Literacy and Academic Success for English Learners Through Science LASERS

Evaluation Report
February 2019

Prepared for the Education Development Center by
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Yale Child Study Center
EVALUATION

This report is based on an independent evaluation of the LASErS program conducted by the Child Study Center at Yale University under the direction of Dr. Chin Reyes, PhD, Research Scientist from the Zigler Center in Child Development & Social Policy. The Zigler Center brings together a diverse group of researchers and practitioners in an effort to improve the well-being of children and families by bringing objective child development research into the policy and public arenas.

The evaluation was conducted to meet the NEi3 standards for independence. Specifically, (a) findings reported to NEi3 were not subjected to the approval of the project developer/grantee; (b) the evaluator independently conducted all key aspects of the evaluation, including the collection of any data used in the impact analysis (outcome measures), the conduct of the impact analyses, and the reporting of study findings.

Suggested Citation:

Literacy and Academic Success for English Learners through Science (LASErS) is an innovative pilot program developed by the Education Development Center (EDC) implemented in a small sample of schools in the Hartford Public Schools district in Connecticut. It was funded as a development grant through the US Department of Education’s Investing in Innovation (i3) Fund, established under Section 14007 of the American Recovery and Reinvestment Act of 2009. LASErS leverages science learning as a vehicle to support young English Learners’ language development by providing teachers and instructional coaches with high-quality professional development and providing families of ELs with resources and educational events to foster language skills outside the school environment. LASErS is designed to train teachers to use scientific vocabulary and engage young children in extended and meaningful conversations around science in a culturally responsive way.

Organization of Report

This report begins with an Executive Summary, followed by an Introductory section that includes background information (context of the study, development of the LASErS program), theory-of-change model, and an overview of the evaluation. The Methodology section provides information on the sample, procedures, measures used, and details of the analytic strategy to assess the impact of LASErS on student outcomes. The Results section is divided into 8 subsections that begins with the assessment of program-readiness, followed by implementation results (i.e., implementation of the four core components of LASErS and classroom implementation). This is followed by student impact analyses and additional exploratory findings. Each Results section ends with a section summary. The report concludes with the Conclusion and Recommendations section.
# Contents

## Overview  
II

## List of Exhibits  
VI

## Acknowledgements  
VII

## Executive Summary  
ES - 1

### Sections

#### Introduction
Study Background  
1
The LASErS Program  
1  
Background/History  
1  
Theory-of-Change  
1
Implementation of LASErS  
2
Impact Evaluation of LASErS  
2

#### Methodology
Sample  
4  
Schools  
4  
Teachers  
5  
Students (full sample)  
7
Procedures  
7
Measures  
7  
Program Readiness and Climate  
7  
LASErS Implementation and Mediators  
8  
Student Achievement  
9
Analytic Strategy  
11  
Program Readiness and LASErS Implementation/Mediators  
11  
Student Achievement  
11

#### Results: Program-Readiness
Findings  
16  
Attitudes toward Science  
16  
Attitudes toward LASErS Programming  
16  
Teaching Efficacy  
16  
Administrator Support  
16  
Classroom Climate  
16
Summary  
17

#### Results: Core Component 1 (Professional Development)
LASErS Professional Development  
20
Assessing Implementation Fidelity for Core Component 1 (PD)  
21
Meeting Implementation Fidelity Thresholds  
21
Results: Core Component 2 (Coaching) 28
LASErS Coaching
Assessing Implementation Fidelity for Core Component 2 (Coaching)
Meeting Implementation Fidelity Thresholds
Findings
  Teachers’ Perspective
  Coaches’ Perspective
  Shadow Coaches’ Perspective
  Observers’ Perspective
Summary 33

Results: Core Component 3 (Family Engagement) 34
LASErS Family Engagement
Assessing Implementation Fidelity for Core Component 3 (Family Engagement)
Meeting Implementation Fidelity Thresholds
  Indicator 1 (Home kids provided)
  Indicator 2 (Family event scheduled)
Findings
  Teachers Communication Strategies
  Parent Perspective
  Challenges with Family Engagement
Summary 41

Results: Core Component 4 (Leadership Alliance) 42
LASErS Leadership Alliance
Assessing Implementation Fidelity for Core Component 4 (Leadership Alliance)
Meeting Implementation Fidelity Thresholds
  Indicator 1 (Grantee provides minutes of meeting to Evaluator)
Tasks Accomplished
Feedback from Alliance Members
Summary 44

Results: Classroom Implementation 45
Implementing LASErS in the Classroom
Findings
  Teaching Ratings and Classroom Observations
  Observation Notes
  Factors that Contribute to Variability in Implementation
Summary 50
List of Exhibits

Table

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>School Demographics at Beginning of Program Year</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Teacher Demographics</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>LASerS Program-Readiness Indicators</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>CHILD Observation Toll Dimension Scores</td>
<td>19</td>
</tr>
<tr>
<td>5</td>
<td>Teacher Ratings: Quality of Coaching</td>
<td>30</td>
</tr>
<tr>
<td>6</td>
<td>Home-School-Community Engagement Scale</td>
<td>36</td>
</tr>
<tr>
<td>7</td>
<td>LASerS Implementation in the Classroom</td>
<td>52</td>
</tr>
<tr>
<td>8</td>
<td>Baseline Equivalence and Impact Analyses for EL Students</td>
<td>55</td>
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<tr>
<td>9</td>
<td>Baseline Equivalence and Impact Analyses for All Students with Subgroups</td>
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Figure

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<tr>
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<td>LASerS theory-of-change model</td>
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The Evaluator would like to extend her gratitude to all participating schools, teachers, and coaches. The Evaluator would like to also thank the following individuals for assisting in various capacities to make this evaluation a success: Maria Accavitti, Stephanie Gutkin, Sarah Grossman-Kahn, Gabriela Drucker, Katherine Long, Landon Hurley, Madeline Klotz, Kathleen England, Jocelyn Tamborello-Noble, Abby Olinger-Quint, Shayne Reed, and the members of the LASerS team and Leadership Alliance.
English language learners (ELs) are underperforming academically, prompting programs to consider the unique language and learning needs of ELs. The Literacy and Academic Success for English Learners through Science program (LASErS), funded through the U.S. Department of Education’s Investing in Innovation (i3) Fund, is a pilot program designed to improve the language proficiency and overall academic achievement of Prekindergarten (PreK) through First Grade ELs in Hartford, Connecticut. LASErS leverages an inquiry-based approach to early science learning as a vehicle to support young ELs’ language development through high-quality language interactions in the classroom and vast opportunities for engagement in both formal and nonformal settings. The Yale Child Study Center (Zigler Center in Child Development & Social Policy unit) conducted a rigorous independent evaluation of LASErS implementation across 11 Hartford Public Schools district schools. The evaluation assessed the implementation of LASErS and the impact of participation on student achievement. Data were collected from online surveys, site observations, interviews, and district-collected student achievement test scores. The evaluation focused on the first rollout year of PreK, Kindergarten, and First Grade.

Findings Summary

Considering Program-Readiness as a Prerequisite to Programmatic Success

Teacher attitudes toward science, teacher attitudes toward LASErS programming, teacher efficacy, administrator support, and classroom social and emotional climate were examined as indicators of program-readiness. Findings indicated that teachers across all program years held positive views of the program, and viewed LASErS as a viable approach to help them address the language and learning needs of ELs. Teachers did not, however, feel efficacious enough to implement the program with integrity, suggesting the need for more concrete supports. Principal support of LASErS was generally low, with few schools prioritizing LASErS. With respect to the social and emotional climate, although teacher self-reports of stress were low, observer ratings of the social and emotional climate were in the ‘undermining’ to ‘baseline’ range, suggesting that the climate was not optimal for learning and development. These findings suggest that the baseline expectation for LASErS to thrive was not met, which made it challenging to implement with fidelity.

Additional analyses revealed that teacher attitudes toward science (as a subject matter) as well as attitudes toward LASErS (as a program) were associated with how comfortable, efficacious, and effective teachers felt about implementing LASErS. When teachers perceived the school to be supportive of the LASErS program, and when the social and emotional learning climate was conducive, teachers were better able to facilitate a language-rich environment, support scientific learning, and engage students in the learning process.

Assessing Implementation Fidelity: The Four Core Components of LASErS

Professional Development (PD). Teachers participated in two modules across one school year, each consisting of four full-day, face-to-face instructional sessions (approx. 56 hours total). These sessions offered strategies and practices through lectures and discussions, classroom video and analyses, and small group activities. Resources for supporting literacy through science
exploration included EDC’s Young Scientist Series curriculum guidebooks and classroom science materials (e.g., for life science, children’s books about living things, science notebooks, hand lenses, terraria, plant pots, and seeds).

Participants appreciated the trainers and the information they provided during PD trainings. New knowledge, creative ways to engage learners, experiential learning, and group discussions were highlights of LASErS PD trainings. PD attendance was the biggest challenge due to unavailability of teacher-substitutes. Other challenges were participants’ need for more concrete strategies in implementing LASErS especially in the context of engaging ELs and their families, the need for more planning time, the need for more materials, and the need for aligning LASErS lessons with district curricula. In spite of all these challenges, participants valued the LASErS program. PD attendance was associated with positive attitudes toward science and the LASErS program itself, as well as with both teacher feelings of efficacy applying LASErS in the classroom and observed quality of classroom implementation.

**Coaching.** District instructional coaches were trained to support teachers in implementing a topic-driven, student-centered, and language-intensive science curriculum. LASErS coaches provided guidance to teachers, helping them complete assignments, and reinforce concepts and strategies from PD into the classrooms. In general, the goal of coaching was to increase the district coaches’ capacity to support teachers in their language facilitation via science instruction. Of the four components, coaching was the most challenging to implement given the variability in the quantity and quality of coaching that occurred in schools. The Grantee had been responsive in addressing the challenges of coaching (e.g., adding shadow coaches and hiring external coaches). In spite of these efforts, coaching continued to be challenging in some schools where principal and school-level buy-in were low. Among schools that received successful coaching, coaches attributed improvements in teaching quality and student language outcomes to the LASErS program.

**Family Engagement.** LASErS promoted family engagement through various activities: hiring a dedicated family engagement specialist to support teachers in planning school-based events, organizing a Parent Advisory Board, and other family engagement activities; providing home activities and science-literacy kits; and holding summer family events at the Connecticut Science Center. Teachers connected with families in various ways: from newsletters to school events, and home activities. Parents, in turn, appreciated these efforts and enjoyed the benefits of program engagement and its perceived impacts on their child’s academic learning. According to the district, schools are re-thinking family engagement because of LASErS. The intentional inclusion of families of ELs, however, continued to be a challenge.

**Leadership Alliance.** The LASErS Leadership Alliance team was comprised of district and state leaders, EL literacy experts, science education experts, and Connecticut early learning system investors—to review LASErS’ implementation, suggest enhancements, and support sustainability and statewide scaling. Among the team, extensive expertise was represented in the areas of early literacy and science education as well as bilingual education, relating to the enrichment of EL and non-EL students’ learning outcomes. Alliance meetings were held quarterly—typically one in-person meeting and the others held virtually. Meetings tended to be consistently well attended.

**Assessing Classroom Implementation**

Trained and certified classroom assessors observed randomly selected classrooms in each rollout year. Teachers responded to an online survey. Results showed that teacher self-report ratings of LASErS implementation were higher than the observer ratings. Teachers noted the challenges of
implementing LASerS on top of daily instruction, especially when the administration was not supportive, the demands of the curriculum were too high, or that LASerS activities did not align with instructional subject matter.

Assessing Impacts on Student Academic Achievement

Findings revealed evidence of promise for the LASerS program. Findings of the confirmatory analyses that included propensity-score-matched ELs only yielded positive impacts on EL students’ test scores in the First Grade rollout year, but not in the PreK and Kindergarten rollout years. Furthermore, findings of the exploratory analyses that included the entire student sample (non-ELs and ELs) revealed that LASerS had a positive impact on non-EL students but not on EL students. The generalizability of these findings is limited for the following reasons. First, the evaluation was limited in terms of the type of assessment used by the school district. These assessments may not have captured fully the domains that LASerS may be most impactful (e.g., oral discursive skills, critical thinking, problem-solving, creativity and innovation). Second, it was limited in terms of the consistency of assessments used across grade levels, making multi-year comparisons challenging. Third, the study was underpowered with only nine or 10 schools in the intervention condition.

Conclusion

Overall, LASerS shows evidence of promise especially when implemented with fidelity. LASerS can continue to improve if it addresses the implementation challenges identified in this evaluation in future iterations of the program.
Early language proficiency provides the foundation for learning in formal education settings (Griffin et al., 2004; Scarborough, 2001). Language demands increase as children progress through school, making it challenging for young English language learners (ELs) who have to learn a new language at a time when their peers are learning English more effortlessly (Dutro et al., 2016). As a result, relative to non-ELs, ELs enter school with lower English language proficiency, are less able to keep up with grade level text-based curricula, are more likely to perform poorly on language tests, and are at greater risk of being diagnosed as learning-disabled (Abedi & Gándara, 2006; August et al., 2005). The academic disadvantage of ELs has caused such concern that both the US Departments of Health and Human Services (DHHS) and Education (ED) have issued a joint policy statement calling for interventions to address the needs of these children (DHHS & ED, 2016).

Currently, an estimated 4.6M students are ELs (National Center for Education Statistics, 2017). By 2060, nearly one in five of the US population is projected to be foreign-born (Colby & Ortman, 2015). In a predominantly English language educational system, this language disparity handicaps the capacity of ELs to progress academically (Kieffer, 2008). Although most teachers recognize the struggle of ELs, they lack skills to address their unique language and learning needs (de Jong & Harper, 2005; Gándara et al., 2005; National Academy of Sciences, Engineering, and Medicine, 2017).

The LASErS Program

**Background/History**

Funded through the US Department of Education’s Investing in Innovation program, **Literacy and Academic Success for English Learners through Science (LASErS)** is a program that aims to support young ELs, given its basis on effective strategies for promoting ELs’ language development (Buysse et al., 2010; Helman, 2016). LASErS’ literacy-infused science instruction is based on EDC’s IES-funded program, Foundations of Science Literacy (FSL), a comprehensive professional development program for PreKindergarten (PreK) and early elementary grades (Gropen, Kook, Hoisington, & Clark-Chiarelli, 2017). LASErS uses science as an integrating context for developing language skills through inquiry-based learning (e.g., listening to children’s observations, questions, and ideas) and engagement in science-speech acts. LASErS leverages formal and informal science learning as a vehicle to support young ELs’ literacy, language, and overall academic success by providing teachers and coaches with high-quality professional development and offering families compelling resources and educational events. LASErS is comprised of four core components: Professional Development (PD) for teachers and coaches, Coaching Supports, Family Engagement, and the Leadership Alliance. Implementation results of each core component are presented in the Results section of this report.

**Theory-of-Change**

Science instruction lays the foundation not only for conceptual knowledge in science, but also for early language development (Guo et al., 2016) potentially through teachers’ frequent engagement
in scientific discourse, leading to greater lexical diversity (Henrichs & Leseman, 2015). With LASErS’ use of science as a focus of discourse across classroom, home, and community settings, and infusing combinations of language (Spanish/English) and modalities (spoken/written), both conceptual knowledge and language development are supported. It is hypothesized that when implemented with fidelity, LASErS improves ELs’ language and literacy proficiency as well as overall academic achievement (see Figure 1). Implementation fidelity was measured for each of the core components (see Appendix).

**Implementation of LASErS**

LASErS was developed using a sequential phase-in model, with the PreK version of LASErS developed in the 2014-2015 school year (SY), and piloted in SY 2015-2016. The Kindergarten and First Grade versions of LASErS were developed in SY 2015-2016 and SY 2016-2017, respectively, and piloted in SY 2016-2017 and SY 2017-2018, respectively. LASErS was implemented in 10 schools in the Hartford Public Schools district (11 schools were originally recruited, and 10 of the 11 preschools were attached to the elementary schools). The schools participating in the program were a purposive sample. The district had recommended them based on low academic performance and high percentage of ELs.

**Impact Evaluation of LASErS**

The impact of LASErS was examined during each of the first year rollout for PreK, Kindergarten, and First Grade. The evaluation examined the unique effects of LASErS for that particular grade level (not a value-added study) by matching students based on baseline characteristics at the beginning of each year. The evaluation focused on the subset of students who were identified by the district as being ELs (as defined by the district in PreK [other language only as primary home language] and in elementary school [English learner]). Students identified as English-only/dual language in PreK or non-EL in Kindergarten-First Grade were excluded from the main impact analyses (confirmatory analyses). The comparison condition consisted of EL students in non-LASErS schools. Exploratory analyses examined the impact of LASErS on all students by matching students regardless of EL status, then by conducting subgroup analyses (impact on ELs vs. impact on non-ELs).
Part A: Program Inputs (Key Components)

1. Professional Development

   (Rollout year only for each grade—Years 2 – 4)
   - Face-to-face PD sessions for teachers and coaches (4 sessions x 2 modules = 8)

2. Instructional Coaching

   (Rollout year only for each grade—Years 2 – 4)
   - Coaching for LASErS teachers in the classroom

3. EL Student & Families Supports

   (Years 2 – 4)
   - Home activities & science literacy kits
   - School-based family events
   - Summer family events at CSC

4. Leadership Alliance

   (Years 2 – 4)

Part B: Participant Uptake

- Program conducts 8 PD sessions
- LASErS teachers and coaches attend 8 PD sessions
- Coaches work with each LASErS teacher
- Family use of home activities & science literacy kits
- Attendance at school-based and summer family events
- Member participation in scheduled Working Group Meetings
- Facilitation of Working Group Meetings

Proximal Outcomes

- Teachers develop Improved quality of language and literacy facilitation for ELs
- Coaches develop Increased skills in appropriate instructional methods for ELs
- Integrated learning in the classroom and home
- Family engagement with school and community resources
- Develop materials and resources for scaling up

Fig. 1. LASErS theory-of-change model.
Methodology

Sample

Schools

The Hartford Public Schools district serves over 20,000 students, and has more ELs than other districts in Connecticut, ~65% of whom are Spanish speakers. Hartford students scored below the state average on standard tests: 33% of Hartford third graders were rated “below basic” on the 2011 CT Mastery Test, compared to 17% of students statewide, and only 5% of Hartford students were considered “advanced”, compared to 18% in the state overall (CT State Department of Education). This trend holds true for ELs. On the same test, 62% of ELs were “below basic” and none were advanced. In the first rollout year, PreK, (SY 2015-2016), 11 schools were initially enrolled (one PreK Magnet school and 10 district schools). However, one school had dropped out at the beginning of the PreK year (though this school rejoined in the K and G1 years), leaving 10 schools in the first rollout year. LASerS schools had higher enrollment rates (i.e., more students per school) and were poorer (i.e., greater percentages of students receiving free lunch) than comparison schools, ts(48)>2, p<.05 (Table 1).

