

Leadership and Assistance for Science Education Reform (LASER)

Intervention Brief | Primary Science Topic Area

WHAT WORKS
CLEARINGHOUSE™

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Scientists, science educators, and educational policymakers emphasize the importance of teaching students about scientific inquiry rather than focusing solely on scientific content. Inquiry-based science interventions aim to improve students' science proficiency by helping them understand scientific processes. In these interventions, students conduct hands-on investigations of science concepts and everyday phenomena, construct explanations for what they observe, consider alternative explanations, and communicate and justify their proposed explanations. Because implementing inquiry-based science instruction is challenging, the Smithsonian Science Education Center (SSEC) developed *Leadership and Assistance for Science Education Reform (LASER)*, a program designed to build capacity for effectively implementing inquiry-based science curricula in schools and districts. When participating in *LASER*, school or district teams attend leadership development institutes to plan the implementation of inquiry-based science curricula. These school or district teams receive support for key aspects of implementation such as professional development for

teachers, access to instructional materials, and support for selecting appropriate assessments. *LASER* also helps schools and districts partner with scientists, science educators, and local business and community leaders who can promote and further support the implementation of inquiry-based science instruction.

This What Works Clearinghouse (WWC) intervention report, part of the WWC's Primary Science topic area, explores the effects of *LASER* on science achievement. The WWC identified two studies of *LASER*. One of these studies meets WWC standards. The evidence presented in this report is from one study of the effects of *LASER* on students, including 44% Hispanic, 31% White, 19% Black, 3% American Indian/Alaska Native, and 2% Asian students. *LASER* was implemented in grade 3 and 6 classrooms at the start of the study with outcomes measured after 3 years of implementation when students were in grades 5 and 8. Study schools were located in 16 urban, suburban, and rural school districts in New Mexico, North Carolina, and Texas.

What Happens When Students Participate in *LASER*?

The evidence indicates that implementing *LASER* has no discernible effects on science achievement.

Findings on *LASER* from the one study that meets WWC standards are shown in Table 1. The table reports an effectiveness rating, an improvement index, and the number of studies and students that contributed to the findings. The effectiveness rating is based on the quality of the designs used in studies, whether the findings are favorable or unfavorable for the intervention, and the number of studies that tested the intervention. See Box 1 for more information on interpreting effectiveness ratings.

In order to help readers judge the practical importance of an intervention's effect, the WWC translates findings across

studies into an "improvement index" by averaging findings that meet WWC standards within the same outcome domain. The improvement index can be interpreted as the expected change in percentile rank for an average comparison group student if that student had received the intervention. For example, an improvement index of -1 means that the expected percentile rank of the average comparison group student would decrease by 1 point if the student received *LASER*. A positive or negative improvement index does not necessarily mean the estimated effect is statistically significant.

The evidence presented in this report is based on available research. Findings and conclusions could change as new research becomes available.

Table 1. Summary of findings on *LASER* from one study that meets WWC standards

Outcome domain	Effectiveness rating	Study Findings	Evidence meeting WWC standards (version 4.0)	
		Improvement index (percentile points)	Number of studies	Number of students
Science achievement	No discernible effects	-1	1	6,291

Note: The effects of *LASER* are not known for other outcomes within the Primary Science topic area, including life sciences, physical sciences, and earth/space sciences.

BOX 1. HOW THE WWC REVIEWS AND DESCRIBES EVIDENCE

The WWC evaluates evidence based on the quality and results of reviewed studies. The criteria the WWC uses for evaluating evidence are defined in the [Procedures and Standards Handbooks](#) and the [Review Protocols](#). The studies summarized in this report were reviewed under WWC Standards (version 4.0) and the Primary Science topic area protocol (version 4.0).

To determine the effectiveness rating, the WWC considers what methods each study used, the direction of the effects, and the number of studies that tested the intervention. The higher the effectiveness rating, the more certain the WWC is about the reported results and about what will happen if the same intervention is implemented again. The following key explains the relationship between effectiveness ratings and the statements used in this report:

Effectiveness Rating	Rating interpretation	Description of the evidence
Positive (or negative) effects	The intervention is <i>likely</i> to change an outcome	Strong evidence of a positive (or negative) effect, with no overriding contrary evidence
Potentially positive (or negative) effects	The intervention <i>may</i> change an outcome	Evidence of a positive (or negative) effect with no overriding contrary evidence
No discernible effects	The intervention <i>may result in little to no change</i> in an outcome	No affirmative evidence of effects
Mixed effects	The intervention <i>has inconsistent effects</i> on an outcome	Evidence includes studies in at least two of these categories: studies with positive effects, studies with negative effects, or more studies with indeterminate effects than with positive or negative effects

How is *LASER* Implemented?

