IES Institute of Education Sciences

Leadership and Assistance for Science Education Reform (LASER)

Intervention Report | 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.[1] 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.[2] Because implementing inquiry-based science instruction is challenging,[3] 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.[4]

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*?[5]

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. Results for each individual outcome measure are shown in Table 4.

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

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

Note: For more information about outcome measures, see study descriptions in Table 6. 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 ***likely*** to change an outcome	Strong evidence of a positive (or negative) effect, with no overriding contrary evidence
Potentially positive (or negative) effects	The intervention ***may*** change an outcome	Evidence of a positive (or negative) effect with no overriding contrary evidence
No discernible effects	The intervention ***may result in little to no change*** in an outcome	No affirmative evidence of effects
Mixed effects	The intervention ***has inconsistent effects*** 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. 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.

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.

Table 2. Components of *LASER*

Key component	Description
Leadership development institutes	*LASER*'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: • Building Awareness for STEM Education Institute: In the first of *LASER*'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 *LASER* model. Participants begin developing goals for implementing inquiry-based science education in their local area and select a leadership team to attend subsequent *LASER* institutes. • Leadership Development and Strategic Planning Institute: In this second *LASER* 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 *LASER*'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 *LASER*. • 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	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: • 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. In Zoblotsky et al. (2016), the SSEC provided districts and schools participating in *LASER* with its *Science and Technology Concepts (STC™)* curriculum, including Spanish-language versions of instructional materials. Teachers in study schools implementing *LASER* 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. *STC™* 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 *STC™* 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 *LASER* were asked to use the *STC™* curriculum as their only science curriculum.
Community-based partnerships to promote and support inquiry-based science education	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. In Zoblotsky 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 *STC™* hands-on science kits. It also partnered with the North Carolina Science, Mathematics, and Technology Education Center to help build support for *LASER* among principals and school district staff, convene workshops to help align *STC™* 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 *STC™* units into the school district's science curriculum plan.

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	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.	School districts or schools pay registration fees and associated travel costs for each *LASER* leadership institute. School districts or schools pay for teacher professional development costs.
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 *LASER* leadership institute are included in the registration fees. Because the *LASER* 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 *LASER*.	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.

Research Summary

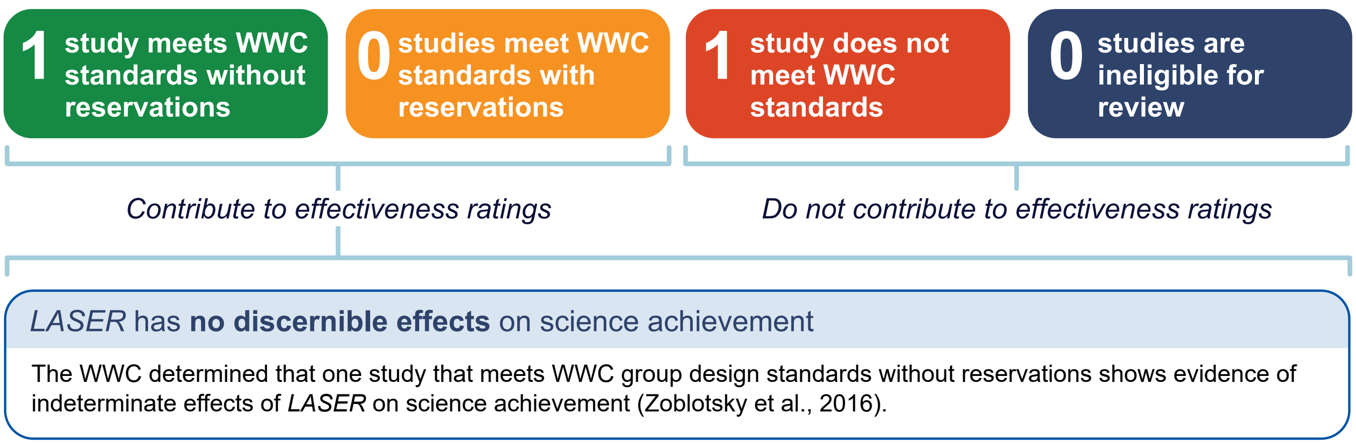
The WWC identified two studies that investigated the effectiveness of *LASER* (Figure 1):

