

Example: Curricular Materials

- Invite children to ask/answer their own questions about community-relevant issues & make decisions for ethical futures.



Your Turn

How might you use these four approaches to equity and justice, and the ideas in the report, in your work as a science education leader?



Children and science and engineering

- Children engage in **meaningful science and engineering** from a very young age, across multiple contexts and settings
- Science and engineering instruction is **under-resourced and not highly prioritized** in preschool through elementary schools



Distribution of Resources

	Elementary science	High school science	Elementary math
Median spending on equipment & consumable supplies	\$1.98/pupil	\$6.88/pupil	\$6.45/pupil
Perceive access is adequate for...			
Equipment	39%	73%	87% (manipulatives)
Instructional technology	49%	70%	67%
Consumable supplies	30%	67%	65%
Facilities	38%	72%	n/a

From NSSME+ (Banilower et al., 2018)

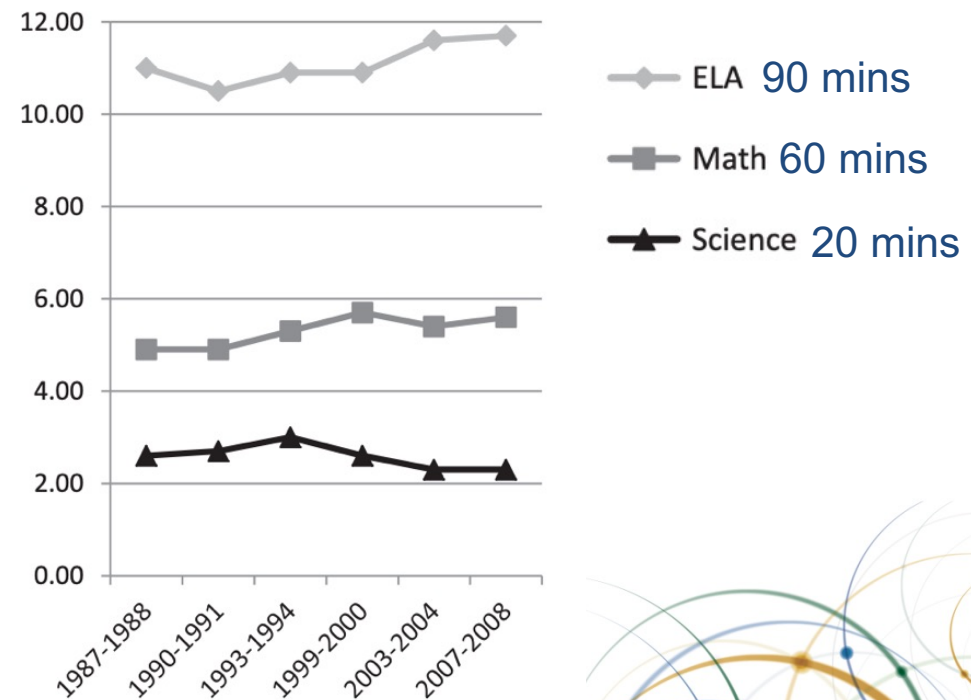
Median spending is inequitably distributed based on FRL, locality (urban/rural), and geographic region.



Instructional Time



On average, substantially less **instructional time** devoted to science and engineering compared to ELA and mathematics.



Frequency of Science Taught in Self-Contained Classrooms

	Percent of Classes		
	All Elementary	K-2	3-5
All/most days, every week	21%	18%	26%
Three or fewer days, every week	39%	41%	8%
Some weeks, but not every week	39%	42%	36%



Needs

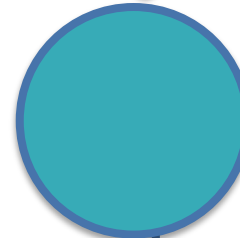
- Instructional **policies, standards, and teaching practices** lack alignment and coherence
- Limited research on **children with learning disabilities and/or learning differences**
 - engage in and experience science and engineering
 - forms of support that might be helpful



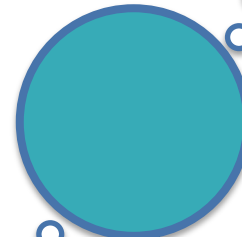
State Policymakers should

Ensure **children not pulled out** of science and engineering instruction for remediation in other subjects.