The following section provides details of how schools and districts can implement *LASER*. This information can help educators identify the requirements for implementing *LASER* and determine whether implementing this intervention would be feasible in their schools or districts. Information on *LASER* presented in this section comes from the study that meets WWC standards (Zoblotsky et al., 2016) and from correspondence with the developer.

- **Goal:** The *LASER* program aims to build the capacity of schools and districts to implement an inquiry-based approach to science instruction to improve student achievement.
- **Target population:** *LASER* is intended for school and district leaders, state education agency leaders, and teachers who serve students in kindergarten through grade 12, as well as parents and local community partners supporting implementation of inquiry-based science curricula.
- **Method of delivery:** SSEC staff provide in-person leadership development institutes with follow-up coaching or support sessions by video conferencing as needed. The content of teacher professional development depends on the particular science curriculum that a school or district has selected for implementation.
- **Frequency and duration of service:** *LASER* implementation occurs over a 2- to 3-year period and begins with a half-day or day-long session for administrators, teachers, parents, and community representatives to learn about the *LASER* model and begin developing goals for implementing the program locally.

Comparison condition: In the one study that contributes to this intervention report, schools in the comparison group used their business-as-usual science curricula. Although some schools in the comparison group were using components of an inquiry-based science curriculum, teachers and staff from these schools did not participate in *LASER* leadership training and did not receive *LASER* program support for curriculum implementation or engagement of community partners.

Selected leadership teams, comprising administrators, teachers, parents, and community members from participating schools and districts, attend a week-long leadership development institute. After schools begin implementing the *LASER* model, leadership teams reconvene for 2- to 3-day sessions with other implementing teams. Refer to Table 2 for additional details.

- **Intervention components:** The *LASER* model (1) offers leadership development institutes to help leadership teams of school and district administrators, teachers, parents, and community partners plan to implement an inquiry-based science curriculum, (2) provides ongoing support for the implementation of this curriculum, and (3) helps schools and districts establish partnerships with scientists, science educators, and local business and community leaders to promote and further support the implementation of inquiry-based science instruction. Refer to Table 2 for additional details.