- 1 study meets WWC group design standards without reservations
- 1 study does not meet WWC group design standards

The WWC reviews findings on the intervention's effects on eligible outcome domains from studies that meet standards, either with or without reservations. Based on this review, the WWC generates an effectiveness rating, which summarizes how the intervention impacts, or changes, a particular outcome domain. The WWC reports additional supplemental findings, such as those reported for students who are English learners, on the WWC website (https://whatworks.ed.gov). These supplemental findings and findings from studies that do not meet WWC standards do not contribute to the effectiveness ratings.

The one study of *LASER* that meets WWC group design standards reported findings on science achievement. No other findings in the study meet WWC group design standards within any outcome domain included in the Primary Science topic area.[6] Citations for the study reviewed for this report are listed in the References section, which begins on page 10.

Figure 1. Effectiveness ratings for *LASER*



Main Findings

Table 4 shows the findings from the one study of *LASER* that meets WWC standards. The table includes WWC calculations of the performance of the intervention group relative to the comparison group in terms of the mean difference and effect size. The effect size is a standardized measure of the effect of an intervention on outcomes, representing the average change expected for all individuals who are given the intervention (measured in standard deviations of the outcome measure). For the mean difference and effect size values, a positive number favors the intervention group and a negative number favors the comparison group. A positive or negative improvement index does not necessarily mean the estimated effect is statistically significant.

Based on findings from the one study that meets WWC standards and includes 6,291 students, the effectiveness rating for science achievement is *no discernible effects*.

Table 4. Findings by outcome domain from the study of *LASER* that meets WWC standards

			Mean (standard deviation)		WWC calculations			
Measure	**Study sample**	**Sample size**	**Intervention group**	**Comparison group**	**Mean difference**	**Effect size**	**Improvement index**	***p*-value**
Partnership for the Assessment of Standards-based Science (PASS): Multiple Choice	Students in grade 5	4,123	435.80 (88.72)	434.88 (88.76)	0.92	0.01	0	.92
PASS: Multiple Choice	Students in grade 8	2,168	323.02 (110.85)	327.22 (106.00)	-4.20	-0.04	-2	.84
PASS: Constructed Response	Students in grade 5	2,585	66.39 (21.09)	64.50 (20.18)	1.89	0.09	+4	.24
PASS: Open-ended	Students in grade 8	1,527	85.08 (15.49)	84.60 (15.32)	0.48	0.03	+1	.90
PASS: Performance Task	Students in grade 5	2,601	66.55 (15.50)	65.09 (16.82)	1.46	0.09	+4	.36
PASS: Performance Task	Students in grade 8	1,408	58.81 (24.49)	53.74 (23.01)	5.07	0.12	+5	.52
North Carolina End-Of-Grade (NC EOG) Science test	Students in grade 5	1,847	255.10 (16.32)	255.50 (17.33)	-0.40	-0.02	-1	.91
NC EOG Science test	Students in grade 8	1,409	252.40 (19.84)	254.52 (18.99)	-2.12	-0.09	-4	.73
Stanford Achievement Test: Science	Students in grade 5	1,189	568.20 (200.71)	578.40 (204.60)	-10.20	-0.05	-2	.75
Stanford Achievement Test: Science	Students in grade 8	291	555.90 (211.10)	599.20 (157.40)	-43.30	-0.23	-9	.48
State of Texas Assessment of Academic Readiness (STAAR) Science test	Students in grade 5	1,163	3,798.80 (460.22)	3,761.80 (407.00)	37.00	0.08	+3	.61
STAAR Science test	Students in grade 8	243	3,734.20 (607.91)	3,889.00 (448.90)	-154.80	-0.29	-11	.38
Outcome average for science achievement for Zoblotsky et al. (2016)						**-0.03**	**-1**	

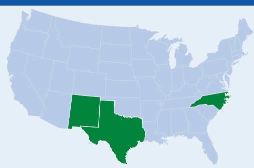
Note: Some statistics may not sum as expected due to rounding.