Table 1. School Demographics at Beginning of Program Year

<table>
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<tr>
<th></th>
<th>Treatment (N=10)</th>
<th>Control (N=40)</th>
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<tr>
<td></td>
<td>M</td>
<td>SD</td>
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<tr>
<td>English Learner %</td>
<td>23.36</td>
<td>8.95</td>
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<tr>
<td>Enrollment</td>
<td>426.20</td>
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<tr>
<td>Free lunch %</td>
<td>81.47</td>
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<td>Black (non-Latino)</td>
<td>24.12</td>
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<td>White (non-Latino)</td>
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<tr>
<td>Latino/Hispanic</td>
<td>64.02</td>
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<tr>
<td>Other race</td>
<td>4.89</td>
<td>4.74</td>
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</table>
Teachers

In the PreK rollout year (SY 2015-2016), 16 teachers and nine coaches participated in LASErS. One school employed the same PreK teacher as another school. In the Kindergarten rollout year (SY 2016-2017), nine of the schools participated (the PreK magnet school no longer met the recruitment criteria, the school that initially dropped out in year one returned, and an additional school dropped out). Fifteen Kindergarten teachers and 10 coaches participated, along with two shadow coaches. In the First Grade rollout year (SY 2017-2018), the same nine schools as the Kindergarten rollout year schools participated. Fifteen First Grade teachers participated along with six coaches, two shadow coaches, and two additional coaches from the Connecticut State Education Resource Center (SERC). The teachers, on average, had approximately 6-13 years of teaching experience for their respective grade level ($M_s=6.9$ years, 12.56 years, and 10.82 years for PreK, Kindergarten, and First Grade teachers, respectively). Teachers in all three grade levels were female (with the exception of one male teacher in the PreK year). Teacher respondents were majority female, White (non-Latino), with master’s degrees (Table 2). Of the respondents, 6.7%-18.8% spoke a language other than English.

According to the teacher survey, most teachers reported that they “often” supported children’s English language proficiency (Specifically, 92% of PreK teachers ($n=11$), 100% of the Kindergarten teachers ($n=8$), and 91% of First Grade teachers ($n=10$)). However, teachers reported a variation of support for supported children’s home language proficiency, ranging from “rarely” to “sometimes” to “often” (see Table 2 for details). This variation in support was also apparent in teachers’ reporting on supported families in helping children learn English and supported families in helping children learn a home language.
## Table 2. Teacher Demographics

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<tr>
<td></td>
<td>n</td>
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<td>n</td>
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<tr>
<td>Sex</td>
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<tr>
<td>Female</td>
<td>11</td>
<td>68.8</td>
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<td>Male</td>
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<tr>
<td>Race/ethnicity</td>
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<td>White (non-Latino)</td>
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<tr>
<td>children’s English language proficiency</td>
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<tr>
<td>Almost never/rarely</td>
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</tr>
<tr>
<td>Sometimes</td>
<td>1</td>
<td>6.3</td>
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<td>Often</td>
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<tr>
<td>Sometimes</td>
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<td>25.0</td>
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<td>Years teaching (current school)</td>
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**Students (Full Sample)**

In PreK, there were 806 students (n=477 and 329 in treatment and control groups, respectively), 52.7% of whom were Latino/Hispanic, followed by 24.9% Black (non-Latino), 35.7% were English language learners (operationally defined in PreK as predominant home language was not English), and 53.3% received free/reduced lunches. In Kindergarten, there were 1,491 students (n=553 and 938 in treatment and control groups, respectively), 56.7% of whom were Latino/Hispanic, followed by 26.7% Black (non-Latino), 27.4% were English language learners, and 61.6% received free/reduced lunches. In First Grade, there were 1,539 students (n=561 and 978 in treatment and control groups, respectively), 59.0% of whom were Latino/Hispanic, followed by 25.9% Black (non-Latino), 29.2% were English language learners, and 80.0% received free/reduced lunches. Details of the analytic sample are provided in Tables 8 and 9 (pp. 55-57).

**Procedures**

This study has been reviewed by the Human Subjects Committee at Yale University (IRB Protocol #1502015337) and qualified for exemption under 45 CFR 46.101(b)(1). School agreement forms and consent forms were returned to the evaluation team. Electronic surveys were administered to teachers and coaches in the fall and spring of each rollout year. PD, school site visits, and classroom observations were also conducted. To lessen burden of data collection on schools, only one randomly selected LASErS classroom per school was assessed in the fall and spring of each rollout year. The school district provided student test scores at the end of each rollout year.

**Measures**

Teachers and coaches responded to surveys in the fall and spring of each program year. In addition, two research assistants observed one randomly selected classroom from each school in the fall and spring of each program year. Classroom observers were trained and certified on the respective assessment tools. Inter-rater reliability for classroom observation measures were calculated (ICCs=.83-.92). Unless otherwise indicated, measures were developed by the evaluator for the purpose of evaluating the LASErS program.

**Program Readiness and Climate**

**Teacher Attitudes toward Science.** This 17-item scale, adapted from the Preschool Teachers’ Attitudes and Beliefs Toward Science Teaching Questionnaire (Maier, Greenfield, & Bulotsky-Shearer, 2013), assessed teachers’ perceived benefits of science learning (e.g., *Science activities for young children help foster their interest in science in later grades; Science-related activities help improve children's language skills*), challenges to teaching science (e.g., *I find it difficult to make science more engaging to children; Teaching science to ELs is particularly challenging for me*), and openness to programming (e.g., *Promoting children's language skills through science is a clever approach; I am willing to try new approaches that will help promote the literacy and language skills of English learners*).

Some items also emphasized the benefits and challenges to EL students in particular. Response options were changed from a five-point Likert scale to a four-point Likert scale (1=strongly disagree, 4=strongly agree) to improve scale reliability resulting from a lesser inclination toward social desirability and lesser ambiguity (Chang, 1994; Garland, 1991; Raaijmakers, Van Hoof, Hart, Verbogt, & Vollebergh, 2000). Cronbach’s αs = .78-85.
**Teacher Attitudes toward LASErS.** This nine-item scale assessed participants’ attitudes toward LASErS—teacher buy-in, the program’s perceived utility, and perceived goodness-of-fit with their teaching routine (e.g., *I am motivated to apply LASErS into my classroom routine; LASErS meets the language learning needs of the children in my classroom; I am confident that English learners benefit from the LASErS program*). Items were rated on a four-point scale (1=strongly disagree, 4=strongly agree) where higher scores reflected more positive attitudes toward LASErS. Cronbach’s α = .90.

**Teacher Efficacy.** This five-item scale assessed the extent to which teachers felt confident in implementing LASErS (e.g., *I feel I am able to teach LASErS lessons quite well; I feel I need more guidance in implementing LASErS more effectively (R); I feel I am able to teach LASErS lessons quite well*). Items were rated on a four-point scale (1=strongly disagree, 4=strongly agree) where higher scores reflected greater efficacy. Cronbach’s α = .84.

**Administrator Support.** This five-item scale assessed the extent to which teachers felt school leaders supported the program (e.g., *School leaders provide committed support to the LASErS program; At my school, LASErS is the least of our priorities (R); There is a designated individual at our school who is responsible for ensuring that LASErS is being implemented at our school*). Items were rated on a four-point Likert scale (1=strongly disagree, 4=strongly agree) where higher scores reflected greater perceived administrative support. Because teachers had expressed discomfort in responding to these items, this measure was collected at only one time point (fall). Cronbach’s α = .78.

**Classroom Social and Emotional Climate.** Two measures assessed the social and emotional climate. The first was a six-item teacher self-report of stress and burnout (e.g., *There is more to do on a single day than I could ever get done; I cannot possibly attend to all the children who are assigned to me at one time; Implementing LASErS demands a great deal of effort, which adds additional stress to my work week*) that was scored on a four-point Likert scale (1=strongly disagree, 4=strongly agree) where higher scores reflected greater stress. Cronbach’s α = .84. The second was observer ratings using the Climate of Healthy Interactions for Learning and Development (CHILD) Observation Tool (Gilliam & Reyes, 2017). The CHILD was added only in the spring semester in PreK after deeming it was important to use a tool that tapped into issues of equity. The CHILD assessed the quality of social and emotional interactions in the classroom that undermined or promoted healthy development and learning. The CHILD consisted of 28 behavioral items across nine dimensions (transitions; directions and rules; social and emotional learning; staff affect; staff awareness; staff cooperation; staff-child interactions; individualized & developmentally appropriate pedagogy; and child behaviors) that can be aggregated into a Total CHILD Score. Observers were trained and certified to assess discrete behavioral indicators as opposed to impressions and were provided with anchoring and calibration guidelines for scoring. Items were scored on a five-point scale ranging from -2 (undermining mental health, learning and development) to +2 (promoting mental health, learning and development). A 0 meant that the interactions fell within the baseline expectation that neither undermined nor promoted mental health, learning, and development. Cronbach’s α = .98 for the CHILD Total score.

**LASErS Implementation and Mediators**

**Coaching Quality.** Teacher ratings of the quality of coaching they received were measured with the LASErS Coaching Quality Scale. On this seven-item scale, teachers rated the quality of coaching they had received based on the LASErS coaching goals (e.g., *My coach listens to my ideas and concerns regarding science-teaching practices, and provides me with useful feedback;*
I feel empowered to implement LASErS after meeting with my coach, and to develop my own ideas for teaching science concepts and skills; My coach encourages me to share my ideas and experiences with science activities in the classroom). Items were rated on a four-point scale (1=strongly disagree, 4=strongly agree). Cronbach’s α = .93.

**Classroom Implementation Quality.** Two classroom observation assessment tools were used to assess the quality of LASErS implementation. The LASErS Implementation Scale (LIS) is a 21-item scale developed by the evaluator that assessed the extent to which teachers implemented LASErS strategies. The Creating a Language-Rich Environment subscale measured the extent to which the teacher facilitated the use of language including use of science speech acts and evidence of sustained conversations (e.g., The teacher asks questions about what children are doing and noticing; The teacher promotes frequent conversations). The Support for Scientific Learning subscale measured the extent to which the teacher provided the necessary tools to foster scientific thinking (e.g., The teacher guides the children to make predictions about the topic and create a plan; The teacher asks questions that help children to think about causes and effects; The children participate in hands-on exploration of materials). The Engagement subscale (e.g., The teacher makes it a point to engage ELs in the activity; Children participate in lessons—e.g., ask questions) measured the extent to which children were engaged and participating actively in LASErS lessons. The teacher self-report was scored on a four-point scale (1=almost never, 4=often/almost all the time). The observer rating scale was also scored on a four-point scale (1=no evidence, 4=compelling evidence). A total score was also calculated (Cronbach’s α = .93).

In PreK, the Early Language & Literacy Classroom Observation PreK (ELLCO-PreK; Smith, Brady & Anastaspopoulos, 2008) was used to supplement the LIS. The ELLCO is comprised of two subscales: the General Classroom Environment that measured classroom structure and curricula (organization of classroom; contents of classroom; classroom management strategies; personnel; approaches to learning; opportunities for child choice and initiative; recognizing diversity in the classroom) and Language and Literacy that measured the language and literacy (discourse climate; opportunities for extended conversations; efforts to build vocabulary; phonological awareness; organization of book area; characteristics of books; books for learning; approaches to book reading; quality of book reading; early writing environment; support for children’s writing; environmental print). Items were scored on a five-point Likert scale (1=deficient (minimal evidence), 5=exemplary (compelling evidence)). Cronbach’s α = .86 (Smith et al., 2008).

**Home-School-Community Engagement.** Teachers responded to the Home-School-Community Engagement Scale, a 12-item measure which examined practices teachers/schools used to engage families, especially EL families, in their child’s education. Example of items include: I provide parents with resources (e.g., readings, tips) they can try at home to further enhance what children learned in the classroom; My school provides opportunities for parents of English learners to support learning in classrooms; Parents of English learners show interest in discussing and understanding what goes on in my classroom (e.g., supporting the learning environment, attending classroom or school learning events, engaging in home activities). The scale is scored on a four-point Likert scale (1=strongly disagree, 4=strongly agree). Cronbach’s α = .94.

**Student Achievement**

Student achievement data were obtained from the district. Assessments were not consistent from year to year. Some assessments were administered to students only in the spring (i.e., no baseline), and other assessments were administered to EL students only. These assessments are summarized below.
**Developmental Indicators for the Assessment of Learning (DIAL-4).** PreK DIAL-4 (Mardell-Czudnowski & Goldenberg, 2011) scores were collected in the fall and spring of SY 2015-2016. The DIAL is an individually-administered developmental screening test designed to identify young children (ages 2 years 6 months to 5 years 11 months) who need further testing or who need help with academic skills. The screening is administered to multiple children at once in a large space with multiple stations (duration is approximately 30 minutes). The total and subscale scores (motor skills, conceptual skills, language skills) were used. The English and Spanish versions of the DIAL were good, with most mean coefficients in the .80s and .90s. The DIAL-4 was correlated with other screening tools such as the Batelle Developmental Inventory (Newborg, 2005), the Differential Ability Scales-Second Edition (DAS-11; Elliott, 2007), and the Vineland Adaptive Behavior Scales (2nd ed.; Sparrow, Cicchetti, & Balla, 2005).

**Dynamic Indicators of Basic Early Literacy Skills (DIBELS) Next.** Kindergarten DIBELS Next (Good et al., 2011) scores were collected in the fall and spring of SY 2016-2017. The DIBELS measures how well a child is with learning early reading skills such as, phonemic awareness, phonics, fluency, comprehension, and vocabulary. For over two decades, several research studies have documented that children’s performance on DIBELS is predictive and strongly related to children’s reading success and academic achievement in school (Dynamic Measurement Group, 2018). The DIBELS is administered individually to students in kindergarten through grade six and is scored in-person. The DIBELS has demonstrated good reliability, as all DIBELS subscales have estimated reliability in the .90s. Concurrent validity of single DIBELS probes with the Woodcock-Johnson Broad Reading Cluster were .36 for Initial Sound Fluency (assessed child’s ability to identify and create sound in a word, verbally presented by the examiner); .56 for Phoneme Segmentation Fluency (assessed child’s ability to deconstruct words into singular phonemes); .51 for Nonsense Word Fluency (assessed child’s ability to link sounds with letters, and combine these into words); and .75 for Letter Naming Fluency (assessed child’s ability to name random upper and lower case letters) (Education Endowment Foundation, 2018; University of Oregon Center).

**Measures of Academic Progress (MAP) Reading.** First Grade MAP Reading (NWEA, 2018a) scores were collected in the fall and spring of SY 2017-2018. The Northwest Evaluation Association (NWEA) MAP Reading is an online, adaptive assessment that efficiently measures oral reading fluency, comprehension, and foundational skills (NWEA, 2018a). It is designed for students in kindergarten through third grade, and takes about 30 minutes to complete. Specific requirements of the students are dependent upon the child’s reading level; some examples of reading tasks include reading a story and answering a question, matching a sentence to a picture or diagram, etc. This is a validated measure, with high item- and test- reliability, and predicts student performance on the Connecticut Mastery Test (NWEA, 2018b).

**Language Assessment Scales (LAS) Links.** Kindergarten and First Grade students’ spring LAS Links (CTB/McGraw, 2006) scores were collected (SY 2016-2017; SY 2017-2018). The LAS Links is a paper-and-pencil assessment of progress towards attainment of English language proficiency in four domains (i.e., speaking, listening, reading, and writing). LAS Links is grounded in Teachers of English to Speakers of Other Languages (TESOL) standards and Early Learning Development standards from multiple states throughout the nation. Reliability/validity data are unclear to date.

**i-Ready.** Kindergarten students’ spring i-Ready (Curriculum Associates) scale scores were collected (SY 2016-2017). i-Ready is a research-based, online assessment program designed to help K-8 students in both their reading and math skills. i-Ready combines adaptive diagnostic assessments for each student, as well as individualized instructions. The National Center on Intensive Intervention at the American Institutes for Research, which rates programs based on
psychometric and progress monitoring standards, gave i-Ready a “convincing evidence” rating, the highest designation, for validity and reliability (National Center on Intensive Intervention, 2018).

**Analytic Strategy**

*Program Readiness and LASErS Implementation/Mediators*

These exploratory variables were analyzed using t-tests, and supplemented with qualitative data from participant survey responses and from observer notes.

*Student Achievement*

The primary focus of the evaluation assesses the impacts of LASErS on ELs. Impacts on the full sample of students, including non-ELs, are also reported.

Separate analyses by rollout year (PreK, Kindergarten, and First Grade) were conducted because no consistent achievement measures were administered from year to year, and because only a subsample of teachers in a school were designated to attend LASErS PD. Hence, students from the treatment group whose teacher was not designated to attend PD were removed from the analyses. Of note, in Kindergarten, one school did not provide a list of student IDs under the LASErS teacher. This school was excluded from the analyses.

**Propensity-score Matching.** Propensity scoring was used within a single model to estimate each school’s probability of participation in treatment, as a function of the observed covariates, reflecting the characteristics of the schools to which treatment was deterministically assigned. Each school’s probability of being assigned to the treatment condition was used as a proxy for the selection process upon which treatment was assigned to them. These treatment assignment measures were computed as a function of school size, percentage of students identified as ELs, percentage of students receiving free/reduced lunch, and percentage of students receiving special education services across three school years (2012-2013, 2013-2014, and 2014-2015). Genetic matching methodology was used (Ho, Imai, King, & Stuart, 2006, 2007). This process aims to minimize the differences between the treatment and comparison groups upon the probability scores of treatment receipt, providing a stratified subset that are relatively equivalent. This matching was achieved by minimizing the Kolmogorov-Smirnov distance (the largest maximum measurement distance) between the two sample distributions of the probability scores, stratified across treatment. Individuals who possessed the largest difference in each iteration of the matching were removed until a p-value of the Kolmogorov-Smirnov statistic greater than 0.2 was achieved. In actuality, the smallest observed probability of the treatment and comparison groups for each year being from the same populations (rejecting the null hypothesis), was 0.68, with most greater than p=0.96. Further attempts to remove up to 15 additional individuals were attempted once equivalence was achieved, in an attempt to create more equivalent groups. However if no meaningful improvement was achieved (improvement in p-value greater than .04) then the matching was terminated. Of note, two sets of propensity matching were conducted: the first matched treatment and comparison EL students only, and the second set matched treatment and comparison students (full sample, regardless of EL status).

