OpenSciEd Research Agenda Kickoff

March 31, 2021
Standards & Curriculum Reform

**Purpose**
- Reforming goals and priorities by publishing a report
- 1-2 years (national)

**Policies**
- Adopting new standards and frameworks through legislation
- 3-4 years (states)

**Programs**
- Developing instructional materials; selecting and using new programs
- 3-6 years (districts/schools)

**Practices**
- Changing teaching strategies; adapting materials to the needs of students and schools
- 7-10 years (classrooms)
Investments in Science Education

Leadership Development
Curriculum-Based Professional Learning
K-12 Instructional Materials
Interim Assessments
Research Agenda

INSTITUTE FOR ADVANCED STUDY
THE NATIONAL ACADEMIES
Achieve
NEXT GENERATION SCIENCE STANDARDS
For States, By States
OpenSciEd
OpenSciEd50+
Council of State Science Supervisors

2007-2009
2009-201
2010-2017
2018-present
2020 - present
A nonprofit organization that aims to improve science education through the development and implementation of high-quality, freely available K-12 science instructional materials.
Jim Ryan
Executive Director

Matt Krehbiel
Professional Learning Director

Sarah Delaney
Curriculum Director

3 OpenSciEd Staff Members
5 Organizations in the Middle School Developers Consortium

- BSCS Science Learning
- NextGen Science Storylines, Northwestern University
- BOSTON COLLEGE, Lynch School of Education and Human Development
- The University of Texas at Austin, Charles A. Dana Center
- University of Colorado Boulder
- OpenSciEd
20 states and D.C. have adopted the NGSS
24 states have adopted standards based on the NRC Framework

1) States that adopted NGSS made no or minimal changes to NGSS standards
2) States that adopted standards based on NRC framework made minimal to moderate changes to NGSS standards

Source: NGSS NSTA

OpenSciEd Partner State
Adopted NGSS
Adopted standards based on NRC Framework for K-12 Science Education
Has not adopted new science standards
65 Facilitators

Round 3 Facilitator Training
June 2019
Students contributing to field test results

5,800
High-quality middle school science classroom and professional learning materials that prioritize equity
Remote Learning Adaptations

REMOTE LEARNING ADAPTATIONS NOW AVAILABLE

Thermal Energy
How can containers keep stuff from warming up or cooling down?

Weather, Climate & Water Cycling
Why does a lot of hail, rain, or snow fall at some times and not others?

Visit OpenSciEd.org for more information.
COVID-19 & HEALTH EQUITY SCIENCE UNITS

GRADES K-2

What can we do to keep our community healthy?

COVID-19 & Health Equity Grades 3-5

How can we make decisions to care for ourselves, our families, and our communities?

COVID-19 & Health Equity Middle School

How can people help end pandemics?

COVID-19 & Health Equity High School

How can we slow the spread of the COVID-19 virus to protect our communities?
Who’s Using this Stuff?

20,961  Registered users on website
203,655  Downloaded items from the website
422,197  Views on our YouTube Channel
A Challenge Paper From

Carnegie Corporation of New York

www.Carnegie.org/Elements
Toward an OpenSciEd Research Community

Jeremy Roschelle
Digital Promise
The Research Opportunities We Envision

- **OpenSciEd-enabled** research
  *Research questions in service of science education broadly*

- **OpenSciEd-inspired** research
  *Research questions that drive innovations based on distinctive features*

- **OpenSciEd-partnership** research
  *Research and evaluation questions of mutual interest to you and OpenSciEd developers*

The vision: an extended community investigating how to improve science education, centered on an open, modern, high quality curriculum.
Types of Research Studies

• **Core research**
  Building scientific knowledge about learning and teaching

• **Design research**
  Exploring improvements, adaptations and extensions

• **Implementation research**
  Building capacity and supporting use

• **Efficacy research**
  For whom and under what conditions does OpenSciEd work?

• **Scale up research**
  Spread, depth, shift of ownership, sustainability, evolution
What OpenSciEd makes possible

Anchoring in one curriculum can help a community achieving greater impact

- A researcher-practitioner district partnership adapts materials to tackle science equity

- A partnership with a state agency reorganizes the built-in teacher supports to be able to scale up teacher professional development statewide

- A rural STEM consortium develops a toolkit and guidelines for adapting OpenSciEd for differing rural communities nationwide
Why we’re excited

OpenSciEd opens up powerful, new research opportunities

Digital Promise’s Beliefs

1. Important research requires bringing researchers, practitioners, developers, funders, and other voices together
2. Individual research projects achieve stronger rigor and relevance when they are part of a community
3. Equity is a pressing challenge that we need to tackle together

Call to Action: Join a working group to define what this community should become and what research it should seek to do.
buildbackbetter.gov

PRIORITIES

We aren’t just going to rebuild what has worked in the past. This is our opportunity to build back better than ever.