From Zoblotsky et al. (2016), the PASS: Multiple Choice, PASS: Constructed Response, PASS: Open-ended, and PASS: Performance Task measures were administered to students in New Mexico, North Carolina, and Texas. The NC EOG Science tests (grades 5 and 8) were administered in North Carolina only, and both the Stanford Achievement Test: Science and the STAAR Science tests were administered in Texas only. The WWC applied corrections for clustering to these findings. Except for the PASS: Constructed Response (grade 5) sample, the *p*-values presented here were calculated by the WWC because the *p*-values reported in the study did not account for the clustered assignment of students to conditions by school. This study is characterized as having an indeterminate effect on science achievement because the mean effect reported is neither statistically significant nor substantively important. For more information, please refer to the WWC Procedures Handbook, version 4.0, page 22.

In What Context Was *LASER* Studied?

The following section provides information on 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.

WHERE THE STUDY WAS CONDUCTED



1 study, 6,291 students in 116 elementary and middle schools in 16 districts in **New Mexico**, **North Carolina**, and **Texas**

Urban, suburban, and rural districts

Race

31% White; 19% Black; 3% American Indian or Alaska Native; 2% Asian; 46% Not specified

Ethnicity

56% Unknown ethnicity; 44% Hispanic

Free & Reduced-Price Lunch: 59%

Special Education: 9%

Gender: 50% Female
50% Male

Grades: PK K 1 2 3 4 5 6 7 8 9 10 11 12 PS

Grade 3—8

Details of the Study that Meets WWC Standards

This section presents details for the study of *LASER* that meets WWC standards. These details include the full study reference, findings description, findings summary, and description of study characteristics. A summary of domain findings for the study is presented below, followed by a description of the study characteristics. These study-level details include contextual information about the study setting, methods, sample, intervention group, comparison group, outcomes, and implementation details. For additional information, readers should refer to the original study.

Research details for Zoblotsky et al. (2016)

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

Findings from Zoblotsky et al. (2016) show evidence of an indeterminate effect of *LASER* on science achievement (Table 5).[7] The findings and research details summarized for this study come from 14 related citations, including the primary study listed above. See the References section, which begins on page 10, for a list of all related publications.

Table 5. Summary of findings from Zoblotsky et al. (2016)

		Meets WWC Group Design Standards Without Reservations		
		Study findings		
Outcome domain	Sample size	Average effect size	Improvement index	Statistically significant
Science achievement	6,291 students	-0.03	-1	No

Table 6. Description of study characteristics for Zoblotsky et al. (2016)