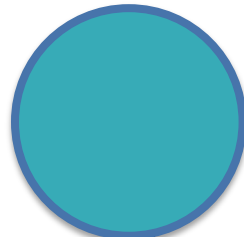
Science and Engineering



Comprehensive



Frequent



Consistent

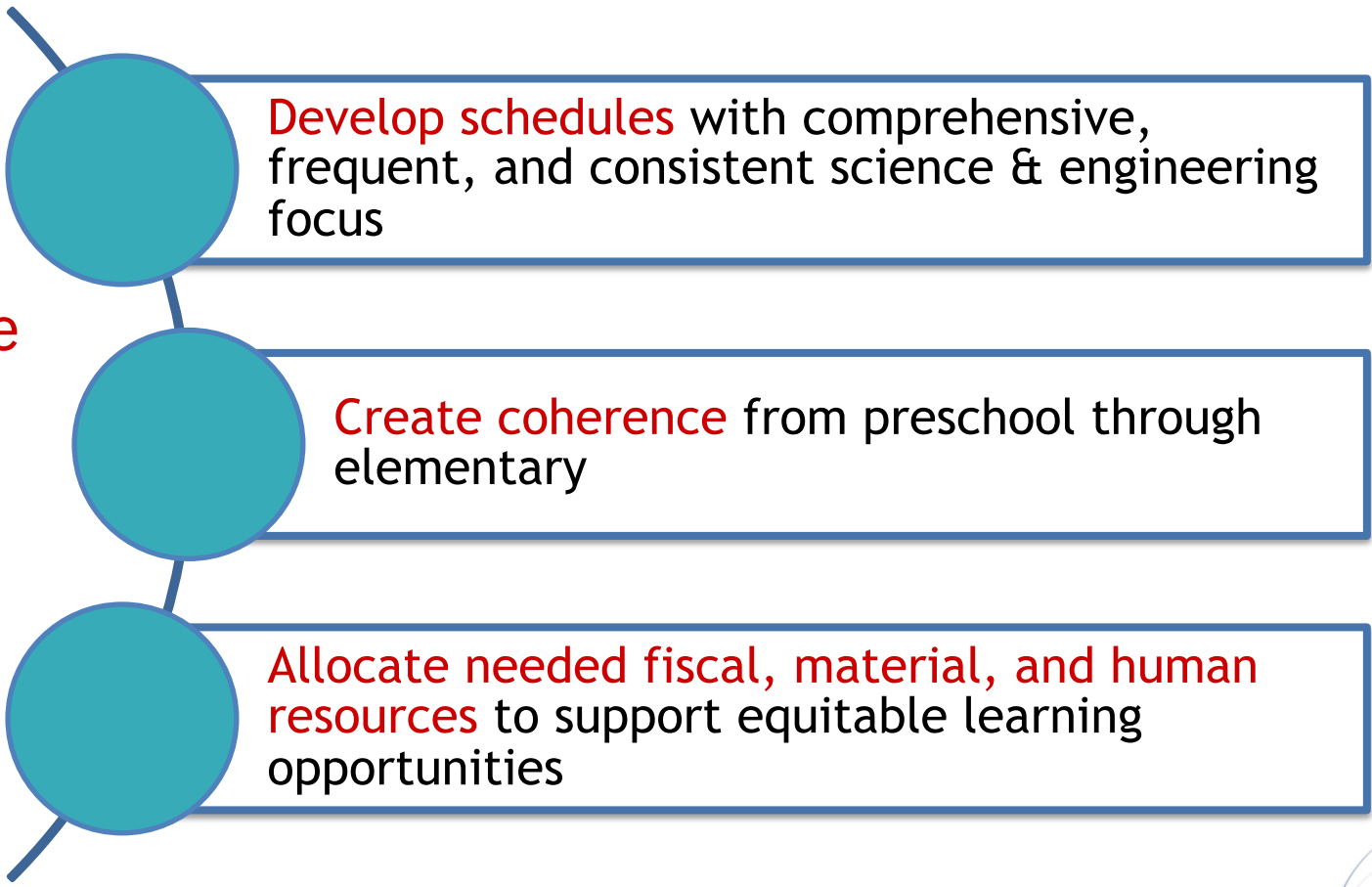
Establish policies

Recommendation 1



District and School Leaders should

Examine Time
& Resource
Allocation to:



Develop schedules with comprehensive, frequent, and consistent science & engineering focus

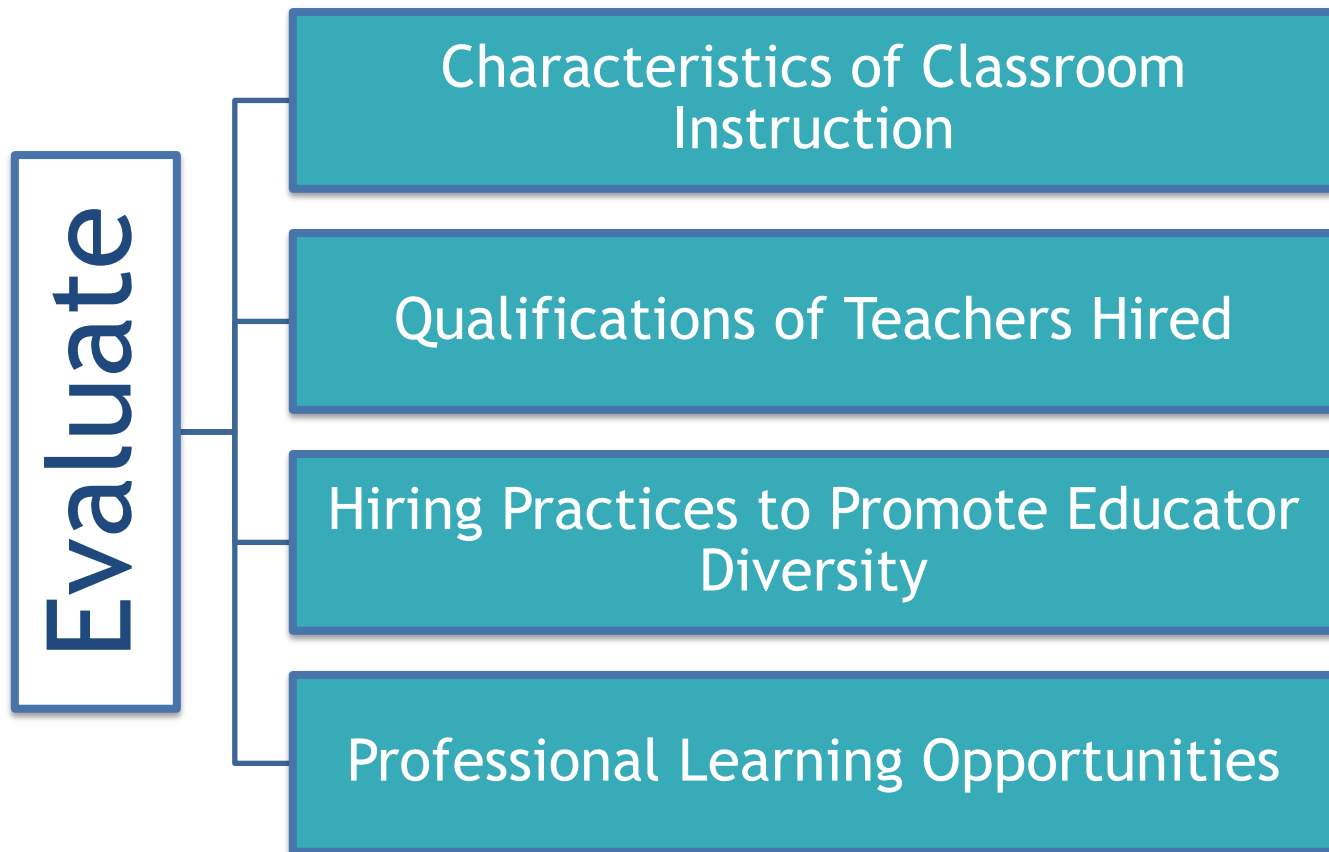
Create coherence from preschool through elementary