**Baseline Equivalence.** Once matching was achieved, a two-level random-intercepts and slopes model using hierarchical linear modeling (HLM; Raudenbush & Bryk, 2002) software with students nested within schools were used to determine baseline equivalence. The following equation was used:
Level 1 equation:

\[ \text{Pretest}_{ij} = \beta_{0j} + r_{ij} \]

Where:

\[ Y_{ij} = \text{Pretest score for student } i \text{ in school } j \]
\[ \beta_{0j} = \text{Mean pretest score for school } j \]
\[ r_{ij} = \text{Random effect representing the difference between student } ij \text{’s pretest achievement score and the predicted pretest mean achievement score for school } j; \ r_{ij} \sim N(0, \sigma^2) \]

Level 2 equation:

\[ \beta_{0j} = \gamma_{00} + \gamma_{01}(\text{LASErS}_j) + u_{0j} \]

Where:

\[ \gamma_{00} = \text{Grand mean pretest score for comparison group} \]
\[ \gamma_{01} = \text{Treatment effect (i.e., conditional mean pretest difference between LASErS and comparison groups)} \]
\[ \text{LASErS}_j = 1 \text{ for treatment group, 0 for comparison (business-as-usual)} \]
\[ u_{0j} = \text{residuals of school } j \text{’s mean from the grand mean; } u_{0j} \sim N(0, \tau) \]

The difference in means must be < .25 SDs. Statistical adjustments were done only if the group mean differences were >.05 SDs.

Impact Analyses. Two sets of analyses were conducted to assess treatment impacts. First, treatment effects on achievement scores of propensity-score matched EL students were conducted. Baseline test scores (if baseline equivalence was not achieved) and student demographics (special education, free lunch, race/ethnicity) were added in the model as covariates. The HLM model for estimating intervention effects was as follows:

Level 1 equation:

\[ Y_{ijk} = \beta_{0j} + \beta_{1j}(\text{Pretest}_{ij}) + \sum M \beta_{mj} X_{mij} + r_{ij} \]

Where:

\[ Y_{ijk} = \text{Posttest score for student } i \text{ in school } j \]
\[ \beta_{0j} = \text{Conditional mean post-test scores for students in school } j \]
\[ \beta_{1j} = \text{Mean pre-test slope for students in school } j \]
\[ \text{Pretest}_{ij} = \text{Pretest achievement score for student } i \text{ in school } j \text{ (added when baseline equivalence for that particular measure was not satisfied)} \]
\[ X_{mij} = M \text{ additional potential student-level covariates representing demographics for student } i \text{ in school } j \text{ (i.e., special education, free lunch, race/ethnicity)} \]
\[ \beta_{mj} = M \text{ coefficients slopes corresponding to additional potential student-level covariates} \]

\[ 1 \text{Baseline composite scores of standardized tests were substituted for those measures with no baseline scores (i.e., LAS Links and i-Ready scores). For the Kindergarten and First Grade impact analyses, fall DIBELS composite scores and MAP reading scores, respectively, were used as covariates.} \]
\( r_{ij} \) = Random effect representing the difference between student 
\( ij \)'s post-test achievement score and the predicted posttest mean achievement 
score for school \( j \); \( r_{ij} \sim N(0, \sigma^2) \)

Level 2 equation:

\[
\beta_{0j} = \gamma_{00} + \gamma_{01}(LASErS_j) + \Sigma_T \gamma_{0t} W_{tj} + u_{0j}
\]

Where:

- \( \gamma_{00} \) = Conditional grand mean posttest score for comparison group
- \( \gamma_{01} \) = Treatment effect (i.e., conditional mean posttest difference 
  between LASErS and comparison groups)
- \( LASErS_j \) = 1 for Tx, 0 for BAU
- \( W_{tj} \) = T additional school-level covariates
- \( \gamma_{10} \) = Grand mean pretest intercept
- \( \gamma_{mo} \) = Grand mean intercept for additional covariates
- \( u_{0j} - u_{1j} \) = Residuals; \( \sim N(0, \tau) \)

Second, treatment effects on achievement scores of all students (propensity-score matched) were 
analyzed using the same equation as above. To assess treatment impacts on ELs vs. non-ELs 
(subgroup analyses), a second model was run by adding a term for EL status (0=non-EL; 1=EL) and 
a cross-level interaction term.

**Treatment of Missing Data.** Because this is a quasi-experimental design, the analysis sample 
is defined as cases with non-missing posttest and non-missing pretest data. Thus, no pretest or 
posttest scores were imputed. All student demographic data the district provided were complete.

**Effect Size Calculation.** Following What Works Clearinghouse recommendations, we 
calculated effect sizes using Hedges’ g:

\[
g = \frac{\gamma}{\sqrt{\frac{(n_1 - 1)s_1^2 - (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}}
\]

Where:

- \( \gamma \) = HLM coefficient for intervention effect that indicates mean 
group differences adjusted for possible covariates at both the student- and 
school levels (\( \gamma_{01} \) in the model found in Section 3.1.8.3)
- \( n \) = sample sizes of the intervention and comparison groups
- \( s \) = variances based on posttest scores for each group
When introducing a new program, it is often assumed that schools are ready to implement it. In reality, an important issue to consider is a school’s program-readiness. That is, will schools meet baseline level expectations or assumptions program developers make to ensure successful implementation? Review of the LASErS programmatic approach suggests that successful implementation of LASErS must meet the following “baseline expectations” from schools:

- **Teachers are excited about science and classroom norms are such that teachers are open to espouse an inquiry-based approach to science teaching.**
  - Science teaching does not come naturally to teachers. Many preschool teachers feel less efficacious about teaching early science and spend less time teaching science than other subjects (Greenfield et al., 2009). Connecting science to literacy requires thoughtful and deliberate efforts on the part of the program developer.

- **Teachers employ a child-centered approach to teaching and engage in discursive interactions with children.**
  - The progressive view of early childhood education places the child at the center of the curriculum. A child-centered emergent curriculum focuses on the process of learning and stems from children’s interests and immediate environment (Jones, 2012). Science learning is most effective when teachers build on children’s natural curiosity by encouraging them to explore, wonder, and experiment, while engaging them in authentic conversations.

- **The classroom social and emotional climate is positive overall.**
  - Teachers co-create the classroom climate, setting the stage for children’s readiness to learn. Children are engaged and learn optimally when the classroom climate is positive (Reyes, Brackett, Rivers, White, & Salovey, 2012). On the other hand, when the climate is negative (e.g., teachers are stressed, children engage in challenging behavior), teachers spend more time on behavior management and less time on classroom activities (e.g., implementing a new program such as LASErS).

- **There is strong administrative support and coaching infrastructure to support the needs of teachers.**
  - Successful implementation of any school program, including LASErS, requires strong buy-in from each school’s principal who sets the tone for what initiatives should be prioritized. School staff are held accountable for prioritizing these initiatives. Moreover, strong administrative support for LASErS entails that schools (or the district) provide resources to support teachers. Coaching is an essential resource for teachers who are learning a new program.
We assessed the following program-readiness indicators (see Methodology section for measures used):

- **Teacher attitudes toward science**: extent to which teachers perceived science to be beneficial to students, challenging to students, or the extent to which they viewed the teaching of science as a way to foster other academic skills especially for ELs

- **Teacher attitudes toward the LASerS program**: teacher buy-in, perceived utility of LASerS, and perceived goodness-of-fit with their current teaching routine

- **Teacher efficacy**: extent to which teachers felt confident implementing the LASerS program

- **Administrator support**: extent to which teachers felt school leadership supported LASerS

- **Social and emotional climate**: assessed by teacher self-reports of stress and burnout and observer ratings of the classroom’s ‘mental health climate’
Findings

Results based on teacher surveys and observer ratings are summarized below (Table 3):

**Attitudes toward Science**

With respect to beneficial effects of science, results showed that PreK-First Grade teachers reported they mostly agreed with the important role science plays in promoting language development and other skills (Ms=3.33–3.59 in the fall, and 3.42–3.61 in the spring). No significant differences in fall-spring scores were detected. Similar trends were found in teacher openness to learning how science can serve the needs of ELs.

With respect to challenges in teaching science, PreK-First Grade teachers on average reported they do not find it challenging (Ms=2.21–2.7 in the fall). There was a slight decline in finding science teaching difficult in the spring, although this was not statistically significant.

**Attitudes toward LASErS Programming**

Although PreK teachers’ initial attitudes toward participating in LASErS programming was lower (M=2.65, SD=0.24) than Kindergarten and First Grade teachers’ (Ms in the three-point range, suggesting more positive attitudes), PreK teachers’ attitudes increased in the spring, M=2.92 (SD=0.23), p=.031. No improvements were detected for Kindergarten and First Grade teachers’ attitudes in the spring.

**Teaching Efficacy**

PreK-First Grade teachers’ fall ratings of efficacy in implementing LASErS well was, on average, below three, suggesting that teachers initially felt they needed more guidance in conducting LASErS lessons. By spring, teachers’ ratings reached the three-point range, though this was not statistically significant.

**Administrator Support**

PreK-First Grade teachers’ ratings of administrator support were in the disagree-agree range (Ms=2.53–2.64, [SDs=0.25–0.52]). Teacher ratings ranged from 1.40–3.20, 2.25–3.00, and 2.20–3.00 in PreK, Kindergarten, and First Grade, respectively. Results suggested that teachers perceived their school leadership not to be prioritizing LASErS, although there was some variability where some teachers reported that principals valued the LASErS program.

**Classroom Climate**

Although teacher self-reported stress in the fall was not as high (Ms=2.58–2.88 [SD=2.26–0.69]) with no detectable change in the spring, observer ratings of the social and emotional climate revealed low levels of the social and emotional climate, with PreK and Kindergarten ratings falling below the baseline expectation (average negative scores on the CHILD Observation Tool) and First Grade ratings within the baseline expectation level (M=0.18 and 0.23 in the fall and spring, respectively). The observer ratings suggested that the learning climate was highly teacher-driven and regimented with limited opportunities for children to express themselves (verbally or creatively), teacher display of affect was bordering on the negative end of the spectrum, and teachers noticed and paid attention to overt child behaviors but not subtle signals for assistance.
Dimensions of the CHILD that are particularly relevant to successful implementation of LASErS include, for example, Staff Awareness, Staff-Child Interactions, and Individualized & Developmentally Appropriate Pedagogy because they tap into issues of equitable treatment of children and child-centered approaches to teaching. Table 4 summarizes the CHILD Dimensions and mean scores from PreK to First Grade. Negative scores on these dimensions reveal that teachers were more likely to notice overt behaviors (not subtle signals that ELs are more likely to exhibit) and interacted more with children who exhibited these overt behaviors, and teachers practiced a highly regimented, teacher-driven approach—limiting opportunities for verbal and creative self-expression. This type of learning climate is not conducive for a program like LASErS to be implemented with fidelity.

Both teacher-reported stress and observer ratings of the social and emotional climate were stable from the fall to the spring semester.

Summary

Teacher attitudes toward science, teacher attitudes toward LASErS programming, teacher efficacy, administrator support, and classroom social and emotional climate were examined as indicators of program-readiness. Findings indicated that teachers across all program years held positive views of the program, and saw LASErS as a viable approach to help them address the language and learning needs of ELs. Teachers did not, however, feel efficacious enough to implement the program with integrity, suggesting the need for more concrete supports. Principal support of LASErS was generally low, with few schools prioritizing LASErS. With respect to the social and emotional climate, although teacher self-reports of stress were low, observer ratings of the social and emotional climate were in the ‘undermining’ to ‘baseline’ range, suggesting that the climate was not optimal for learning and development. Our findings suggest that the baseline expectation for LASErS to thrive were not met, which made it challenging to implement with fidelity.
### Table 3. LASerS Program-Readiness Indicators

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<tr>
<td></td>
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<td>Fall M (SD)</td>
<td>Spring M (SD)</td>
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<tr>
<td>Attitudes toward Science&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Teacher</td>
<td>--</td>
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<tr>
<td>Benefits</td>
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<td>Openness</td>
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<td>Attitudes toward LASerS&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>Teacher Efficacy&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
<td>Administrator Support&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>11</td>
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<tr>
<td>Teacher Stress&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Teacher</td>
<td>7</td>
<td>2.88 (0.25)</td>
<td>2.71 (0.39)</td>
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<sup>a</sup> Rating scale: 1=strongly disagree to 4=strongly agree

<sup>b</sup> Rating scale: -2, -1=undermining mental health, learning, and development; 0=baseline expectation; +1, +2=promoting mental health, learning, and development

<sup>c</sup> p<.10 * p<.05 ** p<.01 *** p<.001
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<thead>
<tr>
<th>CHILD Dimensions</th>
<th>Description</th>
<th>PRE-K</th>
<th>KINDERGARTEN</th>
<th>FIRST GRADE</th>
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<tr>
<td>Transitions</td>
<td>smooth, efficient, flexible, and productive transitions</td>
<td>7</td>
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<td>Directions &amp; Rules</td>
<td>behavior management characterized by setting, modeling, and enforcing clear, consistent, and developmentally appropriate rules of conduct and applying proactive and positive behavior strategies</td>
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<td>-0.38 (0.35)</td>
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<td>Social &amp; Emotional Learning</td>
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<td>-0.31 (0.34)</td>
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<td>Staff Awareness</td>
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<td>-0.19 (0.37)</td>
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<td>Staff Affect</td>
<td>emotional state of staff</td>
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<td>0.00 (0.53)</td>
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<td>Staff Cooperation</td>
<td>staff demonstration of teamwork, camaraderie, and genuine enjoyment of each other's presence</td>
<td>8</td>
<td>0.06 (0.32)</td>
<td>4</td>
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<td>Staff-Child Interactions</td>
<td>how staff fosters interactions characterized by dignity, respect, genuine relationships, equity, and the celebration of diversity</td>
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<td>-0.09 (0.46)</td>
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<td>Individualized &amp; Developmentally Appropriate Pedagogy</td>
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<td>-0.13 (0.37)</td>
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<td>Child Behaviors</td>
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<td>8</td>
<td>0.16 (0.19)</td>
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* Rating scale: -2, -1=undermining mental health, learning, and development; 0=baseline expectation; +1, +2=promoting mental health, learning, and development
Results: Core Component 1 (Professional Development)

LASerS Professional Development

The first core component of LASerS is Professional Development (PD). Designated LASerS teachers participated in two modules across one school year, each consisting of four full-day, face-to-face instructional sessions (approx. 56 hours total). These sessions offered strategies and practices through lectures and discussions, classroom video and analyses, and small group activities. Resources for supporting literacy through science exploration included EDC’s Young Scientist Series curriculum guidebooks (Chalufour & Worth, 2003, 2004, 2005) and classroom science materials (e.g., for life science, children’s books about living things, science notebooks, hand lenses, terraria, plant pots, and seeds).

PreK Modules 1 and 2, respectively, focused on water explorations in the classroom and observing and understanding the characteristics of living things (e.g., discovering how drops of water come together to make streams). Kindergarten Module 1 focused on helping children develop an awareness of design strategies that support building structures (e.g., demonstrating that building materials affect buildings, observing the shapes and sizes of buildings, and learning how to make a building stronger). Kindergarten Module 2 focused on balls and ramps (e.g., understanding the forces and motion of balls and engaging with ramps). First Grade Modules 1 and 2, respectively, focused on light and shadow (e.g., using a flashlight and a mirror to see what happens when the light is reflected), and the structure, function, and information processing of sound and vibrations. Across the program years and various modules, PD participants were provided with science materials, family toolkits, and strategies to engage families in various explorations.
Assessing Implementation Fidelity for Core Component 1 (PD)

For each program year (PreK, Kindergarten, First Grade), designated LASerS teachers were expected to attend eight PD training sessions. Two indicators to measure implementation fidelity for Core Component 1 (PD) include:

- **Indicator 1**: Grantee conducts eight PD sessions for each program year (4 sessions x 2 modules)
  - Data source: Scheduled PD event invitation sent to evaluator
  - Threshold for Fidelity: Program conducts at least seven PD sessions

- **Indicator 2**: Teacher and Coach PD attendance
  - Data source: Attendance sheets
  - Threshold for Fidelity: At least 80% of teachers and coaches attend at least seven PD sessions for each program year

Meeting Implementation Fidelity Thresholds

**Indicator 1 (PD Sessions Provided)**

Except for PreK implementation year, the Grantee provided eight PD training sessions. Only seven PD sessions were offered in PreK because of multiple school cancellations due to inclement weather. For Indicator 1, therefore, the program met the threshold for implementation fidelity.

**Indicator 2 (PD Attendance)**

To assess implementation fidelity for PD attendance, at least one teacher representing their school should be in attendance. Likewise, the designated coach for that school should be present. Of note, for the PreK implementation year, although 10 schools participated in the program, one of the schools employed the same PreK teacher, counting the school total for calculating attendance as nine.

In PreK, seven of nine schools (78%) had teachers attending all seven PD sessions, and three of nine schools (33%) had designated coaches attending. The teachers from the two remaining schools attended between two and four sessions only, and the coaches representing the six remaining schools attended 3-6 PD sessions.

For the Kindergarten year, only five of nine schools (56%) had teachers attending 7-8 PD sessions, and three of nine schools (33%) had designated coaches attending. The teachers from the four remaining schools attended 2-6 PD sessions, and the coaches representing the six remaining schools attended 3-6 PD sessions.
For the First Grade year, six of nine schools (67%) had teachers attending 7-8 PD sessions, and four of nine schools (44%) had designated coaches attending. The teachers from the remaining three schools attended 4-6 sessions, and the coaches representing the five remaining schools attended 0-6 sessions. One school had no coach representative attend any of the PD sessions.

Because less than 80% of schools met the threshold of attending 7-8 PD sessions across all program years, Indicator 2 (PD Attendance) for Key Component 1 did not meet the threshold for implementation fidelity. A fidelity matrix table is found in the Appendix that summarizes Core Component 1.

Findings

Here, we summarize findings based on evaluator notes of PD observations and teacher and coach responses from surveys. Trained observers from Yale attended PD training sessions. Transcribed notes were summarized into themes.

Overall Assessment of PD Sessions

A majority of teachers and coaches who responded to the survey, in general, reported being “satisfied” or “very satisfied” with the topics covered in professional development sessions and expressed appreciation for the efforts and expertise of the LASerS trainers.

“I just loved those fun bottles on the tables. They made me realize that I didn’t fully understand the properties of liquids.” (Pre-K Teacher)

“I found the overview useful. I found the materials useful. I found having administration, coaches and teachers hearing the same message at the same time useful.” (Kindergarten Teacher)

“ Asking our presenters for science support when we need it has been very beneficial!!” (LASerS Coach)

“I loved it! Awesome. Jeff and cindy are thoughtful, caring, and encouraging presenters. I don’t want it to end!” (LASerS Coach)

“LASerS was a great opportunity to re-learn the science skills emphasized!! I truly appreciated this opportunity to learn additional strategies to support science learning!! Jeff, Cindy, and the rest of the LASerS team did a wonderful job in supporting teachers and staff.” (LASerS Coach)

Observers noted that LASerS staff had been very encouraging. They were open and available for questions, assuring teachers that they could always reach out for support.