WWC evidence rating	**Meets WWC Group Design Standards Without Reservations.** This is a cluster randomized controlled trial (RCT) with low cluster-level attrition, low individual non-response, and low risk of bias due to individuals entering clusters after random assignment. For more information on how the WWC assigns study ratings, please see the WWC Procedures and Standards Handbooks (version 4.0) and WWC Standards Briefs, available on the WWC website.
Setting	The study took place during science instruction in 116 elementary and middle schools in 16 school districts in northern New Mexico, central and western North Carolina, and the Houston Independent School District (HISD) in Texas. Students were in grades 3 or 6 at the start of the 3-year study and in grades 5 or 8 when outcomes were measured.
Methods	The authors matched 135 schools into pairs based on similarities in school-level demographics and prior achievement and randomly assigned one school per pair to the *LASER* intervention group (67 schools) and the other to a business-as-usual comparison group (68 schools). The study followed two cohorts of students in participating schools from 2011–12 through 2013–14: an elementary school cohort in grade 3 at the start of the study and a middle school cohort in grade 6 at the start of the study. The sample loss after random assignment (attrition) varied depending on the measure of science achievement and sample of students tested. For the elementary school cohort that took the North Carolina End-of-Grade Science test in grade 5, the sample loss after random assignment (attrition) was within the acceptable threshold for a low-attrition RCT. At the school level, the overall attrition rate was 16% and the differential attrition rate was 6 percentage points. At the student level, the overall non-response rate was 30% and the differential non-response rate was 6 percentage points. For the remaining main findings, the sample loss after random assignment (attrition) was outside the acceptable threshold for a low-attrition RCT or there was risk of bias due to individuals entering the schools after random assignment. For each of these findings, the analytic samples of individuals in the intervention and comparison groups satisfied the baseline equivalence requirement.
Study sample	The analytic sample included a total of 116 schools (62 in the intervention group, 54 in the comparison group) and 6,291 students (3,374 in the intervention group, 2,917 in the comparison group). The elementary school cohort with 4,123 students was followed from the start of grade 3 to the end of grade 5. The middle school cohort with 2,168 students was followed from the start of grade 6 to the end of grade 8. The study authors reported gender, race, and ethnicity for all students in the districts with participating schools, rather than for students in the analytic sample. Across the 16 districts with participating schools, 50% of students were female, 44% of students were Hispanic, 31% were White, 19% were Black, 3% were American Indian/Alaska Native, 2% were Asian, and for 46% race was not specified. Among students in the analytic sample, 59% were eligible for free or reduced-price lunch, 18% were English learners, and 9% had Individualized Education Programs (IEPs).
Intervention condition	Schools in the intervention group implemented *LASER* over a 3-year period. Leadership teams composed of state and local education agency leaders, school administrators, teachers, parents, and representatives from local government, business, and community organizations in each state participated in an initial 1-day Building Awareness for STEM Education Institute. Next, leadership teams representing the intervention schools in each participating district attended a week-long Leadership Development and Strategic Planning Institute and developed strategic plans to implement *LASER*'s five elements of inquiry-based science education. Once inquiry-based science instruction was underway in intervention schools, leadership teams that wanted additional support participated in an Implementation Institute to focus on particular implementation challenges. As a condition of participation in the study, schools in the intervention group were required to use the Smithsonian Science Education Center's (SSEC) *Science and Technology Concepts (STC™)* inquiry-based science curriculum as their sole science curriculum over the 3-year study period. Data from teachers' logs indicated that they implemented one unit from October to June of the first year (2011–2012) and two units in the second year, one in the fall of 2012 and the other in the spring of 2013. For the third year of the study (2013–2014), schools were asked to implement three units, but some schools did not complete the third unit before the end of the school year. The authors provided this information about how *STC™* was implemented in response to a WWC author query. Teachers in intervention schools participated in two types of professional development per unit: an introductory training in which they practiced instructional strategies with SSEC-provided lesson plans, and an intermediate training focused on deepening teachers' understanding of the relevant science content. A regional coordinator worked with teachers and school administrators to help resolve implementation challenges.
Comparison condition	Schools in the comparison group did not participate in *LASER*, and were required to use their business-as-usual science curricula, which could not be *STC™*. The authors reported in response to a WWC author query that some schools in the comparison group used selected components of units from the *Full Option Science System™ (FOSS)*, another inquiry-based science curriculum, as part of teacher-created or supplemental instructional materials during the study period, but that this usage did not appear systematic. Using data from surveys of teachers and principals, teacher instructional logs, and classroom observations, the authors reported that students in the comparison schools were less often engaged in inquiry-based science learning activities than those in the intervention schools; teachers in comparison schools felt less prepared than those in intervention schools to use inquiry-based teaching methods and to assess student science learning; and principals in comparison schools reported that they received lower levels of support for implementing inquiry-based science instruction than those in the intervention schools.