Allocate needed fiscal, material, and human resources to support equitable learning opportunities



Preschool and Elementary School Leaders should

Support and Enhance Teachers' Capacities



State Leaders, District Leaders, & Researchers should

Across preschool through elementary school

- Work together to build connections
- Conduct research to investigate how **alignment and coherence** supports children's learning or science and engineering.



Children's Interest and Motivation

- Science and engineering learning experiences provide opportunities for children to **identify as people who do and value science and engineering.**
- See increases in motivation and disciplinary affiliation when children ...
 - are provided opportunities to explore **questions that matter to them** and
 - are recognized as **knowledge-producers and problem solvers.**



Recognizing the Whole Child

- **Families** (broadly defined) **are essential partners.**
- Development and **expression of proficiencies** is related to ...
 - knowledge,
 - experiences,
 - cultural and linguistic backgrounds, and
 - characteristics of instructional environment and pedagogical approaches.



Developing Children's Ideas and Practices

Children's development of ideas and practices is supported by their own **intuitive and imaginative ways of investigating and designing** as well as by ...

- long-term sustained **experiences**,
- rich **settings and materials** (including age-appropriate technologies), and
- engagement with **peers and knowledgeable others**.



Supporting Children's Engagement

Children can share, use, connect, and develop their understanding of **big conceptual ideas** in science and engineering when instruction...

- 1) is anchored in **design problems and phenomena** that are conceptually rich, accessible, and meaningful to children and
- 2) provides supports for children to **iteratively refine** their explanations and solutions.



Science and engineering learning are **social endeavors**.



Supporting Children's Proficiency

- When teachers **elicit, notice, value, and build on** ideas, experiences, and communicative resources children bring, they can support children in **making sense of the natural and designed world**.
- Robust **formative assessment approach...**
 - provides appropriate **supports**,
 - includes **multiple modalities**, and
 - specifies a way of **making inferences** about children's understanding.



Formative Assessment

- Used for **multiple purposes**
 - Make inferences
 - Planning instruction and determining next steps
 - Monitoring and adjusting classroom **community norms and structures**
- Draws on **multiple forms of evidence** and can be **embedded into activities**

Figure 1.

Initial model of evaporation

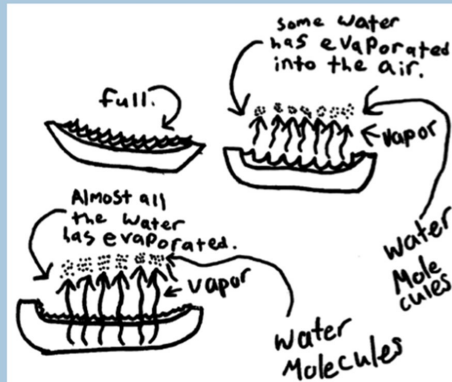
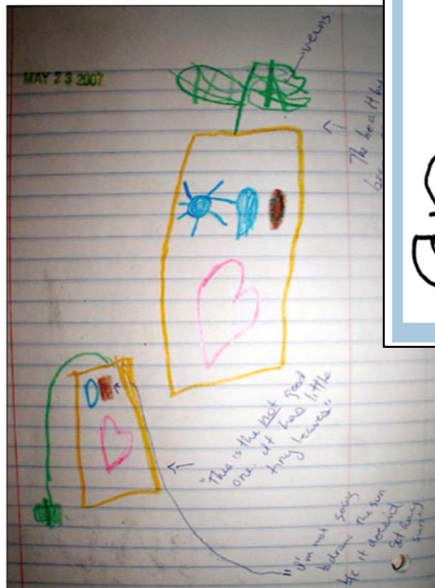
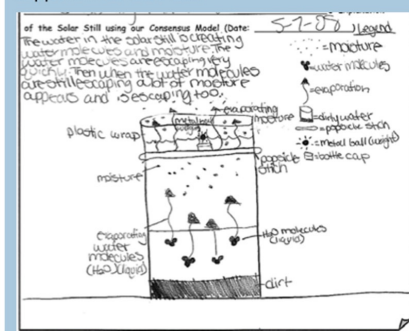


Figure 2.

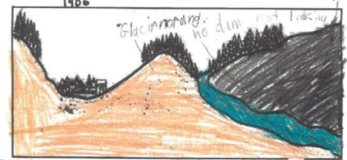
Applying consensus models.

In this diagram, students apply their consensus models of evaporation and condensation to explain what happens in the solar still.



Brenneman and Louro, 2008;
Kenyon et al., 2008; Shim et al., 2018

What do you think caused this town to flood?



By 1915 the town was flooded. This happened because the dam was built and what... through the glacier morning. I know... this because the water is very strong and pushed through the glacier morning. This is important because...