Areas of Strength

The various aspects of LASerS PD that respondents found particularly noteworthy included the following:

Gaining New Knowledge. Respondents across all program years appreciated the new knowledge they were gaining from the PD sessions. PreK and Kindergarten teachers mentioned
that using scientific terms, language, concepts, and vocabulary as being most useful. First Grade teachers appreciated background information provided to prepare them in addressing unexpected questions from students. Coaches who had been strong supporters of the program wanted to continue the LASErS program.

“I feel that the presenters have done an excellent job of understanding the audience they are presenting to and have prepared material with that audience in mind. The background knowledge that they shared with us was invaluable in order for us to handle unexpected questions from our students. Their respectfulness of our time and knowledge was evident and allowed for a free flow of ideas!” (First Grade Teacher)

“The content, support, resources, and materials were excellent! The trainers were experienced, well-informed, and personable! It is unfortunate that teachers did not attend on a regular basis -- I’m sure this impacted the implementation of the strategies and the knowledge of the teachers.” (First Grade Coach)

**Experiential Learning.** Hands-on exploration of LASErS materials and modeling sample lessons were the most helpful parts of the PD for respondents. Most teachers valued the experience of how students might engage with the LASErS materials. Coaches, like teachers, believed that learning about the LASErS materials and exploring them (hands-on) was a very useful part of the professional development session. Participants reported that the hands-on activities in the PDs increased their confidence in implementing the lessons in their own classrooms. They also enjoyed the modeling of how to facilitate discussions so they would be prepared to answer questions their students might ask.

“[I liked] the hands-on work. I can see from a child’s point of view.” (Pre-K Teacher)

“Hands on investigations helped me feel ready to do them in my room.” (Kindergarten Teacher)

“Using the materials so that I could adequately explain how to use them with my students. We were able to perform the observations and therefore know what to expect when we implemented the session with our kids.” (First Grade Teacher)

“Actually working through a session as if we were the students. Our experiment with the blue water helped to build my understanding of how to probe for more information when questioning students.” (LASErS Coach)

In addition to hands-on learning experiences during PD sessions, participants mentioned watching videos as particularly helpful. This allowed them to see how experienced teachers modeled LASErS lessons effectively with students.

**Group Discussions.** Participants had the opportunity of discussing ideas with colleagues during PD sessions, which they appreciated. Although there were instances when discussions were challenging, LASErS staff addressed the situation by “mixing up” the groups so that teachers from different schools could be grouped together and learn from each other.

“Having the time to share our ideas implementation plans with other teachers along with the support from the LASErS Staff” (Kindergarten Teacher)
Opportunities for Improvement

**Attendance and Participant Engagement.** Finding substitutes to take the place of teachers who were attending the LASerS trainings had been challenging over the three program years. Respondents expressed challenges they experienced with the logistics of coming to PDs. The lack of attendance in turn made it more difficult to successfully implement the LASerS framework and communicate it to other members of their teaching team.

“If teachers miss PD, how do they know what to do? How can they get the materials?” (PreK Teacher)

“Multiple teachers expressed that the PD set-up is problematic. It is very difficult to find substitutes for most classrooms. Sometimes substitutes could not handle it and the teacher had to leave the PD session to return to the school. This was particularly an issue for the teacher of a bilingual classroom.” (Observer notes during Kindergarten PD session)

“Inconsistent attendance for other teachers at my school makes sharing and incorporating skills difficult.” (First Grade Teacher)

Observers noted too that in addition to low attendance rates, there were also periods of participant disengagement (e.g., talking amongst themselves, sometimes ignoring the LASerS staff, not asking questions). LASerS staff has addressed these issues by re-arranging tables and having teachers switch positions, or go to different tables and discuss what their students were doing, with teachers who were not typically in their group.

**Need for Concrete Strategies.** Teachers and coaches requested more detailed support in implementing LASerS. PreK respondents expressed wanting more concrete strategies to support communication for ELs in particular, and suggestions for lesson plans on different science topics including science journaling. Most Kindergarten respondents mentioned that they needed clarity in the action plan of LASerS to help guide their lessons (e.g., how to support questioning from the students (including ELs)). Like teachers, the coaches thought having a clear action plan would help in implementing LASerS. One coach also expressed interest in receiving more customized support on being a coach. In First Grade, observers noted that teachers wanted to know “more about creating questions to shift the responsibility to the students” and more ways to assess them. Teachers wanted more assistance in how to ask probing questions.

“I think we need a clearer picture of the program. What the coaching cycles looks like, the teacher action plans.” (LASerS Coach)

“I would like to receive additional support with implementation strategies during station rotation and how to build upon this within my content area instruction.” (Kindergarten Teacher)

Teachers across program years expressed concern that they may not have proper guidance to implement LASerS effectively, citing the need for direct modeling from experienced trainers. Some had suggested that instead of lecture-style PD trainings, classroom demonstrations might be more helpful to them.

“How can I know if I am doing this correctly without any direct modeling of how to implement the lessons with Kindergarteners?” (Kindergarten Teacher)

“Since it is a learning process for both teachers and children I expect there will be challenges
along the way. If there was a way for the presenters do a mini-lesson with a small group of children I would find it very helpful. Observing an experienced adult modeling a lesson would be extremely helpful to me.’ (First Grade Teacher)

To address this, LASErS staff held mock lessons during some PD sessions to engage teachers and demonstrate inquiry-based learning.

“LASErS staff held a mock lesson and had the teachers and coaches engage as if they were students so that they may understand the perspective of their students. Throughout the exercise, they reflected on the activity from a pedagogical lens. LASErS staff facilitate conversation to demonstrate how to use the LASErS ideology in the classroom. During mirrors and shadows activities, discuss better ways to ask students questions and engage in observations. Engage, explore and reflect are key components of the activity and process.” (Observer Notes)

Moreover, teachers requested more assistance in addressing issues of diversity and issues addressing needs of ELs more concretely.

“(We want) continued and expanded discussions with the focus on English Language Learners. The strategies which work well with them benefit all students.” (First Grade Teacher)

“How to develop better communication with non-English speaking parents?” (First Grade Teacher)

“Why doesn’t EDC have a diverse team? Why are there no Spanish speakers on staff?” (Kindergarten Teacher)

Observers noted that LASErS staff had provided participants with strategies on how to engage families. For instance, at one PD session, participants engaged in a reflective exercise to assess how frequently teachers involved parents, especially ethnically diverse families, in the classroom. Participants then came up with solutions to better engage families. At another PD session, one of the questions posed for teachers was “What do I/my students’ families need in order to feel safe, supported, and engaged?”

**Insufficient Planning Time.** Observers noted that planning time at PDs lasted for only a few minutes (e.g., 15 min.), which many participants expressed was not enough time. Teachers and coaches wanted more planning time for their own classes and schools. To implement LASErS effectively, PreK coaches stated they would need time to “meet”, “practice” and “reflect as a team”. Kindergarten teachers wanted more time at the professional development meetings to work with coaches and colleagues to prepare lessons. They wanted to use the time to do prep work. First Grade respondents reported wanting more planning time for their own schools and schedules. They wanted more dedicated time for creating an implementation plan that fits their particular school’s needs.

“We would benefit from planning time. Otherwise we are ready to roll!” (LASErS Coach)

**Inadequate Materials.** Some respondents noted that materials were “inadequate” and that they needed guidance on how to use them. For instance, observers noted that LASErS staff had purchased ramp materials and distributed them in bulk, requiring teachers to spend time preparing them to be used in their classroom. Teachers mentioned they were unclear on how to use the materials. Some teachers also mentioned they had to purchase additional materials on their own to supplement the materials given to them.
“The challenges I foresee is cost of materials and resources to fully implement an effective lesson.” (First Grade Teacher)

Program (Mis)Alignment with District Curriculum. Some respondents expressed concerns with fitting in LASERs with their standard curriculum. This was made more challenging by the fact that there was no space for science in the regular curriculum.

“The challenge is that there is not a place in the curriculum for science. So in order to include it, we have to embed the science experiment into the ELA Block.” (LASERs Coach)

“Finding time in our busy schedule to implement this program without falling behind in the regular curriculum.” (First Grade Teacher)

Moreover, some respondents expressed they needed LASERs staff to make “ELA standard connections” with LASERs curricula. Observers noted that LASERs staff had mentioned to participants that they had aligned LASERs with other science that is already embedded in the literacy curriculum. Some participants, however, complained that was not enough.

Respondents also mentioned wanting more support in working with the administration to address these issues.

“There’s no real buy-in from the schools. The district has unrealistic expectations for English Learners.” (Kindergarten Teacher)

“Have a mandatory administrator PD at the beginning of year to explain process or have minimum of 2 people per school at every session.” (LASERs Coach)

Too Much Information. A few teachers and coaches remarked that too much or repetitive information was being distributed at the trainings that could be reduced in the future sessions.

“There was a lot of information given out in the form of PPT handouts—it was a bit overwhelming, and going forward I think the ‘less is more’ approach might be more effective.” (Pre-K Teacher)

“Everything needs to be made more concise. The coaching meeting forms, the actual PD time, the surveys :)...” (Kindergarten Teacher)

“The amount of time spent out of school and at the trainings. I did not go as religiously to all of the trainings this year as I did last. I felt some of the information was repetitive for coaches who had gone to the trainings for Pre-K last year, and I also had to take on some additional responsibilities in my school this year which made it more difficult to leave the school. I also felt that the teachers who attended LASERs this year needed less support than the teacher who attended last year.” (Kindergarten Coach)

Teachers emphasized the importance of taking a lunch break in future professional development sessions. By breaking for lunch, they would have the time to take in all the information they were learning.
Summary

Participants appreciated the trainers and the information they provided during PD trainings. New knowledge, creative ways to engage learners, experiential learning, and group discussions were highlights of LASErS PD trainings. Attendance was the biggest challenge for successful implementation of LASErS PD primarily due to unavailability of teacher-substitutes. Other challenges were participants’ need for more concrete strategies in implementing LASErS especially in the context of engaging ELs and their families, the need for more planning time, the need for more materials, and the need for aligning LASErS lessons with district curricula. In spite of all these challenges, participants saw the value of the LASErS program.

“Lasers has impacted my questioning. The focus from Lasers on student inquiry and open ended questions has been very impactful.” (PreK Teacher)

“Don’t take away this program, please keep it going. It’s not perfect but the children deserve to have these materials.” (Kindergarten Teacher)

“Time in our scripted day’s activities has made the introduction of these lessons difficult. However, the children’s excitement in participating as “scientists” has bought great joy back to our classrooms!!” (First Grade teacher)
Results: Core Component 2 (Coaching)

LASErS Coaching

The second core component is Coaching. District instructional coaches were trained to support teachers in implementing a topic-driven, student-centered, and language-intensive science curriculum. LASErS coaches provided guidance to teachers, helping them to complete assignments, as well as reinforce concepts and strategies from PD into the classrooms. In general, the goal of coaching was to increase the district coaches’ capacity to support teachers in their language facilitation via science instruction. This was accomplished by:

• building a collaborative relationship with the same teacher (or group of teachers) over an extended period of time;

• provoking teachers’ own thinking about children and how they learn science concepts and skills;

• supporting teacher reflection on the effectiveness of their own science-teaching practices;

• collecting, using, and sharing documentation of science teaching and coaching to support collaborative reflection for children, teachers, coaches, and instructors; and

• modeling the types of interactions and guidance coaches want teachers to provide for children

Of note, EDC had not trained district coaches in the fundamentals of coaching. By nature of their existing role, it was assumed that the district has already provided the requisite training for coaches.
Assessing Implementation Fidelity For Core Component 2 (Coaching)

Of all the core components, coaching was the most difficult to document. The original design of the assessment of implementation fidelity was as follows:

- **Indicator**: Designated LASErS coaches provide coaching (face-to-face with assigned teacher; small group meetings)
- **Data source**: Attendance log
- **Threshold for Fidelity**: At least 80% of teachers receive at least one coaching session

It was challenging for the evaluator to assess the coaching component. For example, in PreK, at least three teachers had reported that they were not provided with any coaching or that their school needed to support LASErS coaching. As a result of lessons learned in PreK, the Grantee modified the coaching component in the Kindergarten rollout year. Two shadow coaches, who had worked both in the district and with the Grantee in the past, were hired. The goal was to “shadow” each coach at least once. In spite of some successes, some schools continued to receive no coaching. One Kindergarten teacher complained,

“There has been zero coaching support for LASErS at our school. WE the teachers have had to constantly reach out for support from them. Lack of subs in order to attend sessions makes it look like LASErS is low on the priority list.” (Kindergarten Teacher)

As coaching continued to be a major challenge, by the First Grade rollout year, additional coaches from the CT State Education Resource Center (SERC) were hired to provide additional coaching to district coaches. This strategy was intended to both build SERC capacity and support LASErS implementation. As in the Kindergarten implementation, shadow coaches continued to oversee the coaching component.

The coaching challenge was also assessed from the coach’s perspective. Some coaches mentioned finding it very difficult to reach out to teachers:

“...it was challenging to meet with the teacher. She was unable to attend many sessions and it was often tricky to schedule visits to the school. I'm not sure if her administrator/district fully supported her participation. I feel one success is that the teacher implemented the science activities even though she didn't attend the PD.”

“Not all teams accessed coaching or met regularly enough to accommodate coaching”

Meeting Implementation Fidelity Threshold

Because of these challenges, we cannot ascertain that at least 80% of teachers had received any coaching at all. Whether or not Core Component 2 (Coaching) met the threshold for implementation fidelity could not be determined. A fidelity matrix table is found in the Appendix that summarizes Core Component 2.
Findings

We summarize the findings from multiple perspectives: teachers, district coaches, shadow coaches, and outside observers from the evaluation team.

Teachers’ Perspective

Teacher ratings of the quality of coaching they received were measured with the LASErS Coaching Quality Scale (Table 5; see measures description in Methodology section). Example of items include

My coach listens to my ideas and concerns regarding science-teaching practices, and provides me with useful feedback and I feel empowered to implement LASErS after meeting with my coach, and to develop my own ideas for teaching science concepts and skills. Items were rated on a four-point scale (1=strongly disagree, 4=strongly agree).

Table 5. Teacher Ratings: Quality of Coaching

<table>
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<th>Measure</th>
<th>PREKINDERGARTEN</th>
<th>KINDERGARTEN</th>
<th>FIRST GRADE</th>
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<tr>
<td>Coating Quality</td>
<td>9</td>
<td>9</td>
<td>13</td>
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<tr>
<td>Spring M (SD)</td>
<td>3.37 (0.42)</td>
<td>2.96 (0.57)</td>
<td>3.14 (0.61)</td>
</tr>
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</table>

On average, PreK-First Grade teachers rated the quality of coaching a three, reflecting adequate quality of coaching among survey respondents.

Coaches’ Perspective

Coaches who responded to the survey were comprised of six PreK, four Kindergarten, and five First Grade coaches.

Time spent coaching varied according to coaches (1-4 hours per week, or no hours if no planning time with teachers, and additional hours spent when planning for family events). LASErS coaching was typically comprised of observing, reviewing strategies and goals, modeling (and at times, videotaping), and discussion.

“At the pre-conference we review what strategy we wanted to focus on (determined at the last post conference). We plan what materials will be needed, what the focus of the lesson will be, what types of questions the teacher will ask to promote discussion and any key vocabulary to focus on. I come in usually the next day to videotape 15-20 mins of the lesson. I usually interact with the students during this time as well to model some of the teaching strategies we’ve discussed. After the lesson, I take about 10 mins to re-watch parts of the video and take some notes on what I want to focus on during the post-conference. At the post-conference, I share the video with the teacher. Sometimes we watch some clips together, sometimes the teacher will watch it on her own - I’ll give her the choice. I ask the teacher what they notice as far as student discourse and teacher questioning. I share what I noticed, starting with some positive points on use of EL strategies and inquiry learning, and then either the teacher or I pick one area to focus on for improvement (i.e. “using parallel talk” or “choosing questions that will better promote discussion”). I ask the teacher for ideas on how to incorporate this and I offer suggestions as well.”
**Approach to Coaching.** Coaches reported that relationship-building—building rapport with teachers, being available, and active listening—were key in the coach-teacher relationship. They empowered teachers, provided the necessary scaffolding, and promoted reflection.

“Our approach to coaching LASErS is empowering and open to sharing ideas and strategies. I work with the teachers and make myself available to co-teach and create lesson materials. We all share ideas and promote reflection after each lesson and at data team meeting.”

“I model and listen this helps with our LASErS teacher as I can listen to her needs, help model a lesson and provide materials”

“I try to guide their thinking and reflection by asking questions that encourage them to think about their lesson. I have also recorded portions of a lesson and then watched clips with the teachers as we conferenced about the lesson.”

As the coaches monitored teachers in their implementation of LASErS, they adjusted their coaching approach depending on teacher needs.

“my approach is to monitor the type of questions the teacher is using to determine if they are designed to promote language development and to push the thinking of students.”

“I believe in following the teacher’s lead in terms of choosing where to focus my coaching. I also believe there needs to be a balance of support and gentle pressure to coach teachers effectively. I think this helped me to be a flexible coach.”

“I spend more time planning with teachers than giving feedback - especially if the teacher is self-reflective and can name, on her own, what went well and what might need changing for the next lesson.”

One coach reported strong collaboration with a teacher.

“[Teacher] and I team taught the lessons and prepared them through collaboration. The shared leadership design is powerful! WE overcame any challenges because we really believe in the learning and the process.”

**Witnessed Changes in Teaching Practices and Student Learning.** Coaches attributed improvements in teaching strategies to LASErS (e.g., mindful questioning, increased exposure to science content, increased strategies for parent involvement to LASErS, and improvements in literacy skills).

“Love watching light-bulb moments when teachers recognize their own learning; making connections between opportunities/experiences/strategies, see where the zones of proximal development for each child and find a way to scaffold the child to next step.”

“Successes: willingness of teacher to implement LASErS; students’ oral and written language improved; students were excited, thrille doing science; students were deeply engaged in learning; family participation.”

“Science is very powerful in promoting inquiry and language development an any age. It’s a good excuse to do more science.”

**Challenges to Coaching.** Among the top challenges, coaches identified multiple activities and school initiatives that required their attention and commitment, making LASErS lower in
priority. Most coaches were coaching many classrooms and as a result were often short on time. Most coaches expressed an interest in improving the efficiency of LASerS planning.