IMEDITATE PRIORITIES:

COVID-19  RACIAL EQUITY  ECONOMY
CLIMATE  IMMIGRATION  RESTORING AMERICA’S
HEALTH CARE  GLOBAL STANDING
IMMEDIATE PRIORITIES:

COVID-19  
CLIMATE HEALTH CARE

RACIAL EQUITY IMMIGRATION

ECONOMY
RESTORING AMERICA’S GLOBAL STANDING
All Standards, All Students

Traditional
Scientists & Teachers
Knowledge of Science Disciplines
Some Students

Contemporary
Students as Scientists and Engineers
Making Sense of Phenomena and Designing Solutions to Problems
All Students

Future
Students as ??
All Students

Some Students

All Standards, All Students
Equality: Students are all treated the same and have access to the same resources

Equity: Students all receive the resources they need so they can achieve the same rigorous outcomes
Shifts from Deficits to Assets

Deficit-Oriented Pedagogy
- Linguistically marginalizing
- Linguistic inequity

Asset-Oriented Pedagogy
- Linguistically sustaining
- Linguistic equity

Terms Indicating Shifts from Deficits to Assets
- Limited English proficient students (LEPs) in the No Child Left Behind Act of 2001
- Students from non-English language backgrounds
- Culturally and linguistically diverse students
- English language learners
- English learners (ELs) in the Every Student Succeeds Act of 2015
- Emergent (or emerging) bilinguals
- Multilingual learners
- Term in future federal legislation?
“Doing” Science

**What happens to our garbage?**

**Cluster 1**
- What do we want to know about our garbage?
  - Phenomenon and driving question of the unit

**Cluster 2**
- What happens to the garbage materials?
  - 5-PS1-3 Properties of matter

**Cluster 3**
- How do we smell garbage materials?
  - 5-PS1-1 Particle nature of matter

**Cluster 4**
- What causes changes in garbage materials?
  - 5-PS1-4 Chemical reactions
  - 5-PS1-2 Conservation of matter
  - 5-LS2-1 Decomposers
What is That Smell?
Students use multiple modalities in increasingly strategic ways over time.

Talk, text, diagrams, symbols, tables, graphs, etc.
Modalities

Beginning of a lesson cluster
Modalities

End of a lesson cluster
Students progress from everyday language to specialized language over time.

- **EWWW! It stinks!**
- **Smell is something. It’s a gas.**
- **Smell is a gas made of particles too small to see.**
- **Smell is a gas made of particles moving freely in space.**

*From everyday to specialized registers*
Registers

Beginning of a lesson cluster

Midpoint of a lesson cluster

Smell travels freely and the wind helps it get more spread out, you can't see smell because it's particulars are too small to see.

End of a lesson cluster
Student Assets

- FAMILY
- EVERYDAY LANGUAGE
- PASSIONS
- RACE
- FRIENDS
- RELIGION
- SKILLS
- CULTURES
- COMMUNITY ISSUES
- FRIENDS
- SPECIALIZED LANGUAGE
- GOALS
- NATIONALITY
- VALUES
- MENTORS
- DREAMS
- ABILITIES
- LANGUAGE
Knowledge of Science Disciplines

Scientists & Teachers

Some Students

Making Sense of Phenomena and Designing Solutions to Problems

Students as Scientists and Engineers

All Students

Future

Students as ??

All Standards, All Students
IMMEDIATE PRIORITIES:

- COVID-19
- CLIMATE
- HEALTH CARE
- RACIAL EQUITY
- IMMIGRATION
- ECONOMY
- RESTORING AMERICA’S GLOBAL STANDING
It’s all a matter of perspective: Starting points for research on OpenSciEd
OpenSciEd Research Agenda Plenary

March 31, 2021
Danny Edelson, BSCS Science Learning
OpenSciEd is an innovation

• What does it take to get people to adopt it?
  • Who adopts it?
  • Why do they adopt it?
  • Who doesn’t? Why not?
• What does it take to implement it successfully?
  • How do people react to the changes that it requires?
  • How do you get people to buy in to the changes?
  • Who buys in? Who doesn’t?
• Does it persist?
  • Is it implemented as designed?
  • How does its use change over time?
OpenSciEd is a Solution to a Challenge

• How do you characterize the challenge?
  • How do you measure “solution”?
• How well does it solve the challenge?
  • Is it better at solving than alternatives?
• Under what conditions does it solve the challenge?
  • For whom?
• At what cost does it solve the challenge?
  • Is it affordable?
  • Is it cost-effective in comparison to alternatives?
OpenSciEd is the translation of a theory of change into an intervention

• Are the assumptions about the system being intervened on valid in the ”real world”?
• Is the intervention a faithful translation of the theory of change?
• Is there evidence that the individual conjectures in the theory of change are valid?
• Is there evidence that the conjectures are valid when combined in a complex intervention?
OpenSciEd is a drosophila (model organism) for educational research

