Next Generation Open Source Science Instructional Materials

December 2017

Introduction

This document describes the OpenSciEd project.

The project will start with grades 6-8 and then expand to all grade levels. Multiple people representing many different organizations have contributed to its development.

This document will inform funding proposals and a multi-year work plan to transform the vision of OpenSciEd into reality for teachers and students across the country.

Our Goal: What are we trying to do?

A group of state education agencies, working with school districts, classroom educators, experienced science curriculum developers and the science education community, will create and field test a complete set of robust, research-based, open-source science instructional materials that are aligned to NGSS and accessible to all students, while building demand for the materials and implementation supports in tandem.

We want to:

- Ensure any science teacher in the U.S. can access and download free NGSS-aligned instructional materials.
- Allow districts and schools to shift focus from developing aligned materials to professional learning for science teachers and leaders around quality instructional materials.
- Provide space for states and districts to work with other organizations to collaborate on innovative approaches to professional learning for science teachers and leaders.

Our Theory of Action

Our theory of action is as follows: If we create a set of exemplary science materials that are:

1. aligned to state standards based on the National Academy of Science's *Framework* for K-12 Science Education, including the Next Generation Science Standards (NGSS);
2. based on research-based understandings about how students learn and how teachers teach;
3. developed through collaboration with educators and extensively tested by teachers and schools; with components to support the development of teacher content and pedagogical knowledge;
4. designed to be used with low-cost, readily available laboratory equipment and materials

amenable to large-scale deployment; and
5. improved over time in response to implementation challenges and successes.

Then we will:

1. provide a model of quality and usability for the field;
2. push the market to change, producing more and better instructional materials choices for schools, districts, and states in the long run;
3. create a large community of science teachers and science education leaders that can support and drive subsequent implementation and science education improvement efforts; and
4. create a generation of students that have a greater scientific knowledge base, the ability to think and reason scientifically, and a deep appreciation of the science discipline.

Phase 1: What Will Be Accomplished?

Phase 1 will be a *concept specification* and *proof of concept* phase. During this phase, a set of *lead states* will work with a small OpenSciEd.org staff and a consortium of leading researchers and curriculum developers in science education to create specifications for the OpenSciEd instructional materials, produce and test prototype units that embody these specifications, and design and employ professional development for field testing teachers. To ensure success and sustainability of this project, the group will establish development and decision-making procedures and create a backbone organization to coordinate the project.

There will be three primary deliverables for phase 1.

Deliverable 1: Specifications

Working collaboratively under state leadership, the OpenSciEd project will develop a set of specifications that describes the instructional materials that are needed. In addition to being high-quality and designed for the NGSS, these specifications will answer questions such as:

- How should various elements of NGSS be prioritized to accommodate practical limitations?
- What is the best approach to sequencing and scaffolding of SEPs and CCCs, both within and across units?
- Which recurring classroom routines and instructional strategies (e.g., driving question board, POE, think-pair-share) should be emphasized? How should readings and homework assignments be considered?
- How should instructional materials be designed to support teacher learning as well as student learning?
- How should instructional materials approach assessment and grading?
- What sorts of technology and laboratory equipment should be considered and expected, and what are the constraints on its use?
- How should considerations for special populations of students and teachers be considered?
- What is the appropriate scope and sequence for grades 6-8?
- How can the materials be designed to meet the needs of states who have adopted similar standards but sequenced them in different grade levels?

The specifications will be completed by spring 2018.

Deliverable 2: Infrastructure and Process

The OpenSciEd project will design and prototype a mechanism by which states and developers can work together to jointly develop quality NGSS-designed instructional materials. This will include an infrastructure designed for future use, including decision rules and governance structures as well as a process (meeting cadence, rules of engagement, outreach needs, etc.) to ensure strong relationships and interdependence of all involved. A key part of this work will be establishing and staffing the OpenSciEd.org.

The infrastructure and process will be established by spring 2018.