“\[I work with K-2 teachers primarily. PreK has not been in my scope of responsibility so stepping in and developing a relationship with the teacher has been important. Other than this, I have 13 teachers I coach, 3 weekly meetings with each grade level I attend, weekly professional learning that I plan and deliver, weekly ILT meetings to plan and respond to, testing and data collection, lesson plan feedback, learning walks, etc. LASerS is at the bottom of my priority list.\]”

“\[Lasers is not at the top - not because we don’t think it’s important but mainly because there is more need in other areas.\]”

“The major challenge (and only challenge) is time management. There are many activities/sessions to complete in a two-three time week period. Lasers is a very important part, but only a piece of the extensive obligations a coach has”

“...lots of information being distributed, but with more organization could happen in less time, allowing for more planning time with my general education staff, allowing coaching time within the building to be used to extend into other K classrooms and include special educators”

“Challenges: need for time to meet and plan, share feedback 1:1 in a quiet environment; TESTING schedule during observations end of the year -- teacher wasn’t able to engage with students”

Some coaches, however, reported that they could implement LASerS in addition to other coaching commitments.

“\[Special Education Compliance & Assessment for ** School. These rank higher in attention and commitment, but do not prevent LASerS from getting the attention it needs.\]”

“I am responsible for coaching 10 other teachers, serve as a coordinator for 504 and Student Support Team meetings, run all Data Teams, manage the distribution of resources, serve as the Lead Mentor for TEAM, teach several periods a week and other duties assigned. Yes I am busy, however, LASerS has provided a focus for coaching at the PreK level that has not previously been a part of the coaching cycle.”

“\[LASerS is a district priority. Our days are packed full with initiatives, but we prioritize LASerS\]”

“I hold professional learning sessions, grade level meetings, learning walks, observing teachers and giving feedback about teaching literacy effectively. I coach individual teachers on their instructional practice. LASerS fits in with my individual coaching cycle... It fits perfectly. We love integrating literacy with science.”

“Other activities include our everyday daily schedules, math, literacy centers, Data Teams, PPTs, school events. Schedules are busy but we are able to reserve time for LASerS each week. LASerS ranks high in comparison to these activities/programs. LASerS fits well into my daily coaching routines that align with my coaching philosophy. LASerS is applicable, fun, and communicative.”

“Filling out these questionnaires, intervention blocks for literacy and numerously, presenting Professional Development, attending parent conferences, testing students (high stakes testing)
testing students and attending SAT’s, bus duty, morning duty, training UConn interns, handling student teachers setting up tutors for grades K-3, organizing volunteers, training in new curriculum. Are you tired yet!! Lasers is the most exciting and rewarding part of my week and the most motivating for students!!”

Finally, one coach noted that changing pedagogical style had been challenging.

“It has been a challenge to adjust the mindset of one teacher who is very used to a whole group teacher-directed approach for teaching. She has made progress in having students share their noticings and wonderings, but we still need to work on peer-to-peer discussion and small group work.” (Kindergarten Coach)

Shadow Coaches’ Perspective

Coaching quality varied, according to shadow coaches, depending on how much buy-in there was from a school. Shadow coaches had observed that when the school had a clear understanding of the commitment that needed to be made, the coaching was more successful both to the coach and to the teacher. When a school demonstrated complete support and buy-in of the LASerS intervention, there was an overall successful coaching atmosphere. One school was an exemplar in this buy-in approach, and the coaches in this exemplar school were well prepared with a LASerS plan. The content was also seamlessly integrated into other subject areas.

According to the shadow coaches, some teachers felt frustrated because not enough time was allocated to coaching. Teachers also expressed frustration over perceived lack support from their coach. For example, they felt undermined by the coach regarding the teacher’s implementation of LASerS. Moreover, although some coaches had reported meeting with the teacher, some teachers reported that they had never met with their coach.

Observers’ Perspective

Data from the evaluator regarding coaching were based on observations conducted to assess teacher implementation of LASerS, and not observations of the coaching process per se. In general, what was observed during scheduled visits was that coach involvement varied across schools: some coaches helped co-teach lessons, others acted as an assistant teacher in lessons, and some were absent from the classroom entirely. For instance, in one First Grade classroom, the coach and the teacher co-taught the LASerS lessons and planned extensively together. At another school, the coach was the only one implementing the LASerS framework, while the teacher took an assistant role. In the fall at this school, the teachers took on an assistant-teaching role; in the spring, the coach worked with a small group of students on a planting project while the teacher worked on a graphic organizer with the rest of the class. At all of the other schools, the coach would come into the classroom for the LASerS lesson and would act as an assistant teacher.

Summary

Coaching is a critical component in implementing a new program such as LASerS. Our findings indicated that there was variability in the quantity and quality of coaching that occurred in schools. The Grantee had been responsive in addressing the challenges of coaching (e.g., adding shadow coaches and hiring external coaches). In spite of these efforts, coaching continued to be challenging in some schools where principal and school-level buy-in were low. Among schools that received successful coaching, coaches attributed improvements in teaching quality and student language outcomes to the LASerS program.
LASErS Family Engagement

Es benefit from a variety of opportunities for discursive interactions—both in and out of the classroom. LASErS promotes family engagement through various activities: hiring a dedicated family engagement specialist to support teachers in planning school-based events, organizing a Parent Advisory Board, and other family engagement activities; providing home activities and science-literacy kits; holding summer family events at the Connecticut Science Center.

LASErS conceptualizes family engagement as a cycle. The basic idea behind the family engagement cycle is that each PD session supports an active interplay between classroom and home-based activities, and that this interplay will be further reinforced by various events and resources (including school-based family events, events at community centers, and resources at libraries).
Assessing Implementation Fidelity for Core Component 3 (Family Engagement)

Two indicators measure implementation fidelity for Key Component 3 (Family Engagement):

- **Indicator 1**: Grantee provides participating classrooms with home activities and science literacy kits
  - **Data source**: Grantee provides documentation that kits were distributed to schools (classrooms)
  - **Threshold for Fidelity**: All kits were distributed to every school (classroom)

- **Indicator 2**: Grantee schedules a family engagement event at the Connecticut Science Center
  - **Data source**: Grantee e-mail notification of event to evaluator; attendance sheets
  - **Threshold for Fidelity**: Event has been scheduled

Meeting Implementation Fidelity Thresholds

**Indicator 1 (Home kits provided)**

For each program year (PreK to First Grade), home kits were provided to every classroom.

**Indicator 2 (Family event scheduled)**

Family events at the Connecticut Science Center were scheduled. In PreK, 18 families attended (two schools had no families represented). In Kindergarten, 18 families attended (four of nine schools had no families represented). In First Grade, 33 families attended (two of nine schools had no families represented).

Because home kits were provided and family events were scheduled, LASERs **met the threshold** for implementation fidelity for Component 3. A fidelity matrix table is found in the Appendix that summarizes Core Component 3.

Note that the implementation fidelity indicators for Key Component 3 were based on outputs and not uptake indicators. Uptake based on family attendance logs, survey responses, and observations are discussed in the next section.

Findings

In this section, we summarize the LASERs Family Engagement component by examining responses to surveys, family event observations, and parent interviews.
**Teacher Communication Strategies**

Teachers responded to the Home-School-Community Engagement Scale (see Measures section under Methodology section). Example of items include: *I provide parents with resources they can try at home to further enhance what children learned in the classroom; My school provides opportunities for parents of English learners to support learning in classrooms.* Items were scored on a four-point Likert scale (1=strongly disagree, 4=strongly agree).

As Table 6 shows, fall mean scores ranged from 2.74 (SD=0.44) to 3.19 (SD=0.32), suggesting that on average, teachers endorsed items relating to family engagement practices. PreK teacher mean ratings were slightly lower (less than 3) than the Kindergarten and First Grade teacher mean ratings (~3), although this was not statistically significant. Across all program years, no significant changes in family engagement were detected.

**Table 6. Home-School-Community Engagement Scale**

<table>
<thead>
<tr>
<th></th>
<th>PREKINDERGARTEN (n=8)</th>
<th>KINDERGARTEN (n=8)</th>
<th>FIRST GRADE (n=10)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fall M (SD)</td>
<td>Spring M (SD)</td>
<td>t</td>
</tr>
<tr>
<td></td>
<td>2.74 (0.44)</td>
<td>2.64 (0.46)</td>
<td>-1.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.19 (0.32)</td>
<td>3.14 (0.35)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.97 (0.26)</td>
<td>3.09 (0.24)</td>
</tr>
</tbody>
</table>

**Teachers connected families with LASErS content in a variety of ways.** Teachers sent LASErS materials and information home to the families. This included general information about LASErS and activity suggestions that parents could do at home. Some teachers established communication about LASErS through newsletters, informal meetings with parents, parent-teacher conferences, and family events.

*“Families were introduced to LASERS through a newsletter. In addition, I personally spoke to parents about LASERS at open house” (Pre-K Teacher)*

*“We send home info from LASErS along with inclosing d information in our monthly newsletter” (Kindergarten Teacher)*

*“Through established meetings time and parent-teacher conferences” (Kindergarten Teacher)*

First Grade teachers noted that they were connecting with families through parent phone calls, family nights, monthly letters or home connection letters, student invitations, Remind 101, Class Dojo, and home based activities. They sent out handouts or letters and shared photos of activities they did in the classroom.

*“Conversations through parent positive phone calls. Helping ELL acquire science...” (First Grade Teacher)*

*“Family nights, reminders and homework connections, student led conferences, case study” (First Grade Teacher)*
Teachers and their coaches carefully planned for school-based family engagement events. Planning for school-based family engagement events took up a majority of coaches’ time with teachers (e.g., setting up materials, planning the layout to showcase LASERs activities, and strategizing on ways to inspire families to apply the same strategies in their homes). PreK was an exploratory year for family engagement, using morning drop-offs or afternoon pick-up times to communicate with families and engage them with LASERs activities. In Kindergarten and First Grade, teachers and their coaches, with the support of the LASERs Family Engagement Specialist, coordinated events in the fall and spring of each program year. Below is a sample of what observers noted during one of the family events:

“Children and parents were gathered together in small groups around two water tables. We observed positive affect (smiling, laughing) shared between parents and the students as well as examples of language related to the water exercise. Examples of questions heard from parents are ‘Is the water going in?’ ‘Where do you think the bubbles are going?’ Examples of descriptions heard from students include, ‘I’m pouring it in this hole’ and ‘The bubbles are going up.’ Teachers were standing near the parents and students for the entire event, observing and encouraging these interactions. Examples of open-ended questions for parents to ask their children were on display near the water tables. Take-home pages with activity ideas (printed in both English and Spanish) and materials (plastic droppers) were provided to parents to support continued water exploration at home. Parents interacted positively, not only with their children, but with each other and the teachers, and appeared very attentive/show positive affect toward the teacher when listening to explanations and instructions. We were notified by a coach who was present that before we arrived, parents were also shown videos of their children engaging in water play activities within their classrooms.” (Observer Notes)

Parent Perspectives

The Evaluation Team approached parents during one of the family events to see if they were open to being interviewed about the LASERs program and how it was working in their household. Five Kindergarten parents agreed to be interviewed by phone. Two of the interviews were conducted in Spanish. Interviewed parents attended at least one of the school-based events and reported that they engaged in the activities their child’s teacher sent home. Whereas interviews with parents revealed that not all the parents understood the LASERs program completely (e.g., “Is that the program where the kids play with balls?” and “The truth is I don’t know anything.”), others were able to describe the science activities they did with their child.

“I really liked it because the kids learned a lot, and these are things that kids need to understand like how things are moving, and what size things are. And they experiment with how these things work. I felt very comfortable watching kids how they are participating and trying to understand what weighs more and what weighs less.”

“I liked the water activity. He clogged my sink trying to put a little thing to clog the water. Instead of putting a little thing to clog the water he put toilet paper in it. So it clogged my sink. We are getting a water table...”

Level of engagement varied. Among the interviewees, English-speaking parents participated more in school-based events than did Spanish-speaking parents. Parents also noticed that it was usually the same parents who attended family events at school:

“I’ve seen the same parents at the same... Sometimes we get new parents. I know it’s difficult
for them because some of them have many kids or some of them have to work but in the best, they try to keep going to the programs, so you know that can tell that they do like the program.”

“I would like to see more parents come to it. Like, it would be much better if other parents came...”

Moreover, some parents felt that there was no meaningful engagement with parents around LASErS other than the teacher telling them about what was happening. Other parents felt they did not understand LASErS enough to know how it has impacted family engagement.

“No, I don’t think my communication with the teacher has changed. It’s just the program and she talks about that.”

Other parents, however, felt that LASErS has improved home-school engagement, and improved communication with the teacher regarding their child’s academic progress:

“From a zero at the beginning to a 10 at the most, it’s about a 6 right now. At the beginning of the year we were at nothing.”

“I am talking more to the teacher. He (son) has special needs so the teacher texts me if my child has any difficulties and we talk about my child’s needs... After he does the (LASErS) projects he has to present them, and then the teacher and him explain to me what they have been working on.”

Regardless of their level of engagement with school events, all parents interviewed expressed overall satisfaction with the program. Parents noticed that their children were engaged much more in their schoolwork, and the curriculum. The students showed more excitement talking about their coursework with their parents. Both English-speaking and Spanish-speaking parents noticed an increase in their child’s communication about their learning, noting that their child’s verbal expressiveness and curiosity resulted from the LASErS program:

“I think my kid is more curious and is always asking and talking about the school work that they are teaching him some things and how things happen. I think he’s learning a lot and I am very happy about that... I think he has improved a lot in his language and I am very happy with the teachers and the school and what they are doing. He is making a lot of progress.”

“My son loves to experiment with different kinds of stuff. It opens his world up to different opportunities that he’s going to do. He likes looking on the cars now, and seeing how it works, so it opened up his mind to different opportunities for him to actually learn about different things. It gives him the opportunity to explore more items that’s around him and outside.”

As one parent of a child who had been involved with LASErS since PreK had shared, her child had shared this love for science with his siblings:

“He wants to build a little house with popsicle sticks now, and learning different kinds of things. He loves, he LOVES every time I go to a meeting because he is able to take home things and then teach his brother and sister about it.”

Two parents of children with special needs noted the benefits of the program on their child’s communicativeness:
“He has improved a lot with the talking. Because right now he is not very social so it helps him to socialize with kids of other classrooms, not only his special needs classes.”

“He speaks like he is a grown man even though he has a speech impediment... He likes to entertain his brother and sister a lot more, and is willing to teach them what he has learned. And learn how to have more patience with them, and uh, he is able to express himself to them, and they love it. They love the interaction, and everything he has learned he expresses it to them and I was amazed the way he explained it to them. He did the weather thing at school and came home and explained to them how it works and everything and explained it to them and I was like really surprised my five-year old can explain this stuff so well.”

Overall, parents expressed their appreciation and enjoyment for the LASErS program. One parent had suggested that the program continue as long as possible.

**Challenges with Family Engagement**

**Following Through with Parents.** “Follow Through” was the biggest challenge engaging families in LASErS. PreK teachers reported that ensuring that parents were carrying out LASErS activities at home was difficult. Several PreK teachers reported that the language barrier made communication between parents and teachers challenging.

“My ELL students’ parents do not speak any English” (Pre-K Teacher)

“Language Barriers, Families losing materials I send home, Families not following through with home pieces” (Pre-K Teacher)

“Parents don’t seem connected in spite of efforts to have AM & PM time for parents to attend. Their responses to handouts are perfunctory (writing down the “right” answer). Kids enjoyed many of the activities but sometimes it lacked continuity and with all of the other demands of the curriculum, it was easily lost in the midst of other activities.” (Pre-K Teacher)

Kindergarten and First Grade teachers alike reported that many parents might not be able to do LASErS activities with their children, despite receiving information. These teachers expressed how it was challenging to get families to come into events and to participate, whether at home or at school. It was noted that some were difficult to reach, as they were not on social media, did not check children’s folders, did not always answer the phone, and as some children take the bus, the teacher does not have face time with all the parents. Some teachers also noted that the language barrier with parents can be challenging, and they did not always understand LASErS activities.

“Getting families to come into events. Many of the families enjoyed building with blocks. The unit on balls and ramps was more difficult for families to understand.” (Kindergarten Teacher)

“...often they are not able to understand the activity- many do not read.” (Kindergarten Teacher)

“At the family nights, adults need to participate more with the children. Many adults do participate but many are still hesitant. We want everyone to have fun and explore science.” (Kindergarten Teacher)

“...often they are not able to understand the activity- many do not read.” (Kindergarten Teacher)
“At the family nights, adults need to participate more with the children. Many adults do participate but many are still hesitant. We want everyone to have fun and explore science.”
(Kindergarten Teacher)

“(Challenges) Families recognizing the significance of the project and being able to communicate the concepts with their children in English as they primarily speak another language in their homes. Also that families will not readily have materials to construct structures and will not put in the extra effort necessary to complete the home activities.”
(First Grade Teacher)

Focus on Spanish Language. Teachers made materials accessible for families of ELs, but most teachers are prepared only to work with Spanish speakers. PreK teachers mentioned that having access to translators (bilingual-English and Spanish) was helpful for communicating with parents of ELs. It was not clear, however, if teachers were successful in communicating with parents who spoke languages other than English or Spanish. One teacher mentioned that this was a part of the program that was not well-developed on her part. One suggestion was to provide LASerS worksheets in other languages. In Kindergarten, teachers provided LASerS materials in both English and Spanish. Some Kindergarten teachers relied on translation programs to communicate with the parents, while other teachers were Spanish speakers. In First Grade, many of the teachers sent out the letters in both English and Spanish. One First Grade teacher sent out letters in Portuguese and two First Grade teachers engaged with the Family Resource Associate or the ELL support staff to communicate with families who did not speak English.

“I am fortunate enough to have a coteacher that speaks Spanish and translates papers/flyers in Spanish. I will talk with my coteacher and the parent so that we are communicating. I would like more resources in Spanish to share with families. I love that tip sheets are available in both languages.”
(Pre-K Teacher)

“Everything went from LASerS needs to be in Spanish as well as in English. Home communications have been written this way thus far so that is a plus. Trying to use a translating communication device from school is too cumbersome and time consuming. A liaison from downtown who can make connections with the EL families participating would be perfect.”
(Kindergarten Teacher)

Lack of Time and Materials. Lack of time and limited materials were brought up as reasons why engagement might be difficult for families.

“Some of the families may feel that they don’t have the equipment to do the projects...”
(Kindergarten Teacher)

“[The biggest challenge was] getting the parents there due to other commitments”
(First Grade Teacher)

EL Families are Less Likely to Engage. Although the overall thrust of LASerS Family Engagement is engaging all families, it is worthwhile to note that the main target of LASerS—ELs and their families—were presumably less likely to participate in LASerS events. Teachers noticed that it was the same parents who attended family events. Even parents who were interviewed, as well as observers, noticed the same trend at events (see section on Parent Interviews).