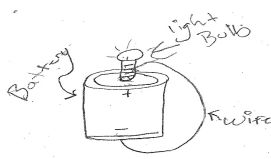
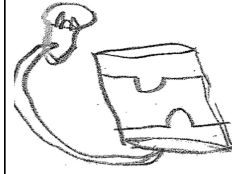
In the low of the water, the water is very strong and pushed through the glacier morning. This is important because...

In the video it is so... the water is very strong and pushed through the glacier morning. This is important because...

Formative Assessment in Practice

- Requires understanding of **interpretation and potential biases**—bias reduced by...
 - Considering data from multiple sources and different contexts
 - Soliciting input from families and other educators
- Requires **attending to detail and substance** of children's work—supported by...
 - Engaging with the science content
 - Examining and discussing children's work with colleagues
 - Rubrics and educative materials

Rubric that highlights characteristics of quality observations.

Feature	Proficient	Improving	Needs Improvement
Complete	All parts of the object being observed are included. <i>For example, in a drawn observation of a terrarium, the plants, rocks, and soil are included.</i>	One or two key parts of the object being observed are missing. <i>For example, the plants and soil are included but not the rock.</i>	Most parts of the object being observed are missing. <i>For example, there is only one rock in the drawing.</i>
Accurate	The observation includes the same color, sizes, and shape as the object being observed. Everything is drawn to scale. <i>For example, the plants are green and drawn to scale relative to the rocks.</i>	The observation includes mostly the same color, size, or shape as the object being observed YET one or two features are different from the actual item. <i>For example, there is a smiley face on the plant, yet the plant is green and drawn to scale.</i>	The observation does not have the same colors, sizes, or shape as the object being observed. <i>For example, the plants are rainbow colored rather than green OR all of the plants are drawn much bigger than the plants.</i>
Clear	Student Work: Observations of Lit Bulbs		Proficient or Needs Improvement
	Sample A:		complete
			accurate
			clear
			labeled
	Sample B:		complete
			accurate
			clear
			labeled
	Sample C:		complete
			accurate
			clear
			labeled

(rubric from Arias and Davis, 2016)

What Can Teachers Do

Arrange instruction around phenomena and design problems

Enact learning experiences that establish norms for a caring, collective culture

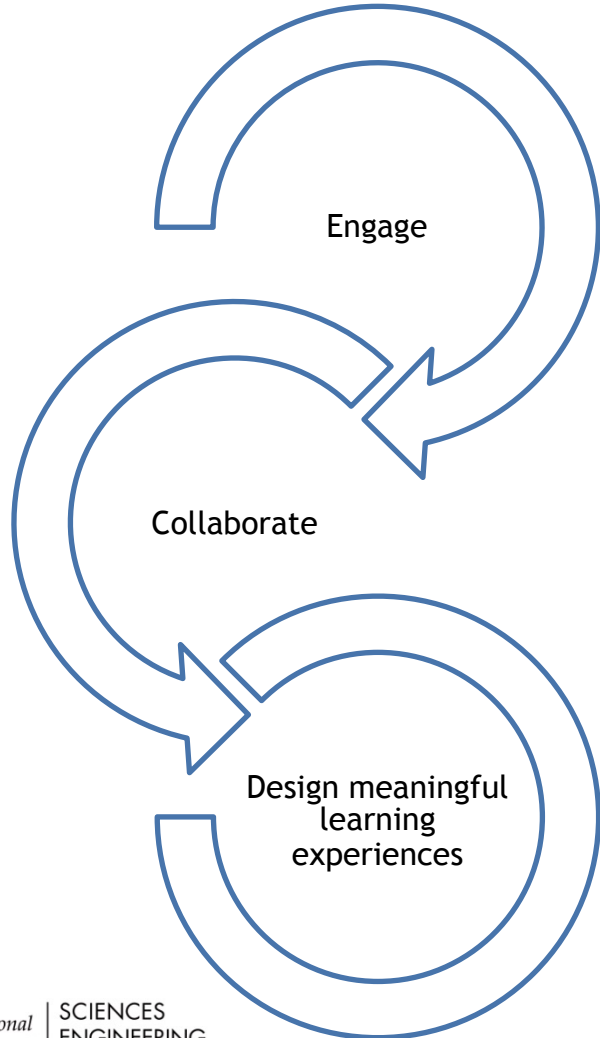
Position children as active thinkers and doers

Include formative assessment processes that gather multiple forms of evidence at multiple timepoints

Seek opportunities to continue to build expertise in working toward equity and justice



Preschool and Elementary School Leaders and Teachers should



Engage and collaborate with families and local community leaders to mutually support children's opportunities for engaging in science and engineering.

Collaboration allows for leaders and teachers to design meaningful and relevant learning experiences and helps families to better support their children's learning outside of school.



Your Turn

What findings or recommendations so far resonate with you and why?