• What research should we do on OpenSciEd (v 1.0) to provide a baseline for future research?
• Under what different conditions should we study OpenSciEd?
• How can we use OpenSciEd to study changes in the system over time?
• What variations on OpenSciEd should we study?
  • What conjectures can be explored by studying variations on OpenSciEd?
Things to remember about the OpenSciEd Middle School Program

• It belongs to the world.
• It is a first draft of a program that is meant to grow and branch.
• It is a challenge to do better
  • in some cases by improving it,
  • in some cases by doing something different.
• It will fail
  • if it never gets a fair chance,
  • if people ask too much of it,
  • if it never gets a chance to get better.
An Initial Logic Model to Guide OpenSciEd Research

Kevin McElhaney
Digital Promise
OpenSciEd logic model features

- **It’s a draft**—we will refine it together.

- **It’s not exhaustive**—it highlights what is most distinctive about OpenSciEd.

- **It’s high-level**—a starting point for more detailed models.
Initial Logic Model to Guide OpenSciEd Research

**Distinctive Principles**
- Coherent to students
- Phenomena-driven
- Development/revision of ideas
- Collaborative knowledge building
- Embody the vision of the Framework

**Unique/Key Affordances**
- Adaptable
- Freely available
- Extensive and detailed
- Approved

**OpenSciEd and Educational Ecosystem**

**System:** Aligns OpenSciEd to system change models to support teacher growth and incentivize the instructional approach. Helps make OpenSciEd adoptable and sustainable.

**Teacher supports:** Enable teachers to implement the OpenSciEd vision and promote teacher growth. Helps make OpenSciEd learnable and feasible.

**Classroom:** Promotes interactions among teachers, students, and materials to achieve desired outcomes. Helps make OpenSciEd implementable and engaging.

**Desired Outcomes**
- System
- Teacher capacity
- Students
- Resources and innovations
**Classroom:** Promotes interactions among teachers, students, and materials to achieve desired outcomes

**Components**
- Teacher as facilitator
- Driven by student questions
- Lesson-to-lesson enactment
- Consensus building among students
- Problematization
- Opportunities for assessment

**Research opportunities**
- Characterize and improve classroom feasibility
- Technologies that support implementation
- Equitable and inclusive instructional practices
- Assessment systems
- Improvements over time
- Practical barriers
**Teacher supports:** Enable teachers to implement the OpenSciEd vision and promote teacher growth

**Themes**
- Content understanding
- Unit storyline
- Goals for specific lessons, discussions, and activities
- Logistical and materials strategies

**Professional learning activities**
- Engage in analysis of and reflection on problems of practice
- Highlight navigation and lesson-to-lesson enactment
- Immerse teachers in content from the student perspective
- Provide opportunities to collaborate and reflect with peers

**Research opportunities**
- Adapting teacher supports to meet local needs
- Professional learning communities, coaching, and teacher-to-teacher support
- Supporting equity across classrooms
- How much professional development is needed, and can teachers get it
- Supporting professional development leaders from non-science disciplines
**System:** Aligns OpenSciEd to system change models to support teacher growth and incentivize the instructional approach

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<th>Components</th>
<th>Research opportunities</th>
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| • Collaborations with state officers who can help align to existing systems and effect change in states  
• System of OpenSciEd professional development service providers with trained and certified facilitators  
• Support for districts to prepare for implementing OpenSciEd | • Variation across states  
• Redirecting resources from curriculum to professional learning  
• Engaging families  
• Accountability systems  
• Strategic partnerships  
• Building district capacity |
Desired Outcomes

Student
- NGSS-based learning outcomes
- Science engagement
  - Phenomena and problems
  - Classroom
  - Coursetaking
  - Community
- Autonomy
  - Science practices
  - Knowledge building practices
- Outcomes are equitable within and across classrooms

Increased teacher capacity to:
- Implement OpenSciEd successfully and sustainably
- Engage all students equitably
- Sustain a classroom culture of “figuring out”
- Achieve self-efficacy

System
- Deeply committed district adoption
- Broad adoption and infrastructure
- Teacher collaborations
- Shifts in accountability practices
- Teacher professionalism
- Increased resources to teacher professional learning
- Strategic partnerships

Resources and innovations:
- Refined and customized materials
- Technologies
- Assessment systems
- Adoption and implementation models
Research opportunity: District adoption

- How are PD materials adapted? Are they adapted with integrity?
- What teacher-to-teacher supports are successful?
- What shifts occur in district policies / accountability practices?
Stay Connected

- Join the conversation on Twitter: #OpenSciEdResearch @DigitalPromise @OpenSciEd
- Email us with questions or ideas: babe@digitalpromise.org kmcelhaney@digitalpromise.org
Program Committee

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Thank you!
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