“It’s always difficult to connect with families. We always seem to get the same couple”
(PreK Teacher)
“[The biggest challenge was] attendance. Only 4 went to open house” (First Grade Teacher)

Summary

LASErS promoted family engagement through various activities: hiring a dedicated family engagement specialist to support teachers in planning school-based events, organizing a Parent Advisory Board, and other family engagement activities; providing home activities and science-literacy kits; and holding summer family events at the Connecticut Science Center. Teachers connected with families in various ways: from newsletters to school events, and home activities. Parents, in turn, appreciated these efforts and enjoyed the benefits of program engagement and its perceived impacts on their child’s academic learning. According to the district, schools are re-thinking family engagement because of LASErS. The intentional inclusion of families of ELs, however, continued to be a challenge.
The LASErS Leadership Alliance team was comprised of district and state leaders, EL literacy experts, science education experts, and Connecticut early learning system investors—to review LASErS’ implementation, suggest enhancements, and support sustainability and statewide scaling. Among the team, extensive expertise was represented in the areas of early literacy and science education as well as bilingual education, relating to the enrichment of EL and non-EL students’ learning outcomes. Alliance members have experience in conducting large-scale studies, producing reports, utilizing and maintaining software tools, conducting evaluations, and addressing policy issues. They also demonstrate their individual leadership through their abilities to coordinate and engage with teachers, districts, parents, and the community to cultivate growth and broaden developmental learning initiatives. Leadership Alliance meetings included the LASErS Project Director, Family Engagement (FE) Specialist, Professional Development Specialists, and the Evaluator.
Assessing Implementation Fidelity for Core Component 4 (Leadership Alliance)

There is one indicator to measure implementation fidelity for Core Component 4:

- **Indicator 1**: Grantee provides minutes of meeting (notes) to Evaluator
  - **Data source**: Minutes of meetings obtained from Grantee (every occurrence)
  - **Threshold for Fidelity**: Meeting minutes sent to Evaluator

### Meeting Implementation Fidelity Thresholds

**Indicator 1 (Grantee provides minutes of meeting to Evaluator)**

Alliance meetings were held quarterly—typically one in-person meeting and the others held virtually. Meetings tended to be consistently well attended, with typically 10 attendees. The meetings were held on the following dates:

- 12/8/15
- 3/8/16
- 9/13/16
- 12/13/16
- 3/8/17
- 9/13/17
- 2/14/18
- 6/3/18
- 6/14/18

The purpose of meetings were to discuss schedules and work plan details, thus allowing for future planning, to inform and accept feedback of progress, and to detect challenges and create solutions. Generally, agenda items discussed school implementation progress, family and community updates, and included a group discussion. Some meetings incorporated updates from the evaluator. Beginning agendas included a discussion of long- and short-term goals, the process of implementation, the evaluation plan, and new member introduction. Mid-term agendas included a summary of the year prior with lessons learned, reactions, a refining of project goals, and a discussion of how to move forward.

The evaluator received minutes of each of the Alliance meetings. For Indicator 1, therefore, the program **met the threshold** for implementation fidelity. A fidelity matrix table is found in the Appendix that summarizes Core Component 4.

### Tasks Accomplished

LASErS delivered a total of 23 PD sessions across the PreK to First Grade rollout years. LASErS partnered with the Connecticut Science Center, State Education Resource Center (SERC), and the
Children’s Museum (vermicomposting) to deliver First Grade sessions on light, shadow, sound, and the structure and function of organisms.

In the 2017-2018 year, LASERs also delivered four-hour bilingual workshops on balls and ramps to 31 Hartford-area family child care providers, and partnered with Hartford Foundation for Public Giving and Hartford’s School Readiness Program for this event. Lastly, LASERs provided a nine-hour “LASERs-Lite” professional development event on balls and ramps to preschool teachers in Fairfield county. The partnership with Cooperative Education Services allowed for 41 directors and teachers to attend this event.

Feedback From Alliance Members

Two members of the Alliance were interviewed or responded to an online survey. According to respondents, the strongest aspects of the program were its family engagement and professional development components:

“LASERs has made schools re-think family engagement.”

“The Professional Learning modules are outstanding and address the key pedagogical needs in early childhood and elementary. The incorporation of family engagement with the links-to-learning approach are also outstanding and a key component of the success of the program. In addition, the ability to layer in the work of the Science Center to extend the expertise into our programs which ultimately extends the reach of LASERs is something that is hard to measure within the program evaluation, but I believe is a significant added benefit to the work.”

Among opportunities for improvement, LASERs could find time during PD training to allow teachers and coaches to plan their lessons. Moreover, the full-day design of the program was perceived to be deterrent to participant attendance. However, one respondent also noted the promising approach of a more compact PD training:

“The development of the LASERs lite program I believe was in response to this reality and provided a way to reach more educators and help them at least begin to shift their approach to teaching science to young learners.”

Summary

The Leadership Alliance was instrumental in providing support to LASERs’ program development and improvement. Its members were highly engaged and contributed their expertise to provide recommendations on how to improve, sustain, and scale-up the program.
Implementing LASErS in the Classroom

This section summarizes results from teacher surveys and classroom observations. Observers were trained and certified in the observation tools that were used. To lessen the burden of data collection on schools, only one classroom in each school was selected randomly to be observed in the fall and spring of each program year. Teachers were also asked to rate their implementation of LASErS only in the spring semester.

The LASErS Implementation Scale (LIS) was used to assess the extent to which teachers implemented LASErS strategies. The LIS is comprised of a Total Score and three subscales (Creating a Language-Rich Environment, Support for Scientific Learning, and Engagement). The teacher self-report was scored on a four-point scale in the direction almost never-often/almost all the time. The observer rating scale was scored on a four-point scale in the direction no evidence-compelling evidence. In PreK, the ELLCO-PreK was used to supplement the LIS. Items were scored on a five-point scale in the direction deficient (minimal evidence)-exemplary (compelling evidence). Details of these measures are provided in the Methodology section of the report.

Findings

Teacher Ratings and Classroom Observations

Table 7 summarizes the results of the LIS and ELLCO-PreK scales. In PreK, teacher ratings of how often they implemented LASErS strategies in the spring were in the often-almost always range (Ms across Language-Rich Environment, Support for Scientific Learning, and Engagement subscales were between 3.37 to 3.72), which mirrored adequate-compelling evidence of implementation on the LIS observer scale. This is in contrast to observer ratings that scored LIS subscales in the limited-adequate evidence range in the fall (Ms ranging from 2.68-3.04). Teacher self-ratings were significantly higher than observer ratings, ts(3)>3.87, p<.05. Observer ratings declined in the spring where classroom averages were closer to limited evidence of implementation, Ms between 2.14-2.33, t(7)=2.76 for the LIS Total Score, and ts>-2.43 for Engagement and Support for Scientific Learning subscales, ps<.05. Decline in the Language-Rich Environment subscale was only marginally significant, t(7)=2.19, p=.065.

In addition to the LIS, ELLCO-PreK scores were within the basic level (some evidence) range during the fall semester for the General Classroom Environment and Language and Literacy subscales. No significant changes were detected in the spring for both subscales; the Language and Literacy environment score declined in the spring, bordering on the inadequate/limited range, though this was not a statistically significant decline.
In Kindergarten and First Grade, the same trend for teacher ratings of LASErS implementation was found to be similar to PreK ratings (in the adequate-compelling range), as were observer ratings (in the limited-adequate range). There were no significant declines, however, in Kindergarten and First Grade LIS scores.

**Observation Notes**

To supplement the quantitative findings, qualitative notes from observations are summarized in this section. Below are some notes from the observations. In general, teachers used the experiments introduced in the LASErS PDs.

*In a spring observation, a teacher was using the LASErS framework to work with students around 3D objects and 3D shapes. She laid out a variety of objects from around the classroom and had students group them and provide an explanation for why they grouped them the way they did. It was from this exploration that the class came up with a series of “defining features” for various 3D shapes (rectangular prism, sphere, cone, pyramid, etc.).*

* * *

**Kids in circle on the carpet grouping objects from the classroom by shape**

When one child started a new grouping of objects, Teacher asked him to explain why he had started a new group.

**Teacher:** How are they different?

**Student:** One’s a circle and one is a square.

[Another child groups boxes and asked why]

**Teacher:** How are they similar?

[The teacher asks each child to explain similarities and differences using descriptive words]

**Student:** They are all flat with corners.

**Teacher:** What do we call this shape? (Pointing to flat surface of a box)

**Student:** A rectangle

According to observers, teachers consistently used the language promoted in the PD trainings, introducing words like “wonder,” “notice,” “observe,” and the technical experiment-related words to their classes. Teachers, for instance, would often ask students, “What do you notice?” or “What do you observe?” Most classrooms applied a “Know-Wonder-Learn” framework to structure lessons. This framework involved a conversation before the activity where students discussed what they already know and what they have questions about. Then, after the activity, the class came back together to record what they had learned from their exploration.

*Before working with oil and water moving, one teacher put up the following as the goals for the day:*

  - What sizes and shapes do you see?
  - What do you notice?
  - What happens?

Observers, however, noted that although the framework was applied, teachers rarely provided opportunities to scaffold students’ wonderings, or rarely provided opportunities to engage in discursive interactions once students gave out the right answer. There was very little practice with generating hypotheses or planning experiments. The following is an excerpt from observer notes
regarding a “typical exchange” observed in First Grade LASerS classrooms at a fall school visit.

*Teacher:* What do you notice when you drop?
*Student:* It goes flat when I drop it.
*Teacher:* Does it stay the same shape?
*Teacher:* What did you notice about water and oil?

[Teacher helped the girl sound out the word “fast”]

*Teacher:* Did you write down your observations?

[Teacher wrote down and drew observations]

“What do you notice?” [repeated many times]

*Teacher:* Can you see through it?
*Student 1:* I can see through it but it’s blurry.
*Student 2:* I can only see a little bit [while looking through plastic cup]
*Teacher:* Find which one is translucent. Which one is opaque? Which one doesn’t let light through?

Finally, observers noted that teachers who were “successful” in implementing LASerS at the beginning of the year continued to be successful, and the teachers who had struggled at the beginning of the year continued to demonstrate challenges with successfully implementing the LASerS framework at the second observation.

**Factors that Contribute to Variability in Implementation**

In addition to low teacher and coach attendance rates at PD trainings, and a lack of dedicated coaching supports for LASerS, multiple factors may have accounted for variability in implementation. Here, we analyzed qualitative data obtained from survey respondents. Themes that emerged include:

1. **Time Constraints**
   a. Lack of time / no planning time
   b. Competing priorities
2. **Lack of Program Supports**
   a. Lack of administrative support
   b. Lack of coaching support
   c. Lack of materials
3. **Perceived Program Misalignment**
4. **Ambiguity over LASerS: Curriculum or Pedagogical Approach?**

**Time Constraints.** Teachers need adequate time to plan and prepare for LASerS. Lack of time was the most cited challenge teachers faced in implementing LASerS in the classroom. The majority of PreK teachers, for instance, stated that finding time to implement LASerS in the classroom was the biggest hurdle.

“[I am] split between two classrooms and needing to cover all curriculum in a short time.”  
*(PreK Teacher)*

“Combining LASerS with district requirements; LASERS coincided with testing windows which made it hard to collect evidence.”  
*(PreK Teacher)*
“Having the time to connect the lessons to the ela standards [is a challenge].” (First Grade Teacher)

Although some teachers mentioned no additional preparation time was allocated for LASerS, others had mentioned using regular prep time for LASerS lessons. Teachers noted that having more time planning for LASerS during PD sessions would help their own implementation.

“I need more time at the LASerS workshops to work with my colleagues and coach to prepare lessons” (Kindergarten Teacher)

The lack of time also stemmed from competing priorities among various school initiatives. Teachers struggled over other commitments that took precedence over LASerS. Some teachers were focused on language arts and math-based curriculums.

“Preschool Assessment Framework Observations-2 standards each week, 3 hand written observations per student with 18 students. 2. NAEYC Accreditation Folders 3. Daily classroom work/upkeep/activities 4. Lesson Planning 5. Small group planning 6. Assessment/Monitoring 7. LASerS-not that I want to do it last, but without planning time and other expectations, I do not feel like I am able to give it the time that I think it deserves and needs.” (PreK Teacher)

“Our day consists of 7hrs and 10 minutes of dedicated instructional time with the exception of 30 minutes for lunch and 20 minutes for recess. There is only one free block of time once every other week which LASerS can fit into without something else having to be put aside.” (Kindergarten Teacher)

“the philosophy of the program is great. I am not able focus time on the program because I have many other programs to do in my school.” (LASerS Coach)

“I am split between 2 classrooms with 22 students in a room and one additional person. To provide good literacy instruction in both rooms along with math, science is a challenge.” (PreK Teacher)

“We have a new language arts program and a new math program both require a lot of time and energy. LASerS comes below the other two areas” (Kindergarten Teacher)

In First Grade, for instance, teachers cited their other curricular and administrative obligations as barriers to finding the time to successfully facilitate LASerS lessons. Teachers noted specific programs such as Eureka and Fundations.

“Eureka, ELA curriculum, new grading system, new testing system, PPT, 504, etc...” (First Grade Teacher)

“Daily, teaching first grade, phonics, writing, math, Guided Reading, Intervention” (First Grade Teacher)

**Inadequate Program Supports.** Competing priorities highlighted the lack of administrative support for LASerS (refer to Section on Program-Readiness).

“We have a new language arts program and a new program that both require a lot of time and energy. According to the administration, LASerS comes below the other 2 areas.” (Kindergarten Teacher)
“Ratio of student to teacher is high, 1-24, so management becomes difficult at times. Curriculum mandates make it difficult to implement consistently.” (Kindergarten Teacher)

“Try to fit in daily but sometimes just not able to with other demands, principals need to be on board.” (Kindergarten Teacher)

Other teachers wanted more assistance from other staff in implementing the program.

“In including all staff in this science training and not just the teachers.” (PreK Teacher)

“Classroom is a busy place. Staff shortages – hard to make sure language was rich and engaging for students at all times.” (PreK Teacher)

Some teachers expressed concerns over not having proper guidance to implement LASErS, citing the need for coaching. Moreover, some teachers mentioned that the program needed to provide more materials. One teacher said they had to purchase extra materials to supplement the activities.

Perceived Program Misalignment. Teachers recognized the importance of the hands-on components of LASErS, and aimed to integrate it into their daily routine (e.g., during center time, literacy units). However, some teachers discussed the struggle of finding ways to incorporate LASErS into their daily routine. Some teachers found ways to integrate LASErS seamlessly into their daily teaching routine:

“It fits well because we have a sensory table activity every day, it is aligned with my understanding of language and child development.” (PreK Teacher)

“I believe in the child-initiated, inquiry model. I do LASErs water exploration during station time. To do observations of the children and ask good questions about their discoveries can be a challenge with just one other helping hand in a classroom of 22 year olds. (PreK Teacher)

“A. LASErs could fit into the 2 play times that we have planned in the day because we have the water table as an open choice during the day. What is difficult is having teachers designate time to sit with students to do the discussions, which is the goal of LASErS, so it is not ideal at times, although we want to dedicate time to it. B. I agree with LASErS because I feel that it is engaging and fun. I think it is a great vehicle for learning and that it is so open ended that inquiry can continue to grow and develop. This method of inquiry is what I want to use in my classroom.” (PreK Teacher)

“The Water Table Schedule has worked in to the schedule pretty well. Students are well established with the routine and expectations. They are getting more comfortable with making observations about the water table and drawing their experiences.” (PreK Teacher)

“LASErS is integrated into our daily routine. Students are building, think or sharing their structures...” (Kindergarten Teacher)

“I believe that children need more time to explore in kindergarten. The more hands on activities the more language and learning can happen. I try to fit the LASErS program in at least 3-4 days a week” (Kindergarten Teacher)
“Literacy block in native language require my attention and commitment. LASerS is a complement/or a way to enhance language skills.” (First Grade Teacher)

“LASerS fits well, it is just making the extension of time for implementation, classroom and behavior management.” (First Grade Teacher)

Others, however, found it particularly challenging:

“It doesn’t [align with my teaching routine]. I have to use certain days to incorporate LASERs with my classes.” (PreK Teacher)

“LASERs may not be a part of daily routine due to Specials classes Mon.-Wed. and Teachers half-day schedule.” (PreK Teacher)

“We find it difficult to incorporate effective teaching the Lasers material.” (PreK Teacher)

“It is a stretch because the teacher is only in our building part time and that schedules alternates morning and afternoons on a weekly basis. Administration has been beyond helpful in providing time for me to meet with [teacher] when we have not been able to schedule meetings after school or during lunch.” (LASerS Coach)

“[LASerS] is difficult find time in the school day to implement this on top of daily instruction…” (Kindergarten Teacher)

“Right now it does not fit into my schedule. I use literacy time to be able to fit in experiments.” (First Grade Teacher)

“I believe that children learn better through social interactions and LASERs provide a way to accomplish this but right now my schedule is very tide with others demands. I been using the Morning Meeting time to complete the investigations.” (First Grade Teacher)

“The challenge is that there is not a place in the curriculum for science. So in order to include it, we have to embed the science experiment into the ELA Block.” (First Grade LASerS Coach)

One teacher noted that intentional teaching of LASerS lessons was required in finding ways to incorporate it into existing curricula.