Table 2. Components of *LASER*

Key component	Description
Leadership development institutes	<p><i>LASER</i>'s leadership development and capacity-building model is designed to support schools and districts in implementing inquiry-based science curricula with a series of leadership development institutes. These leadership development institutes include:</p> <ul style="list-style-type: none"> • Building Awareness for STEM Education Institute: In the first of <i>LASER</i>'s three leadership development institutes, representatives from state or local education agencies, school administrators, teachers, parents, and community-based partners attend a half-day to 1-day training to learn about research on inquiry-based science education and the <i>LASER</i> model. Participants begin developing goals for implementing inquiry-based science education in their local area and select a leadership team to attend subsequent <i>LASER</i> institutes. • Leadership Development and Strategic Planning Institute: In this second <i>LASER</i> institute, leadership teams gather for a week-long training. Participating teams learn how different stakeholders (parents, teachers, principals, district leaders) typically respond to school- or district-wide initiatives to change educational practices in school settings, draft a strategic plan for implementing <i>LASER</i>'s five elements of inquiry-based science education in their local school or district, and connect with experts in inquiry-based science instruction and systemic school change, as well as colleagues in other regions who are also implementing <i>LASER</i>. • Implementation Institute or Next Step Institute: After leadership teams have begun implementing inquiry-based science education, they can choose to attend a 2- to 3-day follow-up institute once per year, either a regional Implementation Institute or a national Next Step Institute. Leadership teams connect with other teams in their region or from other regions, assess which aspects of their initial strategic plan have been successful, and explore potential solutions to implementation challenges.
Ongoing support for implementing an inquiry-based science curriculum	<p>For 3 years, the Smithsonian Science Education Center (SSEC) provides participating schools and districts ongoing support to implement an inquiry-based science curriculum that the leadership team selects. The SSEC also supports the implementation of the curriculum by helping schools:</p> <ul style="list-style-type: none"> • Plan and provide professional development to teachers that is aligned with the inquiry-based science curriculum and tailored to individual teachers' science content knowledge and familiarity with inquiry-based instruction. Often, this includes peer coaching from current or former teachers with expertise in inquiry-based instruction to teachers with less experience. • Provide classrooms with cost-efficient and timely access to equipment and supplies that students need to participate in the inquiry-based science curriculum's hands-on investigations. Typically, these hands-on learning activities require consumable materials (such as cotton swabs, chemicals, paper cups, or modeling clay) that must be replenished periodically so other students can participate in the investigations. • Select and use assessments that capture student learning in both science content and the scientific process, enable teachers to diagnose and address student misconceptions, and align instruction to state or school district science standards. Teams may also administer assessments of student attitudes toward STEM and of teachers' instructional practice or content knowledge. <p>In Zoblotzky et al. (2016), the SSEC provided districts and schools participating in <i>LASER</i> with its <i>Science and Technology Concepts (STC™)</i> curriculum, including Spanish-language versions of instructional materials. Teachers in study schools implementing <i>LASER</i> received introductory- and intermediate-level professional development from the SSEC. The SSEC developed online videos to support teachers' ongoing professional development and provided schools with a regional coordinator who worked with principals and teachers to address implementation concerns. <i>STC™</i> is designed to be implemented as a series of units over the course of a school year in each grade. Teachers reported completing only one unit of the <i>STC™</i> curriculum during the first year of the study, two units during the second year, and two or three units during the third year. In response to a WWC author query, the study authors confirmed that schools implementing <i>LASER</i> were asked to use the <i>STC™</i> curriculum as their only science curriculum.</p>
Community-based partnerships to promote and support inquiry-based science education	<p>The SSEC partners with scientists and science educators in local businesses, nonprofits, universities, and other organizations to promote inquiry-based science education to school and district administrators and provide additional expertise and resources to help schools and districts address implementation challenges, such as aligning the inquiry-based curriculum to state standards.</p> <p>In Zoblotzky et al. (2016), the SSEC engaged the Los Alamos National Laboratory Foundation to help cultivate partnerships with school districts and provide staffing, space, and logistical support for schools to receive, store, and refurbish <i>STC™</i> hands-on science kits. It also partnered with the North Carolina Science, Mathematics, and Technology Education Center to help build support for <i>LASER</i> among principals and school district staff, convene workshops to help align <i>STC™</i> units to state curricular standards, and develop supplementary units and extension activities for participating teachers. Finally, the SSEC worked directly with the Houston Independent School District Science Department to modify scope and sequence documents and instructional calendars to help teachers integrate the <i>STC™</i> units into the school district's science curriculum plan.</p>

What Does *LASER* Cost?

This preliminary list of costs is not designed to be exhaustive; rather, it provides educators an overview of the major resources needed to implement *LASER*. The program costs

described in Table 3 are based on the information available as of February 2020.

Table 3. Cost ingredients for *LASER*

Cost ingredients	Description	Source of funding
Personnel	<p>The costs of the Building Awareness for STEM Education Institute varies based on duration, number of attendees, and facilities available. The Leadership Development and Strategic Planning Institute has a registration fee of \$7,000 for a team of five individuals. The Implementation Institute costs vary by region. The national Next Step Institute costs \$425 per individual or \$1,200 for a team of three. Teacher professional development costs depend on the inquiry-based curriculum the school district or school selects.</p>	<p>School districts or schools pay registration fees and associated travel costs for each <i>LASER</i> leadership institute. School districts or schools pay for teacher professional development costs.</p>

Cost ingredients	Description	Source of funding
Facilities	Leadership development institutes are hosted by Smithsonian Science Education Center staff who provide physical space for the sessions. Teacher professional development occurs in the school or school district, which is responsible for providing the physical space for training activities. The inquiry-based curriculum that the school district or school selects is implemented in students' regular classrooms during science instruction time.	School districts or schools provide physical space for teacher professional development and classroom instruction.
Equipment and materials	The costs of materials provided to teams attending a <i>LASER</i> leadership institute are included in the registration fees. Because the <i>LASER</i> model does not specify a particular curriculum, the cost of equipment and materials, including any consumable supplies that students use to conduct hands-on investigations as well as reusable instructional materials, varies depending on the curriculum selected by school districts or schools that participate in <i>LASER</i> .	The registration fees that school districts or schools pay for leadership institutes cover the cost of materials provided to attendees. School districts or schools purchase curriculum and related materials for students and teachers to use.