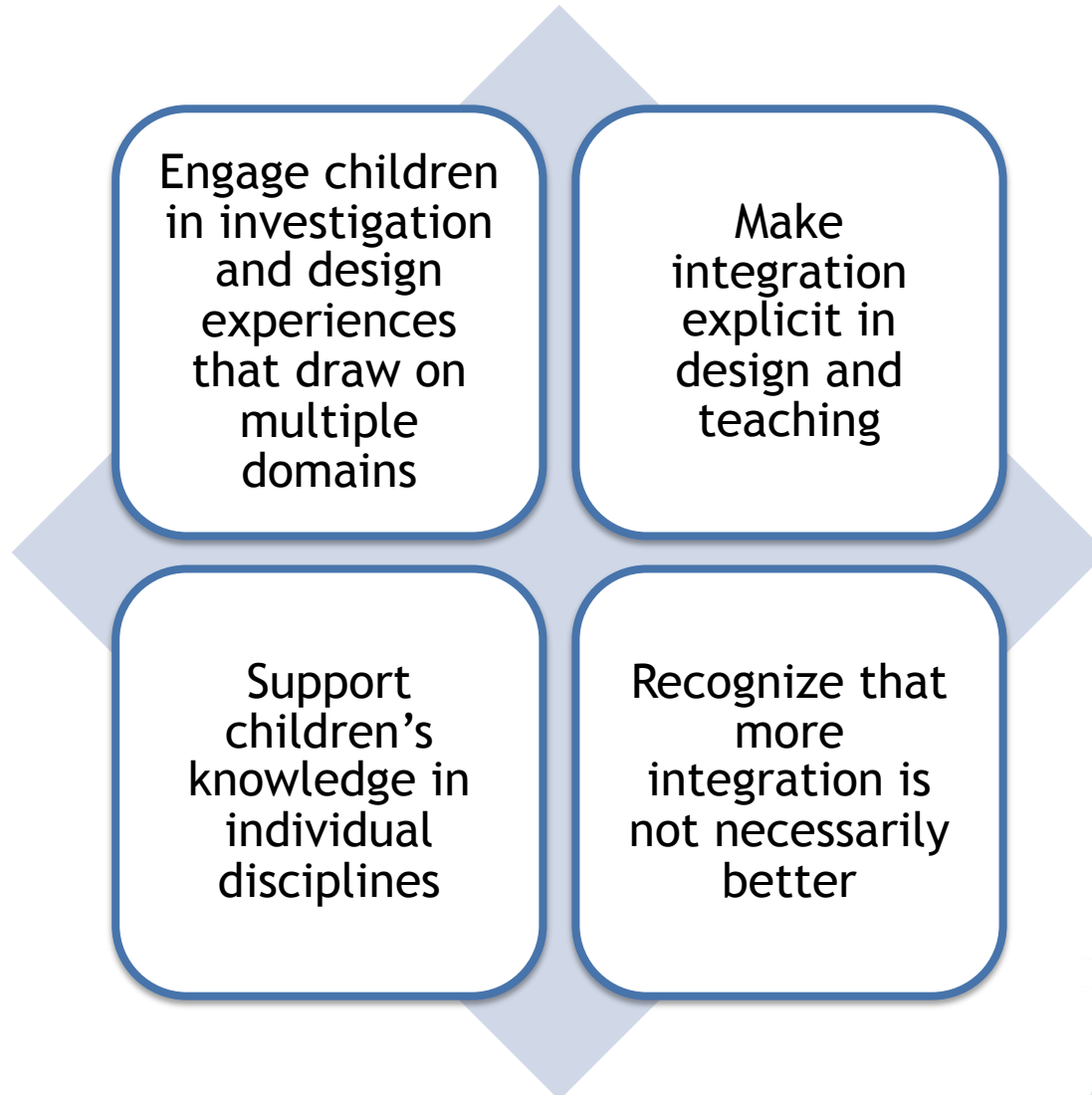


Content Integration

- Integration has potential to...
 - enhance **connections between subjects** (science and engineering to, e.g., ELA, math, computational thinking) and
 - effectively increase amount of **instructional time** for science and engineering.
- Integration can benefit all domains if design...
 - respects **unique content and disciplinary practices** of all domains,
 - leverages meaningful and mutually supportive **connections** among subject areas, and
 - is **developmentally, culturally, and linguistically appropriate**.



Principles Guiding Effective Integration



Opportunities for Effective Integration

ELA

- Incorporate text to help children **develop and deepen explanations** and situate reading in conceptually coherent, meaningful pursuits of understanding and solutions.
- Incorporate text describing doing and using science/engineering to **expand views of science/engineering** and help children develop **identities and interests**.
- Support children in **producing texts and inscriptions** to represent reasoning.

Mathematics

- Help children engage in **quantification** (distinguishing and developing measures for attributes).
- Support children in **transforming & analyzing data**, and understanding foundational concepts of **data representation and statistics**.

Computational Thinking

- Use science/engineering contexts to highlight **computational thinking practices**
- Use computational thinking as method for **exploring science/engineering concept**



Potential Pitfalls of Integration

ELA

- “I Do, We Do, You Do” model: Teachers can use interactive modeling to guide learning to engage in science or engineering practices while still allowing children to drive the investigation or design.
- Vocabulary first instruction: An “activity before concept, concept before vocabulary” approach is generally useful in science and engineering.

Mathematics

- Sequencing: STEM integration can lead to trivializing math concepts or, alternatively, expecting use of math concepts before children understand their conceptual underpinnings.
- Utilitarian understandings: Sometimes easy-to-measure numerical attributes (e.g., distance) are used in lieu of more powerful conceptual values (e.g., rate).
- Mathematical practices at the early grades are dealt with unevenly in NGSS



Potential Pitfalls of Integration

ELA

- “I Do, We Do, You Do” model
- Vocabulary first instruction

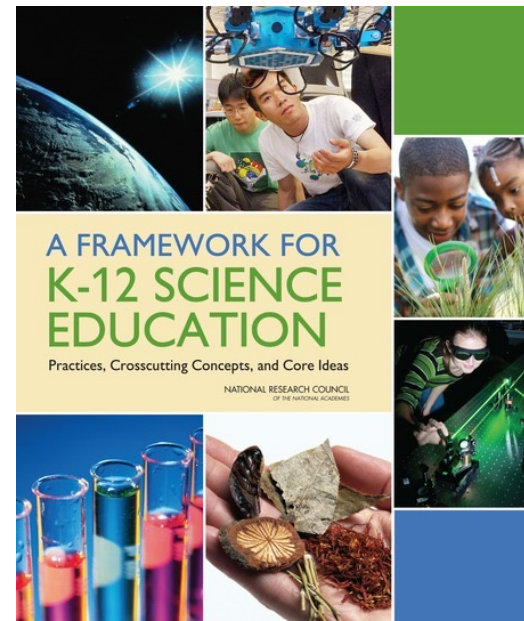
Mathematics

- Sequencing
- Utilitarian understandings of math
- Appropriate work on mathematical practices at the early grades



Curriculum Materials

- High-quality instruction requires **curriculum materials** that ...
 - build toward the **vision of the *Framework***;
 - are grounded in **investigation and design**;
 - are **coherent, flexible, adaptable, equitable, responsive**; and
 - have **evidence** supporting their effectiveness.