“LASERs can fit into our daily schedule if it is aligning with the literacy unit we are working on but currently it is something we have to attempt to work into the schedule in order to complete certain activities by the given deadlines. I do believe that science can be integrated through other subjects and should be. Students are naturally curious about the world around them! We should foster that curiosity.” (First Grade Teacher)

**Summary**

Although teacher self-report ratings of LASerS implementation were in the adequate-compelling range, observer ratings were in the limited-adequate range. In addition to low teacher and coach attendance rates at PD trainings and lack of dedicated coaching supports for LASerS (discussed in other sections), multiple factors were explored to explain variability in classroom implementation.
Teachers noted the challenges of implementing LASErS on top of daily instruction, especially when the administration was not supportive, the demands of the curriculum were too high, or that LASErS activities did not align with instructional subject matter. These challenges highlight ambiguity over the LASErS program. Is it a “curriculum” or is it an “approach”? As a curriculum, more efforts on the part of the Grantee should be spent on conducting a crosswalk of the LASErS curriculum into teachers’ actual curriculum. There should be more explicit guidelines on how to integrate LASErS into regular lessons. As an approach, implementing LASErS would mean having thoughtful, intentional, and authentic conversations with children (and being especially mindful of ELs) around any subject matter. Implementing LASErS would mean encouraging children to wonder, probe deeply into their thinking, and guide their explorations. LASErS may also be both a curriculum and approach. Either way, teachers needed more concrete guidance in applying LASErS in the classroom.
Table 7. LASErS Implementation in the Classroom

<table>
<thead>
<tr>
<th>Measure</th>
<th>Source</th>
<th>PREKINDERGARTEN</th>
<th>KINDERGARTEN</th>
<th>FIRST GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fall M (SD)</td>
<td>Spring M (SD)</td>
<td>t</td>
</tr>
<tr>
<td>LASErS Classroom Implementation Scale Totala</td>
<td>Teacher</td>
<td>9 --</td>
<td>3.54 (0.31)</td>
<td>--</td>
</tr>
<tr>
<td>Language-Rich Environment</td>
<td></td>
<td>9 --</td>
<td>3.72 (0.30)</td>
<td>--</td>
</tr>
<tr>
<td>Support for Scientific Learning</td>
<td></td>
<td>9 --</td>
<td>3.52 (0.31)</td>
<td>--</td>
</tr>
<tr>
<td>Engagement</td>
<td></td>
<td>9 --</td>
<td>3.37 (0.42)</td>
<td>--</td>
</tr>
<tr>
<td>LASErS Classroom Implementation Scale Totalb</td>
<td>Observer</td>
<td>8 2.76 (0.69)</td>
<td>2.18 (0.42)</td>
<td>-2.76*</td>
</tr>
<tr>
<td>Language-Rich Environment</td>
<td></td>
<td>8 2.77 (0.71)</td>
<td>2.14 (0.53)</td>
<td>-2.19*</td>
</tr>
<tr>
<td>Support for Scientific Learning</td>
<td></td>
<td>8 2.68 (0.65)</td>
<td>2.16 (0.44)</td>
<td>-3.28*</td>
</tr>
<tr>
<td>Engagement</td>
<td></td>
<td>8 3.04 (0.82)</td>
<td>2.33 (0.36)</td>
<td>-2.43*</td>
</tr>
<tr>
<td>ELLCO-PreKc</td>
<td>Observer</td>
<td>-- --</td>
<td>-- --</td>
<td>--</td>
</tr>
<tr>
<td>General Classroom Environment</td>
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<td>8 3.43 (0.59)</td>
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<td>0.91</td>
</tr>
<tr>
<td>Classroom Structure Sum</td>
<td></td>
<td>8 14.50 (2.83)</td>
<td>16.13 (1.25)</td>
<td>1.27</td>
</tr>
<tr>
<td>Curriculum Sum</td>
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<td>8 9.50 (1.51)</td>
<td>9.63 (1.30)</td>
<td>0.17</td>
</tr>
<tr>
<td>Language and Literacy</td>
<td></td>
<td>8 3.13 (0.43)</td>
<td>2.86 (0.18)</td>
<td>-1.51</td>
</tr>
<tr>
<td>Language Environment Sum</td>
<td></td>
<td>8 12.38 (2.13)</td>
<td>11.50 (2.27)</td>
<td>-0.77</td>
</tr>
<tr>
<td>Books &amp; Book Reading Sum</td>
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<td>8 14.75 (1.49)</td>
<td>12.88 (1.81)</td>
<td>-2.38*</td>
</tr>
<tr>
<td>Print &amp; Early Writing Sum</td>
<td></td>
<td>8 10.38 (2.33)</td>
<td>9.25 (0.89)</td>
<td>-1.39</td>
</tr>
</tbody>
</table>

a Rating scale: 1=almost never; 2=rarely; 3=sometimes; 4=often or almost always
b Rating scale: 1=no evidence; 2=limited evidence; 3=some evidence; 4=compelling evidence
c Rating scale: 1=deficient/minimal, 2=inadequate/limited; 3=basic/some; 4=strong/sufficient; 5=exemplary/compelling

\( p < .10 \) * \( p < .05 \) ** \( p < .01 \) *** \( p < .001 \)
Confirmatory Analyses: Impacts on EL Students

Here, students were matched at baseline based on propensity-score-matching of EL students only. The analytic sample consisted of 182 EL students in PreK (20 schools), 132 EL students in Kindergarten (12 schools), and 136 EL students in First Grade (14 schools). All student outcome variables were collected from the Hartford Public Schools district. Data were analyzed using HLM techniques. Table 8 shows both baseline equivalence testing and impact analyses for EL students. Effect sizes (ESs) in PreK, Kindergarten, and First Grade ranged from |0.01| to |0.17|, meeting criteria for baseline equivalence. For the impact analyses, fall scores were used as additional covariates when ES > .05.

PreK Findings

No significant impacts on EL scores were detected, with effect sizes of -0.01, 0.04, -0.09, and 0.16 for the DIAL Total score, and motor, concepts, and language subtests, respectively (Table 8).

Kindergarten Findings

The DIBELS Composite scores, i-Ready scale scores and LAS Links overall scale scores were examined. Of note, because i-Ready and LAS Links were administered only in the spring, DIBELS fall scores were used as additional covariates. Table 8 shows no impacts were found, with ESs of -0.13, 0.03, and 0.10 for DIBELS, i-Ready, and LAS Links, respectively.

First Grade Findings

The NWEA MAP Reading and LAS Links overall scale scores were examined. First Grade students assigned to the intervention group scored higher than First Grade students in the comparison condition in NWEA MAP Reading scores (ES=0.51). There was a trend (p=.053) favoring LASErS students in LAS Links scores (ES=0.31).

Exploratory Analyses: Impacts on All Students

This set of analyses was based on propensity-score matching across all students regardless of EL status. In the first set of analyses (Model 1), we estimated the impacts of LASErS on all students using HLM. In the second set of analyses (Model 2), we conducted subgroup analyses (impacts on
non-ELs vs. impacts on ELs). Table 9 shows that baseline equivalence was satisfied for all outcomes across all grade levels. Similar rules as those in confirmatory analyses for adding baseline scores were used.

**PreK Findings**

Across all students, regardless of EL status, no impacts on PreK DIAL scores were found, although scores improved for the intervention group especially in the concepts and language subtests (ESs = 0.18 and 0.25, respectively). Inspection of subgroups (non-ELs vs. ELs) revealed significant effects were detected for non-ELs on the concepts subtest (ES = 0.30) where non-EL students in the intervention group scored higher than non-EL students in the comparison group. By contrast, EL students in the intervention group scored lower than EL students in the comparison group on the concepts subtest (ES = -0.42).

**Kindergarten Findings**

Across all students, regardless of EL status, Kindergarten students in the intervention group scored higher than Kindergarten students in the comparison condition (ES = 0.47) in the i-Ready assessment. Inspection of subgroups revealed a significant positive effect on i-Ready scale scores favoring non-EL students in the intervention group (ES = 0.56), and a trend effect ($p = .051$) on DIBELS Composite scores favoring the same group (ES = 0.35). No impacts were found for ELs, except for a trend effect ($p = .074$) favoring EL students in the comparison group (ES = -0.46).

**First Grade Findings**

No effects were found on NWEA MAP Reading scores across all students or within subgroups of students. A trend effect ($p = .053$) was detected for LAS Links scale scores, favoring EL students in the intervention group (ES = 0.31).

**Section Summary**

Findings revealed evidence of promise for the LASErS program. Findings of the confirmatory analyses that included propensity-score-matched ELs only yielded positive impacts on EL students’ test scores in the First Grade rollout year, but not in the PreK and Kindergarten rollout years. Furthermore, findings of the exploratory analyses that included the entire student sample (non-ELs and ELs) suggested that LASErS had a positive impact on non-EL students but not on EL students.

These findings are limited in generalizability for the following reasons. First, the evaluation was limited in terms of the type of assessment used by the school district. These assessments may not have captured fully the domains that LASErS may be most impactful (e.g., oral discursive skills, critical thinking, problem-solving, creativity and innovation). Second, it was limited in terms of the consistency of assessments used across grade levels, making multi-year comparisons challenging. Third, the study was underpowered with only nine or 10 schools in the intervention condition.
### Table 8. Baseline Equivalence and Impact Analyses for EL Students

#### Baseline Equivalence

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Comparison</th>
<th>LASErS</th>
<th>Estimated Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N schools</td>
<td>N students</td>
<td>Pretest M</td>
</tr>
<tr>
<td>PreK: DIAL-4 Total</td>
<td>11</td>
<td>60</td>
<td>90.56</td>
</tr>
<tr>
<td>Motor</td>
<td>11</td>
<td>60</td>
<td>92.71</td>
</tr>
<tr>
<td>Concepts</td>
<td>11</td>
<td>60</td>
<td>88.36</td>
</tr>
<tr>
<td>Language</td>
<td>11</td>
<td>60</td>
<td>88.00</td>
</tr>
<tr>
<td>Kindergarten: DIBELS Composite</td>
<td>5</td>
<td>38</td>
<td>12.69</td>
</tr>
<tr>
<td>i-Ready Scale Score</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LAS Links Overall Scale Score</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>First Grade: NWEA MAP Reading</td>
<td>5</td>
<td>48</td>
<td>145.90</td>
</tr>
<tr>
<td>LAS Links Overall Scale Score</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

#### Impact Analyses

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Comparison</th>
<th>LASErS</th>
<th>Estimated Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N schools</td>
<td>N students</td>
<td>Posttest M</td>
</tr>
<tr>
<td>PreK: DIAL-4 Total</td>
<td>11</td>
<td>60</td>
<td>113.41</td>
</tr>
<tr>
<td>Motor</td>
<td>11</td>
<td>60</td>
<td>116.16</td>
</tr>
<tr>
<td>Concepts</td>
<td>11</td>
<td>60</td>
<td>110.03</td>
</tr>
<tr>
<td>Language</td>
<td>11</td>
<td>60</td>
<td>101.88</td>
</tr>
<tr>
<td>Kindergarten: DIBELS Composite</td>
<td>5</td>
<td>38</td>
<td>106.36</td>
</tr>
<tr>
<td>i-Ready Scale Score</td>
<td>5</td>
<td>31</td>
<td>332.70</td>
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<tr>
<td>LAS Links Overall Scale Score</td>
<td>5</td>
<td>38</td>
<td>391.91</td>
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<tr>
<td>First Grade: NWEA MAP Reading</td>
<td>5</td>
<td>48</td>
<td>162.55</td>
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<tr>
<td>LAS Links Overall Scale Score</td>
<td>5</td>
<td>48</td>
<td>415.09</td>
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### Table 9: Baseline Equivalence and Impact Analyses for All Students with Subgroups

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<tr>
<th>Outcome Measure</th>
<th>MODEL 1</th>
<th>Baseline Equivalence</th>
<th>MODEL 2</th>
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<td></td>
<td>All Students</td>
<td>Non-ELs</td>
<td>ELs</td>
</tr>
<tr>
<td></td>
<td>Comparison M (SD)</td>
<td>LASErS M (SD)</td>
<td>Coefficient (SE)</td>
</tr>
<tr>
<td>PreK:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIAL-4 Total</td>
<td>95.81 (15.45)</td>
<td>93.72 (15.61)</td>
<td>-2.09 (2.55)</td>
</tr>
<tr>
<td>Motor</td>
<td>93.03 (14.87)</td>
<td>92.66 (15.91)</td>
<td>-0.37 (2.57)</td>
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<tr>
<td>Concepts</td>
<td>93.42 (15.55)</td>
<td>91.78 (15.94)</td>
<td>-1.64 (3.02)</td>
</tr>
<tr>
<td>Language</td>
<td>94.11 (15.28)</td>
<td>91.77 (16.35)</td>
<td>-2.35 (3.09)</td>
</tr>
<tr>
<td>Kindergarten:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIBELS Composite</td>
<td>24.39 (10.87)</td>
<td>19.89 (20.27)</td>
<td>-4.00 (5.13)</td>
</tr>
<tr>
<td>i-Ready Scale Score</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>LAS Links Overall Scale Score</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>First Grade:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NWEA MAP Reading</td>
<td>152.33 (10.98)</td>
<td>150.99 (10.96)</td>
<td>-1.35 (2.49)</td>
</tr>
<tr>
<td>LAS Links Overall Scale Score</td>
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## Impact Analyses

### Outcome Measure

<table>
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<tr>
<th></th>
<th>MODEL 1</th>
<th></th>
<th></th>
<th>MODEL 2</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>All Students</td>
<td>Non-ELs</td>
<td>ELs</td>
<td>All Students</td>
<td>Non-ELs</td>
<td>ELs</td>
</tr>
<tr>
<td></td>
<td>Comparison M (SD)</td>
<td>LASErS M (SD)</td>
<td>Coefficient (SE)</td>
<td>P</td>
<td>Hedge's $g$</td>
<td>Comparison M (SD)</td>
</tr>
<tr>
<td>PreK:</td>
<td>(21 schools, 451 students)</td>
<td>[9 LASErS schools, 307 LASErS students]</td>
<td>(21 schools, 270 students)</td>
<td>[9 LASErS schools, 185 LASErS students]</td>
<td>(21 schools, 181 students)</td>
<td>[9 LASErS schools, 122 LASErS students]</td>
</tr>
<tr>
<td>DIAL-4 Total</td>
<td>113.03 (17.77)</td>
<td>114.78 (18.02)</td>
<td>1.75 (2.11)</td>
<td>0.417 0.10</td>
<td>112.49 (17.64)</td>
<td>115.12 (18.11)</td>
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<tr>
<td>Motor</td>
<td>114.12 (16.24)</td>
<td>113.80 (17.20)</td>
<td>-0.32 (2.19)</td>
<td>0.884 -0.02</td>
<td>114.46 (16.03)</td>
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<td>3.01 (1.95)</td>
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<td>112.73 (17.11)</td>
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<td>105.60 (18.26)</td>
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<td>4.75 (3.01)</td>
<td>0.130 0.25</td>
<td>107.48 (17.05)</td>
<td>112.57 (18.97)</td>
</tr>
</tbody>
</table>

### Kindergarten: (16 schools, 383 students) [8 LASErS schools, 256 LASErS students] (12 schools, 248 students) [4 LASErS schools, 162 LASErS students] (11 schools, 135 students) [7 LASErS schools, 94 LASErS students]  

|                          |                          |                          |                          |                          |                          |                          |
| DIBELS Composite         | 112.47 (57.53) | 125.75 (50.68) | 13.28 (7.55) | 0.100 0.25 | 113.41 (51.83) | 132.02 (53.65) | 18.62 (8.72) | 0.051 0.35 | 117.98 (58.90) | 93.49 (50.68) | -24.49 (12.67) | 0.074 -0.46 |
| i-Ready Scale Score      | 327.40 (25.82) | 339.68 (26.00) | 12.28 (5.27) | 0.038 0.47 | 325.28 (25.05) | 340.78 (28.86) | 15.51 (5.47) | 0.015 0.56 | 333.43 (26.87) | 322.40 (26.00) | -11.03 (8.63) | 0.225 -0.42 |
| LAS Links Overall Scale Score* | -- -- -- -- -- -- -- -- -- -- | -- -- -- -- -- -- -- -- -- -- | -- -- -- -- -- -- -- -- -- -- | -- -- -- -- -- -- -- -- -- -- | -- -- -- -- -- -- -- -- -- -- | -- -- -- -- -- -- -- -- -- -- |

### First Grade: (17 schools, 405 students) [9 LASErS schools, 266 LASErS students] (15 schools, 269 students) [9 LASErS schools, 178 LASErS students] (14 schools, 136 students) [9 LASErS schools, 88 LASErS students]  

|                          |                          |                          |                          |                          |                          |                          |
| NWEA MAP Reading         | 169.48 (15.24) | 170.71 (12.91) | 1.23 (2.87) | 0.675 0.09 | 171.34 (14.25) | 172.16 (13.21) | 0.83 (2.79) | 0.771 0.06 | 166.15 (15.83) | 169.70 (10.63) | 3.55 (2.48) | 0.173 0.28 |
| LAS Links Overall Scale Score* | -- -- -- -- -- -- -- -- -- -- | -- -- -- -- -- -- -- -- -- -- | -- -- -- -- -- -- -- -- -- -- | -- -- -- -- -- -- -- -- -- -- | -- -- -- -- -- -- -- -- -- -- | -- -- -- -- -- -- -- -- -- -- |

* Administered only to ELs in the spring semester
In this section, we explore relationships across program-readiness variables and elements of program implementation, by combining teacher/classroom data across the three rollout years (N=48 teachers). Only significant correlations are reported. The goal is to present a picture of how different facets of implementation work together to either strengthen or hinder successful implementation of LASERs.

Role of Program-Readiness

Science as a subject matter does not come naturally to early childhood educators (Davis, Petish, & Smithy, 2006). Teaching science, while also infusing language/literacy skill-building, requires careful examination of how ready schools and teachers are in accepting LASERs. Here, we examine intercorrelations among teacher program-readiness (attitudes toward science and LASERs as a program, perceived administrator support, the learning climate) and classroom implementation.

Attitudes toward Science

Teachers who rated science as being more beneficial to students and who were more open to science teaching were more likely to engage with EL families, rs(30)>.36, ps<.05, had more positive attitudes toward the LASERs program, rs(28)>.43, ps<.001, and rated themselves higher on LASERs Implementation, rs(28)>.51, ps<.05.

Teachers who rated science teaching as more challenging felt more stressed, r(28)=.57, p=.001, felt less efficacious implementing LASERs in the classroom, r(28)=-.39, p=.036, had less positive attitudes about the LASERs program, r(28)=-.38, p=.044, and rated themselves lower on LASERs implementation, r(28)=-.46, p=.011. In particular, PreK teachers who rated science teaching as more challenging had classrooms with lower observer ratings of the classroom social and emotional climate, r(4)= -.95, p=-.048 and student engagement in classroom activities, r(7)=-.81, p=.008. Moreover, Kindergarten teachers who rated science teaching as more challenging attended fewer PD training sessions, r(9)=-.73, p=.009.

Attitudes toward LASERs Programming

Teachers with more positive attitudes toward LASERs were more likely to engage with EL families, r(29)=.49, p=.005, felt more efficacious implementing LASERs, r(29)=.69, p<.001, and rated themselves higher on LASERs implementation, r(28)=.50, p=.005. In particular, PreK teachers with more positive attitudes toward LASERs received higher observer ratings in the ELLCO General Classroom Environment in spring, r(5)=.82, p=.025. Moreover, Kindergarten teachers with more positive attitudes toward LASERs received higher observer ratings on the Support for Scientific Learning, r(6)=.82, p=.012 and Student Engagement, r(6)=.86, p=.006 subscales of the LASERs Implementation Scale.
Administrator Support

PreK teachers who reported more support from administrators received higher ratings on the Support for Scientific Learning subscale of the LASErS Implementation Scale, \( r(5) = .80, \ p = .032 \).

Teacher Efficacy

Teachers who were feeling more efficacious about implementing LASErS in the classroom rated themselves higher on the LASErS Implementation Scale, \( r(28) = .61, \ p = .001 \). PreK teachers who reported feeling more efficacious about implementing LASErS in the classroom received higher observer ratings on the ELLCO Language and Literacy scale, \( r(5) = .77, \ p = .044 \).