For More Information:

About *LASER*

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About the cost of the intervention

Information about the cost of the intervention was provided by the Smithsonian Science Education Center.

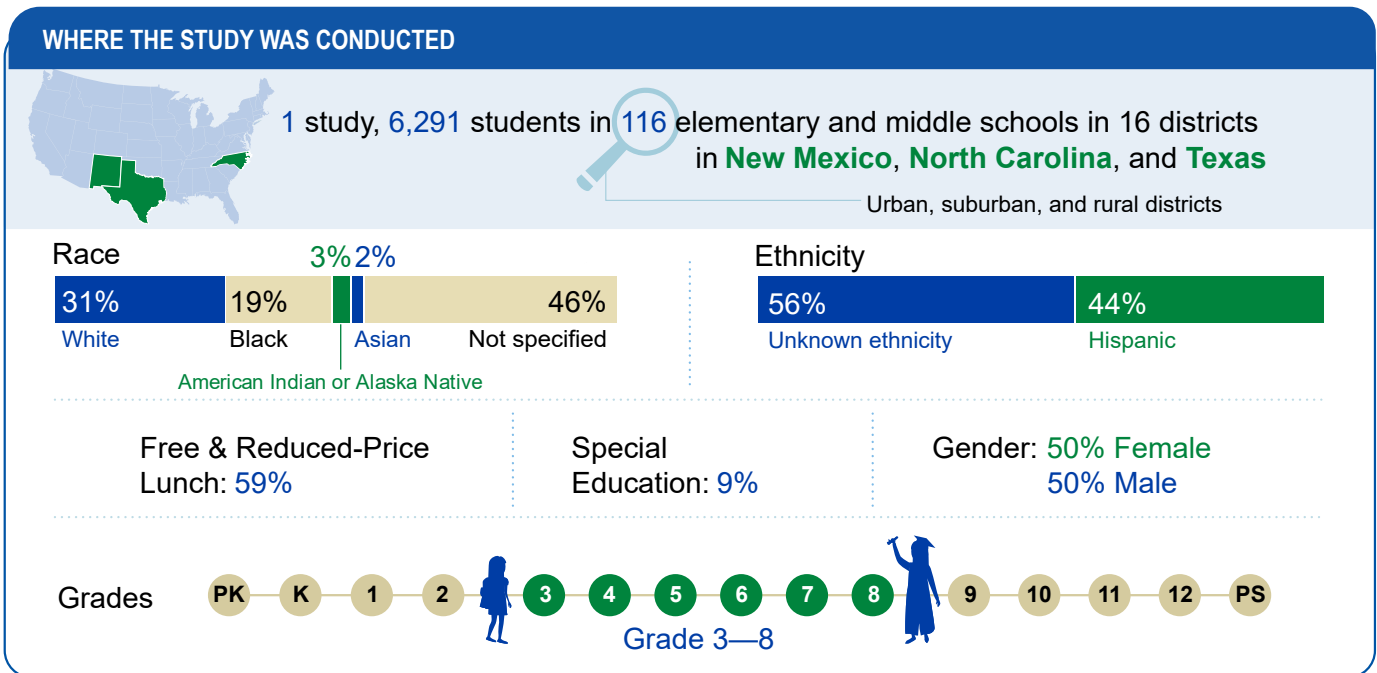
About the study that meets WWC standards

Zoblotsky, T., Bertz, C., Gallagher, B., & Alberg, M. (2016). *The LASER model: A systematic and sustainable approach for achieving high standards in science education: SSEC i3 Validation final report of confirmatory and exploratory analyses*. Center for Research in Educational Policy, University of Memphis. https://ssec.si.edu/sites/default/files/Zoblotsky_etal_2016_Smithsonian_LASER_i3_Validation_Report_FINAL_09_01_16.pdf

In What Context Was *LASER* Studied?

The following section provides information about the setting of the study of *LASER* that meets WWC standards, and a description of the participants in the research. This information can help educators understand the context in which the study of *LASER* was conducted and determine whether the program might be suitable for their setting.

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Read more about the *LASER* intervention and the studies that are summarized in this brief in the [Intervention Report](#).