Curriculum Developers should

Recommendation 10

Partnerships with
researchers, teachers,
school or district leaders,
and families and
community leaders

Provide opportunities for children's sensemaking
around investigation/design;

Build on children's interests & repertoires of
practice;

Provide educative supports for teachers;

Provide opportunities for teachers to make
productive adaptations;

Provide supports for teachers to make meaningful
connections to communities and families;

Explore integrating with other domains;

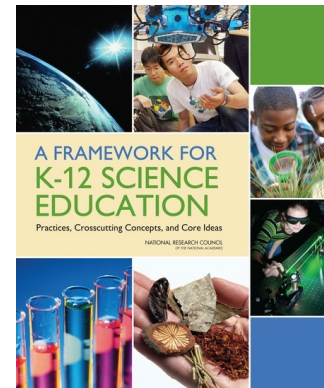
Manageable for use in preschool & elementary
settings;

Align preschool and elementary instruction; and

Show evidence of effectiveness.

State and District Leaders should

- Rely on a robust **evidence-based review, selection, and implementation process** when making decisions about curricular programs to adopt
- Ensure science & engineering units build toward the vision of the *Framework* and are grounded in investigation and design, coherent, flexible, adaptable, and equitable.

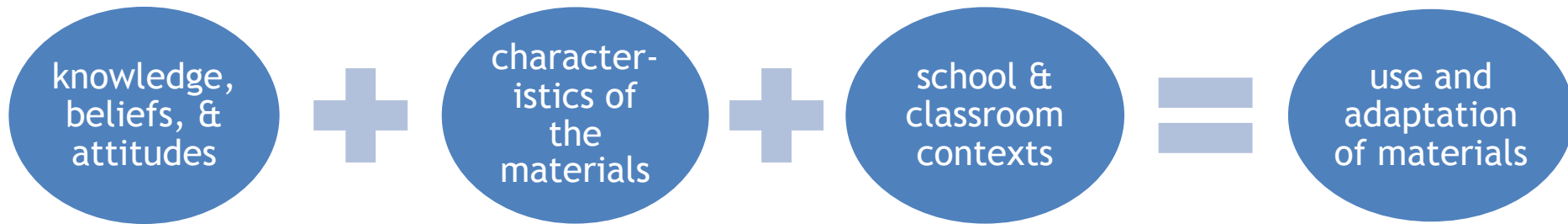


An Example of a State Curriculum Review Process from the Report

- Louisiana's instructional materials **review process**
 - Committees of Louisiana **educators evaluate materials** based on state-developed rubrics (quality, alignment to state standards)
 - **Publishers can respond** to the evaluation before publication
 - State **DoE publishes a compilation** of the results of the evaluations — updated weekly
 - **Districts can purchase top-tier materials** under a state contract. Lower tier materials can be purchased and used (but not via a state contract, so more expensive).
 - **Districts** then need to (a) expect and support teacher adaptation, (b) provide coherent professional learning opportunities, and (c) ensure provision of physical materials for investigation and design.



Educator's Use and Adaptation of Curriculum Materials



Design principles for educative curriculum materials

- Using multiple forms of support
- Providing suggestions for productive adaptations
- Providing supports that are situated in teachers' practice
- Incorporating educative features that can be used directly as teaching tools
- Focusing on supporting sensemaking and evidence-based claims
- Using instrumental science and engineering practices to incrementally work toward change in teachers' practice (Davis et al., 2017)

State and District Leaders should

Sustained Professional Learning Opportunities

Adequate Access to Materials, Equipment, and Physical/Digital Resources

Ensure Every School Has Materials and Resources That Work Toward Equity and Justice



Demographics & Diversifying Workforce

- Elementary teachers: 89% white and 79% women
 - Similar for early childhood teachers
 - Starkly different from children being taught
- Support needed to enact instruction **responsive to & supportive of children's cultural & linguistic backgrounds.**
- Research highlights importance of:
 - **diversifying** teacher & teacher educator **workforce**
 - placing preservice teachers in mentored, **supportive field placements**
 - using **sustained professional learning experiences** synergistically with **educative curriculum materials**



Supporting Educators

Supports provide opportunities to expand on teachers' strengths.



Preschool through Elementary Teachers

Professional learning experiences are beneficial in supporting the development of teachers' knowledge, attitudes, beliefs, and practices when teachers...

- **Collaboratively analyze practice** and children's thinking
- **Make connections** among professional learning opportunities (educative curriculum materials & workshops) to their classrooms
- Engage in **instructional co-design**
- Work with **supportive coaches or facilitators**



Teacher Educators, PD Facilitators, School/District Leaders should

Help teachers to recognize **importance and value** of teaching science and engineering

Understand and address **needs and goals** of classroom teachers

Support teachers in **connecting** their professional learning with classroom practice

Foreground **authentic and equitable** science and engineering content and disciplinary practice

Allow for meaningful **integration** of science and/or engineering with other subjects

Support teachers' effective **use and adaptation** of science and engineering curriculum materials



A Model for Change

Organizational Culture

- Value for Science
- Principal Leadership

“Supporting a cascading leadership model may be important for developing educator capability, where **both administrators and teacher leaders are supported** in advancing instructional change in science and engineering.”