Classroom Social and Emotional Climate

**Teacher-Reported Stress.** PreK teachers who reported greater stress received lower ratings on the Language-Rich Environment scale, \( r(7) = -.81, \ p = .008 \). Teacher self-reported stress did not correlate with observer ratings of the social and emotional climate.

**Observer Ratings.** Higher observer ratings of the classroom social and emotional climate, assessed by the CHILD Observation Tool, were associated with higher observer ratings on the LASErS implementation scale, \( r(15) = .75, \ p = .001 \) and in PreK, and higher ratings of the ELLCO General Classroom Environment Scale, \( r(6) = .96, \ p < .001 \). In PreK, higher observer ratings of the classroom social and emotional climate were associated with higher teacher ratings of student engagement, \( r(4) = .99, \ p = .013 \). Moreover, the higher the observer rating of the classroom social and emotional climate, the less likely PreK teachers found LASErS to be challenging, \( r(4) = -.95, \ p = .048 \).

Role of Professional Development Training and Coaching

LASErS, aimed at promoting language and literacy by building around science as a subject matter, required specialized training in both language/literacy skill-building as well as scientific knowledge and thinking, thus making PD and coaching essential to ensure successful implementation. Here, we explore associations among LASErS PD attendance, teacher perceptions of coaching quality, program-readiness, and classroom implementation.

Teachers who attended more PD trainings were less likely to find science challenging, \( r(17) = -.55, \ p = .016 \), and reported greater efficacy \( r(28) = .38, \ p = .036 \) and more positive attitudes toward LASErS, \( r(28) = .49, \ p = .006 \). Teachers who attended more PD trainings also reported higher coaching quality, \( r(28) = .57, \ p = .001 \). Moreover, PreK teachers who attended more PD trainings reported greater stress, \( r(7) = .73, \ p = .029 \). Kindergarten teachers who attended more PD trainings received higher observer ratings on LASErS Implementation in the Classroom, \( r(6) = .73, \ p = .041 \), particularly for the Engagement subscale, \( r(6) = .81, \ p = .015 \).

Teachers who rated coaching quality higher found science teaching to be more beneficial, \( r(29) = .52, \ p = .003 \), less challenging, \( r(14) = -.50, \ p = .047 \), and were more open to science as a viable approach to fostering language skills, \( r(20) = .49, \ p = .020 \). Teachers who rated coaching quality higher also had more positive attitudes toward the LASErS program, \( r(29) = .84, \ p < .001 \), reported greater efficacy
implementing LASErS, $r(29)=.69$, $p<.001$, and rated themselves higher in LASErS implementation, $r(28)=.39$, $p=.034$.

Section Summary

In this section, we explored how program-readiness, program inputs (PD and coaching), and classroom implementation were interrelated.

Importance of Program Readiness

We found that teacher attitudes toward science (as a subject matter) as well as attitudes toward LASErS (as a program) were important to consider because they were associated with how comfortable, efficacious, and effective teachers felt about implementing LASErS. These findings suggest that efforts to help teachers understand and appreciate the importance of science and its connections to other facets of child development and learning need to be addressed to ensure successful program implementation. School leadership and the social-and-emotional learning climate, likewise, were essential building blocks because of their associations with the quality of implementation. When teachers perceived the school to be supportive of the LASErS program, and when the social and emotional learning climate was conducive, teachers were better able to facilitate a language-rich environment, support scientific learning, and engage students in the learning process.

Importance of PD and Coaching

We found that PD attendance was associated with teachers finding science as less challenging, having more positive attitudes toward the program, feeling more efficacious implementing LASErS and actually implementing it with greater fidelity. Receiving high-quality coaching was also beneficial.
Conclusion and Recommendations

Summary of Findings

Based on effective practices to promote early scientific thinking and language development, LASErS is a promising program that addresses the academic needs of young ELs. Schools were offered high-quality professional development opportunities and coaching supports, and engaged with school-based family events. The LASErS Leadership Alliance offered useful feedback and support to ensure that the program was as effective as possible.

Implementation Fidelity

LASErS met the threshold for fidelity in two of its four core components. Assessing the implementation of the four core components of LASErS—Professional Development (PD), Coaching, Family Engagement, and the Leadership Alliance—revealed challenges in the areas of participant attendance in PD training sessions and commitment to coaching supports. The Grantee had been responsive to address implementation challenges in these areas. In spite of this, data from classroom observations revealed variability in the quality of implementation of LASErS, which may be attributed to various “program-readiness” factors (teacher attitudes and beliefs about science and the LASErS program itself, teacher efficacy, administrative support, and learning climate).

Impact on Student Achievement

Results of the confirmatory analyses that focused on propensity-score-matched ELs demonstrated positive impacts on ELs’ test scores in the First Grade rollout year, but not in the PreK and Kindergarten rollout years. Results of exploratory analyses that included both ELs and non-ELs, however, revealed that LASErS had a positive impact on non-EL students but not on ELs in PreK and Kindergarten. These findings are tentative given the study’s limitations, which are discussed in the next section.

Discussion

Root Causes of Implementation Challenges

ELs’ language development will improve to the extent that the learning environment supports it (Ballantyne, Sanderman, & Levy, 2008; Dickinson & Tabors, 2001). The maximal benefits of LASErS to young ELs was eclipsed by variability in implementation resulting from competing priorities, high stress levels, and misalignment with district pedagogical practices. Based on observations, survey data, and interviews with various stakeholders, the root of implementation challenges were three-fold: subject matter difficulty, inherent challenges with the target population (ELs), and a mismatch between LASErS pedagogical approach and the learning climate in the schools.
Science as a Challenging Subject. Science is inherently a difficult subject to teach and learn, and it is not emphasized in preschool and in the early elementary grades (Davis et al., 2006). New teachers of younger students have a cursory understanding of science, lack academic preparation in science, feel inefficacious about teaching early science, and spend less time teaching science (Davis et al., 2006; Greenfield et al., 2009). In our study, in spite of teachers’ generally positive attitudes toward science, observations of LASERs implementation revealed that teachers could still improve in supporting scientific learning in the classroom, which can be addressed with effective coaching.

Inherent Challenges with Engaging ELs. Not only are teachers of younger grades unprepared to teach science, they are also unprepared to engage diverse learners such as ELs in science (Davis et al., 2006). More American educators are finding themselves teaching ELs. ELs face the arduous task of learning a new language while also honing their home language, making it a unique challenge in American education that most teachers are unprepared to address. ELs need teachers who are flexible and possess a pluralistic language orientation (Gámez, 2015; Penington & Salas, 2016). In our study sample between only one and three teachers across PreK to First Grade spoke a language other than English.

Exacerbating the language barrier is the silent struggle ELs face. In the mainstream classroom, ELs often exhibit anxiety, withdrawing from social interactions that stem from their sense of efficacy in communicating in English (Pappamihiel, 2002). This leaves ELs both neglected and overlooked by teachers who likely fail to notice internalizing behaviors or subtle overtures for assistance. The challenge is that ELs need intentional language supports (Hoisington, Young, Anastasopoulos, & Washburn, 2015a, b), yet teachers fail to notice ELs when they attempt to communicate their needs. Our evaluation of the LASERs program showed that this is the case in many classrooms we observed.

Mismatch between Programmatic Approach and Learning Climate in Schools. Strict adherence to curriculum and disregarding student interests in teaching science pose a major problem in science instruction (Davis et al., 2006). This instructional approach also poses problems in language instruction. Developing language skills is more likely to occur when teaching is child-centered than when it is adult-centered (Burchinal et al., 2008). This is especially true for low-income children (Huffman & Speer, 2000) and for ELs who need individualized attention (Bear & Smith, 2016; Buysse, Castro, & Peisner-Feinberg, 2010). Child- (or student-) centered means children lead the lesson’s flow, and instruction is tailored to each child’s unique developmental and sociocultural needs (Kostelnik, Soderman, & Whiren, 2011). Data from classroom observations revealed that the pedagogical approach in the LASERs classrooms was highly regimented and teacher-driven. Given the district’s prescriptive approach to implementing curricula, teachers in our sample found it challenging to implement LASERs with high quality, which may have resulted in higher levels of teacher stress that was observed. Teacher job stress adversely affects both teachers (poor health, increased turnover, low performance) and students (lower achievement, more likely to be expelled) (Gilliam, 2005; Greenberg, Brown, & Abenavoli, 2016). This may be problematic for at-risk students such as ELs, who need individualized learning supports and settings that promote a warm and consistently responsive atmosphere that celebrates diversity and focuses on ELs’ strengths (Bear & Smith, 2016; Dutro, Nuñez, & Helman, 2016; US DHHS & ED, 2016).

Study Limitations

As a development grant, the intervention was delivered to a limited number of schools (11 in the first rollout year, and 9 the following years), and the evaluation’s design and scope were limited
to a quasi-experimental design with student achievement data drawn from district-collected test scores. The study was severely underpowered given the small sample size and also given the low survey response rate (50%-75%). Moreover, the student achievement assessments may not have directly assessed the domains that LASErS impacted directly. For example, oral discourse skills and scientific thinking skills, such as creative thinking and problem-solving skills, are often not part of a district’s priority areas for assessment. LASErS may have also benefitted the communicativeness of students with special needs, as suggested anecdotally from some parents. Finally, the district used different assessments from year to year, making it difficult to assess the impact of LASErS across the years. For these reasons, the findings of this evaluation are tentative.

Recommendations for Program Quality Improvement

The Grantee has undergone an iterative and intensive program development of LASErS over four years. What was striking about its implementation in the school district was the need to first address program-readiness. Strong buy-in and commitment at the principal level were needed to set the tone for prioritizing LASErS in teachers’ daily classroom instruction. In addition to school-level support, teachers also needed to value science as a path to language and other developmental outcomes, be comfortable in teaching science, and feel efficacious implementing LASErS by improving their knowledge and skills. Future PD training sessions may have to devote a significant amount of time on boosting program-readiness to ensure successful implementation. PD training may also need to be separate training sessions for teachers and coaches so that certain aspects of program delivery can be emphasized more, depending on the audience.

Second, the Grantee has to directly address the inherent challenges to science instruction and language promotion. With very little time to plan for lessons, teachers needed more concrete, intentional supports for teaching science as well as for promoting language interactions. For instance, teachers may benefit from several actual lesson plans that demonstrate how the various science topics can be implemented and extended, and how they are tied to district curricular standards. Teachers may also benefit from finding concrete ways of promoting language instruction for ELs (see Hoisington et al., 2015a, b). One strategy is to analyze more videotapes of high-quality science instruction and language interactions, which is a powerful teaching strategy because it is concrete and allows teachers to reflect on important strategies that they can try on their own.

Third, the Grantee has to devise innovative strategies that intentionally and meaningfully incorporate the unique language, learning, and situational needs of ELs (and their families) into the program. Based on observation data from this study, EL students were “lost” as the central focus of the program at times. This may result from current teaching strategies that operate on assumptions made about general student learning and engagement. The situation of diverse language learners is unique. New immigrants who come from lower-income and linguistically isolated neighborhoods that experience discrimination feel unwelcome or uncomfortable in academic spaces (Barrueco, Smith, & Stephens, 2015). Moreover, a new study showed that parents of early elementary school students reported inconvenient meeting times and the inability to get off from work as primary barriers to school engagement (Redford, Huo, & McQuiggan, 2019). Parents of ELs are more likely to experience these barriers. Developing innovative ways to engage ELs and their parents therefore have to be explored. For instance, will EL families feel less marginalized when avenues for program participation better reflect their cultural identities (e.g., family-friendly multicultural events held at nonformal settings where EL families are most likely to belong)? How can science be more accessible and less intimidating to families with limited oral and reading skills? According to the district, schools are re-thinking family engagement because of LASErS. Going forward, LASErS needs to intentionally address barriers in EL family engagement to ensure that this target group is not glossed over.
Fourth, given the complexity of coaching challenges in the district, the Grantee may need to rethink its coaching component. How can EDC provide the needed coaching supports to teachers when there is no strong coaching infrastructure? In addition to the district’s own efforts to infuse LASErS in its PD training, finding a LASErS “champion” in the district (identified by experiences with successful LASErS teachers) who could provide preliminary coaching or modeling of a lesson in the classroom may be a potential strategy. Moreover, teachers may find it convenient to engage in an online learning platform that can be designed to build a community of learners where teachers can share their successful strategies or provide feedback to other teachers with implementation challenges.

**Conclusion**

Using a multi-method approach, we examined both the extent to which LASErS was implemented-as-intended and the degree to which LASErS had an impact on student achievement. Overall, given the variability in implementation fidelity, LASErS shows evidence of promise. LASErS can continue to improve if it addresses the implementation challenges identified in this evaluation in future iterations of the program.
References


Jones, E. (2012). The emergence of emergent curriculum. YC Young Children, 67(2), 66-68.


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## MEASURING FIDELITY OF IMPLEMENTATION

### Key Component 1: PD for LASERs Teachers and Coaches (Rollout Year for each Grade Level)\(^1\)

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Operational Definition of Key Indicator</th>
<th>Unit-Level (Program) Implementation Score Criteria</th>
<th>PreK (SY 2015-2016)</th>
<th>Kindergarten (SY 2016-2017)</th>
<th>First Grade (SY 2017-2018)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indicator 1:</strong> PD sessions conducted each years for rollout for new teachers</td>
<td>Program conducts 8 PD sessions (4 sessions x 2 modules) Data Source: Scheduled PD event invitation sent to Evaluator</td>
<td>Low (0): 0-2 PD sessions conducted by program Mod (1): 3-6 PD sessions conducted by program High (2): 7-8 PD sessions conducted by program -- Adequate Fidelity at Program Level = 1; program conducts at least 7 PD sessions (score of 2) Low Fidelity at Program Level= 0; program conducts fewer than 7 PD sessions (score of 0)</td>
<td>7 sessions offered (1 PD cancelled due to scheduling challenges with district)</td>
<td>8 sessions offered</td>
<td>8 sessions offered</td>
</tr>
<tr>
<td><strong>Indicator 2:</strong> PD sessions attended (rollout year for each of 3 grades)</td>
<td>New LASERs teachers and coaches attend 8 PD sessions Data Source: Attendance</td>
<td>Low (0): 0-2 sessions attended by each teacher/coach Mod (1): 3-6 sessions attended by each teacher/coach High (2): 7-8 sessions attended by each</td>
<td>Teachers: 7/9 (78%) scored 2 Coaches: 3/9 (33%) scored 2</td>
<td>Teachers: 5/9 (56%) scored 2 Coaches: 3/9 (33%) scored 2</td>
<td>Teachers: 6/9 (67%) scored 2 Coaches: 4/9 (44%) scored 2</td>
</tr>
</tbody>
</table>

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\(^1\) Measured three times once for every rollout year (Rollout year for PreK program is 2015-16; roll-out year for Kindergarten program is 2016-17; roll-out year for Grade 1 program is 2017-18)
<table>
<thead>
<tr>
<th>Indicators</th>
<th>Operational Definition of Key Indicator</th>
<th>Unit-Level (Program) Implementation Score Criteria</th>
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<th>Kindergarten (SY 2016-2017)</th>
<th>First Grade (SY 2017-2018)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>sheets for LASerS teachers and coaches collected by Grantee (end of each session)</td>
<td>teacher and coach -- Adequate Fidelity at Program Level = 1: at least 80% of teachers and coaches attend at least 7 PD sessions (score of 2) Low Fidelity at Program Level = 0: fewer than 80% of teachers and coaches attend at least 7 PD sessions (score of 0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Implementation Score</td>
<td>0 (Low) Inadequate fidelity</td>
<td>0 (Low) Inadequate fidelity</td>
<td>0 (Low) Inadequate fidelity</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total score for implementation of PD at program-level**

Range for Total Score: 0-2 (2 indicators)

- Indicator 1 = 1
- Indicator 2 = 0

| Total Score = 1 | Total Score = 1 | Total Score = 1 |

**Threshold for Adequate Implementation of PD at Sample Level**

| Fidelity at the program level = 2 | Failed to meet threshold | Failed to meet threshold | Failed to meet threshold |
## Key Component 2: Coaching

This component’s fidelity could not be measured (see results section of report for details on coaching).

## Key Component 3: Family Engagement

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Operational Definition of Key Indicator</th>
<th>Unit-Level (Program) Implementation Score Criteria</th>
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<th>Kindergarten (SY 2016-2017)</th>
<th>First Grade (SY 2017-2018)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indicator 1:</strong> Home activities and science literacy kits</td>
<td>Availability of home science and literacy kits</td>
<td>Low (0): No kits were distributed by Grantee to schools</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Source: Grantee documents number of kits distributed at the end of each rollout year</td>
<td>High (1): All assigned kits were distributed by Grantee to schools</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Implementation Score</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Indicator 2:</strong> Scheduled summer family events</td>
<td>Grantee e-mail notification of event to Evaluator (every occurrence)</td>
<td>Low (0): No event scheduled</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High (1): Event scheduled</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Implementation Score</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total score for implementation of Family Supports at Sample Level</strong></td>
<td></td>
<td>Indicator 1 = 1</td>
<td></td>
<td>Indicator 1 = 1</td>
<td>Indicator 1 = 1</td>
</tr>
<tr>
<td>Range for Total Score: 0-2 (2 indicators)</td>
<td>Indicator 2 = 1</td>
<td>Indicator 2 = 1</td>
<td>Indicator 2 = 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Score = 2</td>
<td>Total Score = 2</td>
<td>Total Score = 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Threshold for Adequate Implementation of PD at Sample Level</strong></td>
<td>Fidelity at the program level = 2</td>
<td>Meets threshold</td>
<td>Meets threshold</td>
<td>Meets threshold</td>
<td></td>
</tr>
</tbody>
</table>
## Key Component 4: Leadership Alliance

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Operational Definition of Key Indicator</th>
<th>Unit-Level (Program) Implementation Score Criteria</th>
<th>PreK (SY 2015-2016)</th>
<th>Kindergarten (SY 2016-2017)</th>
<th>First Grade (SY 2017-2018)</th>
</tr>
</thead>
</table>
| **Indicator 1:** Facilitation of working group meetings | Grantee provides minutes of meeting (notes) | **Low (0):** No meeting minutes provided to Evaluator  
**High (1):** Meeting minutes sent to Evaluator | | | |
| | Data Source: Minutes of meetings obtained from Grantee (every occurrence) | Implementation Score | 1 | 1 | 1 |
| **Total score for implementation of Family Supports at Sample Level** | | | | | |
| **Range for Total Score:** 0-1 (1 indicator) | | | | | |
| Threshold for Adequate Implementation of PD at Sample Level | Fidelity at the program level = 1 | | Meets threshold | Meets threshold | Meets threshold |