Outcomes and measurement	Study authors reported findings for elementary and middle school cohorts separately on six outcome measures that are eligible for review in the science achievement domain. All students completed the WestEd-developed Partnership for Standards-based Science Assessment (PASS) Multiple Choice assessment, which measures students' understanding of scientific facts, concepts, principles, laws, and theories. Students from a randomly selected subsample of schools within each cohort completed two other PASS assessments, the PASS Performance Task and either the PASS Constructed Response (in the elementary school cohort) or the PASS Open-ended assessment (in the middle school cohort). The Performance Task assessment measures students' ability to use equipment to perform an investigation; make observations; generate, organize, and analyze data; and communicate findings. The PASS Constructed Response and PASS Open-ended assessments measure students' ability to analyze a problem, manipulate data, and construct an explanation using evidence. The authors administered each test in spring 2014 (the final year of implementation of the intervention). Study authors also reported spring 2014 results for three state standardized science assessments: the State of Texas Assessment of Academic Readiness Science Test and the Stanford Achievement Test: Science, each administered to students in participating schools in the HISD, and the North Carolina End-of-Grade Science Test, administered to students in participating schools in North Carolina. The study authors reported supplemental findings for students with IEPs; students who were English learners; students who qualified for, and who did not qualify for, free or reduced-price lunch; and female and male students. Other supplemental findings included science achievement outcomes measured after the first year of implementation of the intervention; these findings did not meet WWC standards. Summaries of these findings are available on the WWC website (https://whatworks.ed.gov). The supplemental findings do not factor into the intervention's rating of effectiveness. The study also collected data from state standardized assessments in mathematics and reading achievement. These outcomes are ineligible for review under the Primary Science review protocol and thus are not included in this review.
Additional implementation details	No additional information reported.

References

Studies that meet WWC group design 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

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Studies that meet WWC group design standards with reservations

None

Study that does not meet WWC group design standards

Poderoso, C. (2013). *The science experience: The relationship between an inquiry-based science program and student outcomes*. ProQuest Dissertations and Theses. https://pqdtopen.proquest.com/doc/1318596989.html?FMT=ABS The study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.

Studies that are ineligible for review using the Primary Science review protocol

None

Endnotes

[1] National Research Council. (2012). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas.* Committee on a Conceptual Framework for New K-12 Science Education Standards. Board on Science Education, Division of Behavioral and Social Sciences and Education. The National Academies Press.

[2] See Furtak, E. M., Seidel, T., Iverson, H., & Briggs, D.C. (2012). Experimental and quasi-experimental studies of inquiry-based science teaching: A meta-analysis. *Review of Educational Research, 82*, 300–329.

[3] See Chapter 10 in National Research Council. (2012). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas.* Committee on a Conceptual Framework for New K-12 Science Education Standards. Board on Science Education, Division of Behavioral and Social Sciences and Education. The National Academies Press.

[4] The descriptive information for this intervention comes from Zoblotsky et al. (2016). The What Works Clearinghouse (WWC) requests that developers review the intervention description sections for accuracy from their perspective. The WWC provided the developer with the intervention description in December 2020 and the WWC incorporated feedback from the developer. Further verification of the accuracy of the descriptive information for this intervention is beyond the scope of this review.

[5] The literature search reflects documents publicly available by June 2020. Reviews of the studies in this report used the standards from the WWC Procedures and Standards Handbook (version 4.0) and the Primary Science review protocol (version 4.0).

[6] The effects of *LASER* are not known for other outcome domains within the Primary Science topic area, including life sciences, physical sciences, and earth/space sciences.

[7] A previous review of *LASER* using version 3.0 of the WWC Procedures and Standards Handbook and version 2.0 of the Primary Science review protocol treated the elementary and middle school cohorts as two separate studies. To be consistent with the updated definition of a study in version 4.0 of the WWC procedures, the current review treated the elementary and middle school cohorts as separate samples within a single study. For both cohorts, the findings were produced by the same research team, used the same process to form the intervention and comparison groups, and had the same outcome measures, data collection, and analysis procedures (see WWC Procedures Handbook, version 4.0, pp. 9-10 and Appendix D). The previous review found that both elementary and middle school samples in the manuscript met WWC group design standards without reservations and found indeterminate effects on science achievement. The current review also found that the study meets standards without reservations (with one elementary school finding receiving this rating; other findings meet standards with reservations) and found indeterminate effects on science achievement.

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