“The school principal appears to play an important role in creating an organizational culture that supports elementary science and engineering. However, research suggests that some elementary principals, and their administrative staff more broadly, lack expertise in science and thus the confidence to supervise teachers’ science instruction.”

Educator Capability

- Professional Leadership
- Partnerships

Policy and Management

- Time and Resources
- Staffing



“Beyond designated instructional time, another important factor in supporting science and engineering instruction is administrators’ provision of **funding** and the allocation of **resources**.”

District and School Leadership

Science and engineering instruction is included as a strong part of curriculum when preschool and elementary school and district leaders

- emphasize importance of science and engineering education
- foster shared responsibility among teachers
- allocate time and resources and
- provide professional learning opportunities.



Role of Specialists

Specialists have **greatest impact** when ...

- school and district administrators and other leaders are involved in science education and
- overall district and school culture places value on science and provides resources to support it.



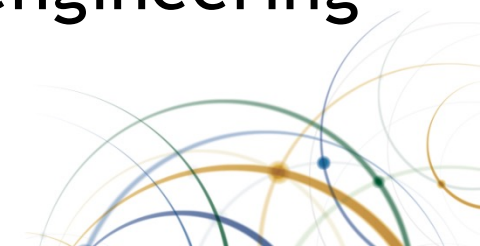
District Leaders should

Provide professional learning opportunities for

- Principals
- Center directors
- Other school leaders

to enhance leaders' capacity for providing instructional leadership.

Focus on science/engineering practices & support leaders in seeing multiple ways science/engineering are valuable for children.

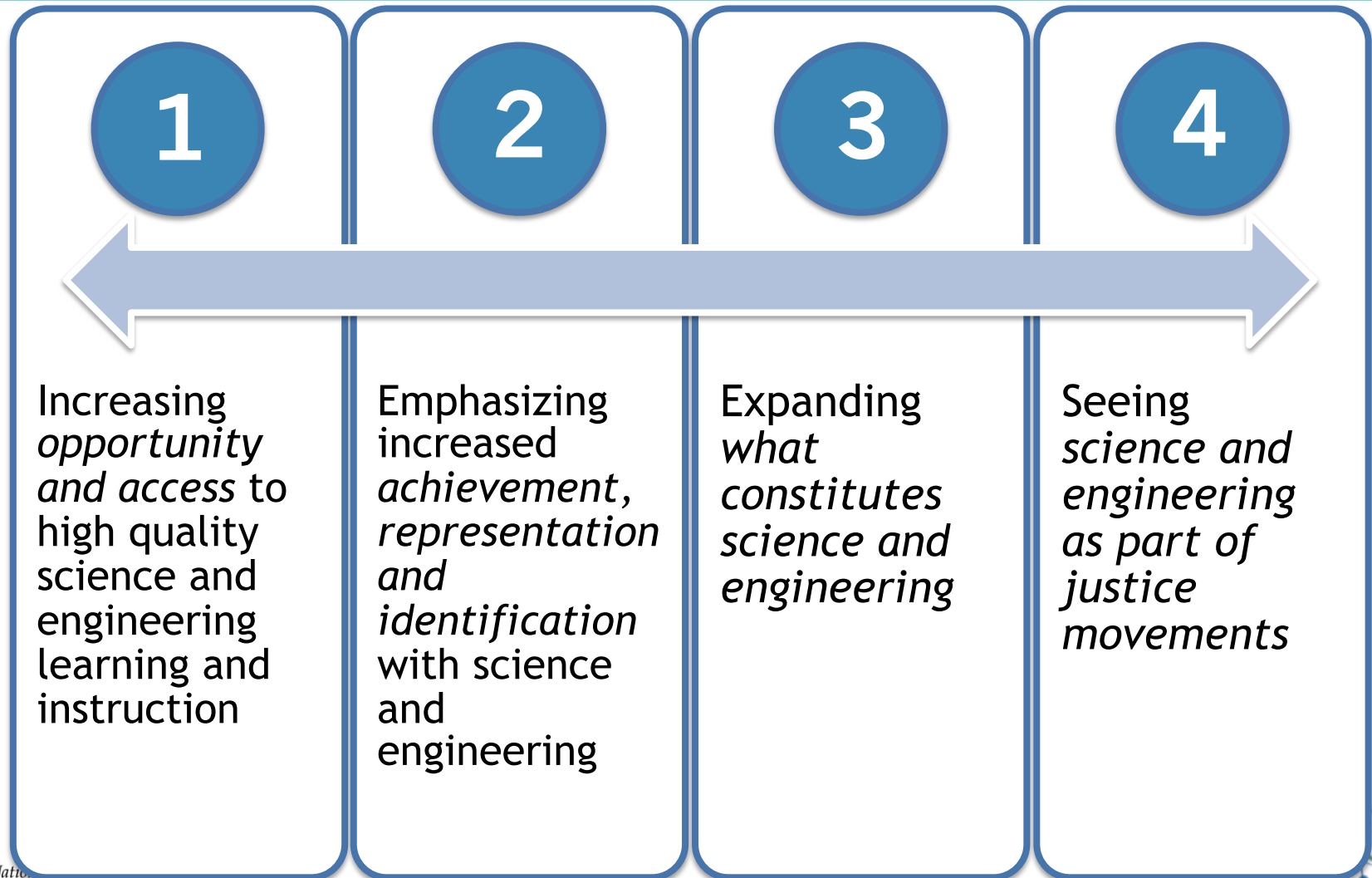


Your Turn

What connections do you see between what's been presented today and your own work?