Deliverable 3: Prototype Units

The OpenSciEd project will select 6 existing research-based, OER middle-school units to serve as prototype units and revise them to meet the specifications detailed above. These units will serve as *proof of concept* prototypes for the purposes of developing and testing the processes for collaborative design and field testing with states. The prototype units will also serve as models for the broader development to take place in Phase 2. The prototype units will be available for limited field testing in fall 2018, revised based on feedback from field tests during the 2018-19 school year, and be available for wider field testing by the fall of 2019.

The prototype units will live in an online "content management system" with functionality TBD. Accompanying the prototype units will be documentation and tools needed for a successful field test, including professional development modules, field testing plans, data collection rules and procedures, video examples, and student work samples.

Phase 1: How Will This Work?

The OpenSciEd project will be supported in phase 1 by the Carnegie Corporation of New York as an initial sponsor, contributing $2M. Phase 1, fall 2017 to spring 2019, will include the following project partners, staffing, and governance plan.

The State Organization "OpenSciEd.org"

A collection of partner states plus an advisory board made up of science and education leaders will provide overall leadership for the development and field testing of aligned science instructional materials, thus resulting in a curriculum that is "by states, for states."

A Developer Consortium

A developer consortium made up of national leaders in science education research and development, will consult with OpenSciEd.org to develop specifications for NGSS-aligned 6-8 instructional materials, model a process for collaborative development and field testing of units with state partners, and use this process to produce a set of "prototype units". When developing subsequent RFPs, the state leadership team will determine whether the initial consortium developer is eligible to apply.

Achieve

Achieve will provide quality control services, ensuring that the resulting product is “by states, for states” and represents the NGSS.

Staffing and Initial Governance

A fiscal sponsor will house a project director and manage grants and contracts to project partners and others.

Phase 2: What’s Planned?

During phase 1, the OpenSciEd project will seek funding to move forward with large-scale materials development in phase 2. Using the specifications, process, and infrastructure developed in Phase 1, OpenSciEd.org will issue an RFP for Phase 2 development. While the specifics of the RFP will be determined by the state leaders, it will include additional units and grades. It may also include additional content for existing units, a new developer consortium, or revised curriculum specs based on field testing.

Why?

OpenSciEd addresses several problems currently facing science education in the United States.

- **Design challenges**. Designing curricula for the NGSS is difficult. Currently, few, if any, NGSS-aligned, full-year curriculum have been identified in the marketplace. This effort will advance the collective ability of both the producers and consumers to define and describe quality science instructional materials.

- **Immediate need**. States that have adopted new science standards need instructional materials to provide to schools immediately. This project will collect exemplary research-based curriculum projects (stand-alone units) that already exist, revise them to work better together, and accelerate them to the classroom for broad use.

- **Built for scale**. In previous decades, and unlike other disciplines, quality science instructional materials generally didn’t secure a sizable portion of the marketplace. By involving states at the onset, and by building a community of science education leaders around the development of these instructional materials, the likelihood of usage at scale increases.

- **Giving every teacher access**. Open source curriculum creates the landscape for grassroots adoption of quality materials. Individual teachers, who often aren't decision makers in curriculum adoption, can freely access open source curriculum.

- **Increased market for professional development**. Open source curriculum allows a variety of professional development providers to enter the market to deeply support teachers using research based practices such as ongoing, job embedded learning, structures in which traditional "vendors" have not been able to accommodate. Furthermore, open source provides the option for districts to use providers that the already have relationships with to build and

implement curriculum connected professional development.

- **Better enactment**. In the past, districts and states struggled to execute instructional materials enactments well, often failing to create coherent policies and programs that connected curriculum with professional learning and accountability. District and state goals and strategies were developed in silos, with little communication or collaboration across jurisdictions. A common set of instructional materials, with the widespread support of the science education community, will facilitate the sharing of implementation tools (pacing guides, observation protocols, professional development modules, etc.) and plans, enabling smarter local strategies and enhancing the quality of enactment. Because the instructional materials will be open source, other organizations will be free to adapt them and offer related services, such as equipment procurement and professional development.
- **Better prepared pre-service teachers**. Teacher preparation programs, who are traditionally theory heavy and curriculum agnostic can access open source materials to train upcoming teachers, setting the bar for high quality instruction early and concretely.

While the initial development of will be focused on the needs of the OpenSciEd.org states, the resulting instructional materials will be freely available to anyone.