Equity and Justice: A High-Level Synthesis Across Report



Equity and Justice: Opportunity and Access

1

Increasing
opportunity and
access to high
quality science
and engineering
learning and
instruction

- Biggest issue is **instructional time**. Lack of resources, particularly in schools that serve larger proportions of children of color, also negatively affects opportunity and access.
- Drawing on children's **cultural and linguistic resources** can give a broader range of children opportunity and access.
- Leaders **set up the conditions** that allow science and engineering to be taught well in schools.

Equity and Justice: Achievement, Representation, and Identification

1

2

3

4

- **Educational policies** aimed to increase achievement in reading & mathematics have had unintended effect of decreasing children's opportunities to learn science.
- Helping children **orient to meaningful phenomena & design challenges** & developing classroom culture oriented toward **collective well-being & knowledge building**, may help them engage more fully in sensemaking & develop their identities as people who do science and engineering.
- Texts & curriculum materials can **increase representation**, allowing broader range of children to "see themselves" in science/engineering. Diversifying teacher educator workforce can help preservice elementary teachers see themselves as people who can teach science.

Equity and Justice: What Constitutes Science and Engineering

1

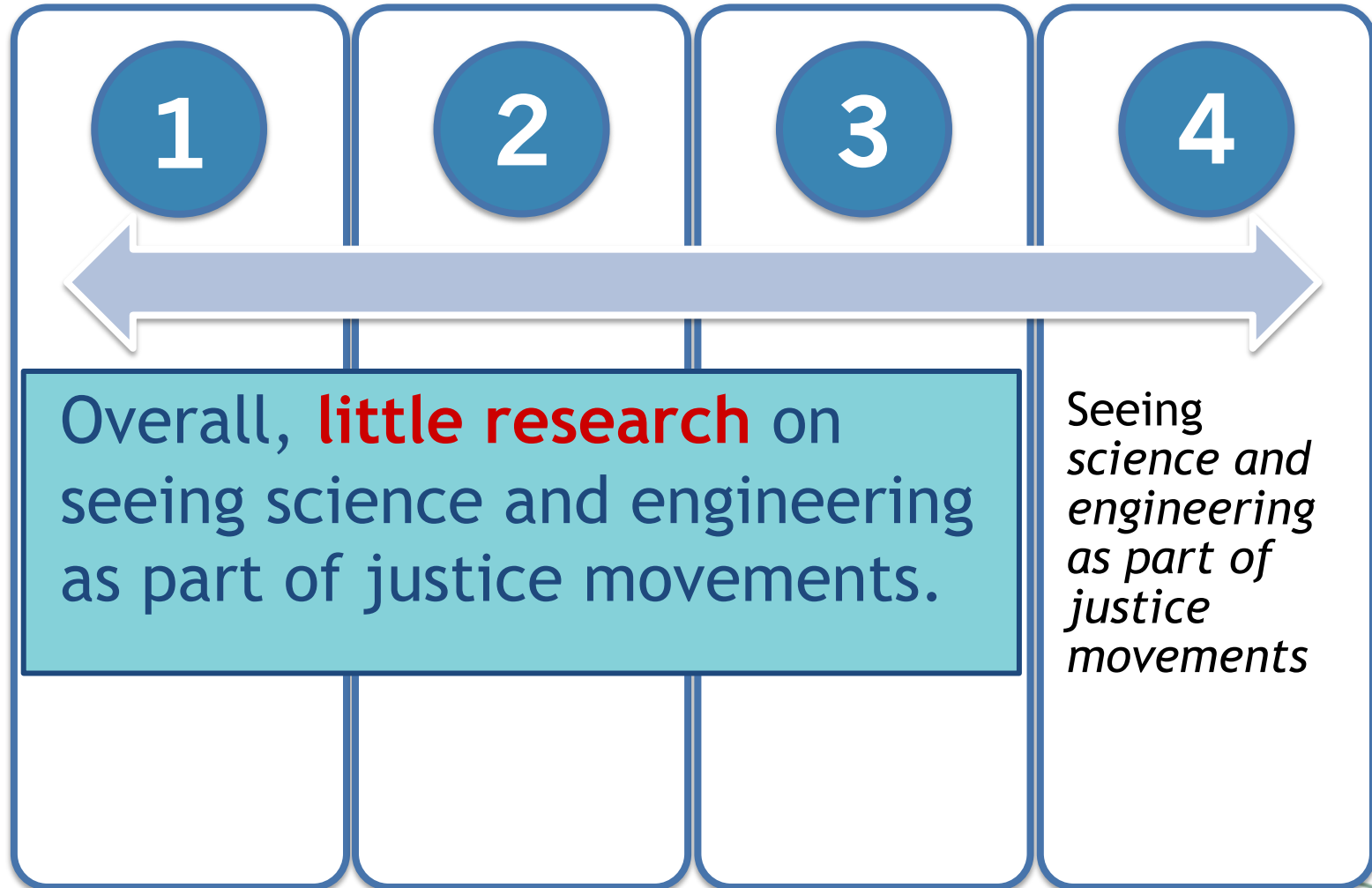
2

3

4

- Systems can **reify status quo**. Principals can support shifts in perspectives on what constitutes science/engineering.
- Expanding how science/engineering **discourses** are defined & **connecting to families and places** can help develop more expansive perspective.
- By failing to recognize science/engineering in **what children say or do**, educators may fail to capitalize on rich opportunities to learn.
- **Expanded vision of science/engineering practices** (e.g., observation, argumentation) helps to demonstrate the strengths Indigenous children or other children of color bring to science and at the same time, extends all children's perspectives about what constitutes science.

Equity and Justice: Part of Justice Movements



Questions and Discussion

Thank you for your engagement!

If you're interested in reading the report, you can obtain a PDF (for free!) or order the book at nap.edu — search for Science and Engineering in Preschool through Elementary

Practitioner companion volume coming in Fall 2022!

