MASSACHUSETTS PRESCHOOL EXPANSION GRANT (PEG)

Year 4 Final Evaluation Report

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Executive Summary

In late 2014, the Massachusetts Department of Early Education and Care (EEC) was awarded a federal Preschool Expansion Grant (PEG) to support the expansion of high-quality early childhood education in Massachusetts to four-year-old children from low-income families. Although the Massachusetts PEG model supported and encouraged local program development and adaption, PEG programs were expected to implement 13 quality elements (Exhibit E.1).

Exhibit E.1. PEG Model Quality Elements

1.	A collaborative local governance structure designed to oversee implementation and work on systems coordination for all children in the community;
2.	Full-day, full-year programming (at least 8 hours/day, 12 months/year);
3.	A maximum class size of 20;
4.	A maximum child-teacher ratio of 10:1;
5.	A curriculum/a aligned with the MA Preschool Standards and Guidelines (curriculum/a may vary by grantee);
6.	The use of Teaching Strategies Gold® as a formative assessment tool;
7.	One educator in each classroom with a bachelor's degree in a relevant field;
8.	Salaries for all educators commensurate with comparable positions in public schools within the respective community;
9.	Professional development training and coaching for teaching staff, and other supports for planning and implementation of curriculum, in collaboration with the LEA;
10.	Family engagement activities, including support for kindergarten transition and resources about child development;
11.	Comprehensive services including services addressing health, mental health, and behavioral needs for all families;
12.	Inclusion of students receiving special education support; and
13.	Efforts to build linkages with services for children from birth to age 3 as well as connections with elementary schools.

The PEG evaluation, conducted by Abt Associates, looked at the implementation of the PEG program, outcomes for educators, classrooms, families, and children, and impacts on children's skills. The evaluation also examined the cost of PEG implementation.

The PEG program had a clear model for what high quality instruction and learning environments should look like to achieve the desired outcomes for children and families. The combination of adequate funding, strong state and local involvement and support, and programs with a history of strong leadership and community ties likely contributed to strong evidence of program effectiveness in the context of substantial local variation in the content and modes of delivery of program inputs.

The evaluation found that programs met basic expectations for all of the 13 quality elements.

- All of the PEG programs instituted collaborative decision-making structures (Quality Element 1).
- All of the PEG programs provided the structural inputs such as class size, staff-child ratio, length of program day and year, formative assessment and educator salaries, with virtually no local variation in implementation (Quality Elements 2 - 8).
- All of the PEG programs invested in intensive professional development for educators, including both lead teachers and assistants (Quality Element 9); there was local variation in the content and delivery of these supports.
- All of the PEG programs provided supports for vulnerable families (Quality Elements 10 - 13). There was local variation in the content and delivery of these supports.

The PEG evaluation focused intensively on measuring the implementation of two of the quality elements—supports for educators and supports for families. Educator supports are important mediators of classroom quality, which is a key mediator of positive outcomes for child learning and development. Family supports are key mediators of family well-being and involvement in their child's education, which can also contribute to positive child outcomes.

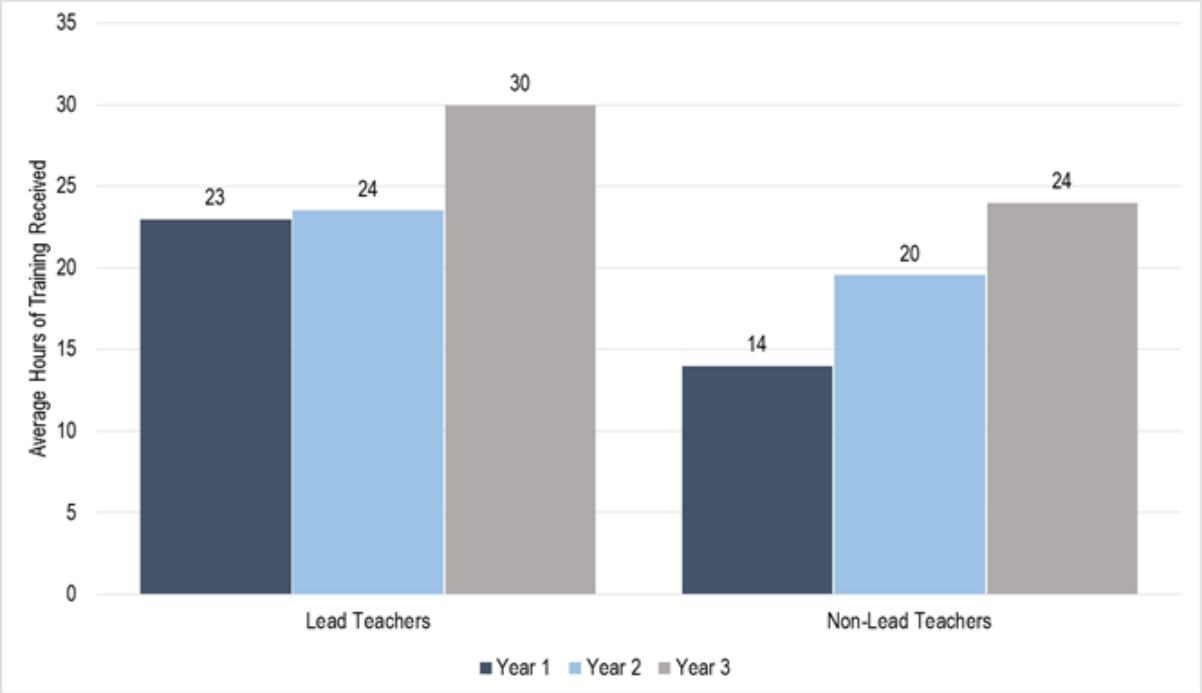
Educator Supports

PEG teachers were paid salaries commensurate with comparable teaching positions in public schools within their respective communities. These salaries were substantially higher than the salaries typically paid to teachers in community-based early childhood programs. It is important to note that despite the higher salaries, only half of PEG teachers reported being satisfied with their compensation levels.

All of the participating districts and programs worked to build the instructional capacity of PEG teachers through multiple job-embedded professional learning opportunities, including training and coaching, and paid release time for instructional planning and collaboration. Over the four years of implementation, the supports for educators increased in amount and in the broader inclusion of all classroom staff and not solely lead teachers.

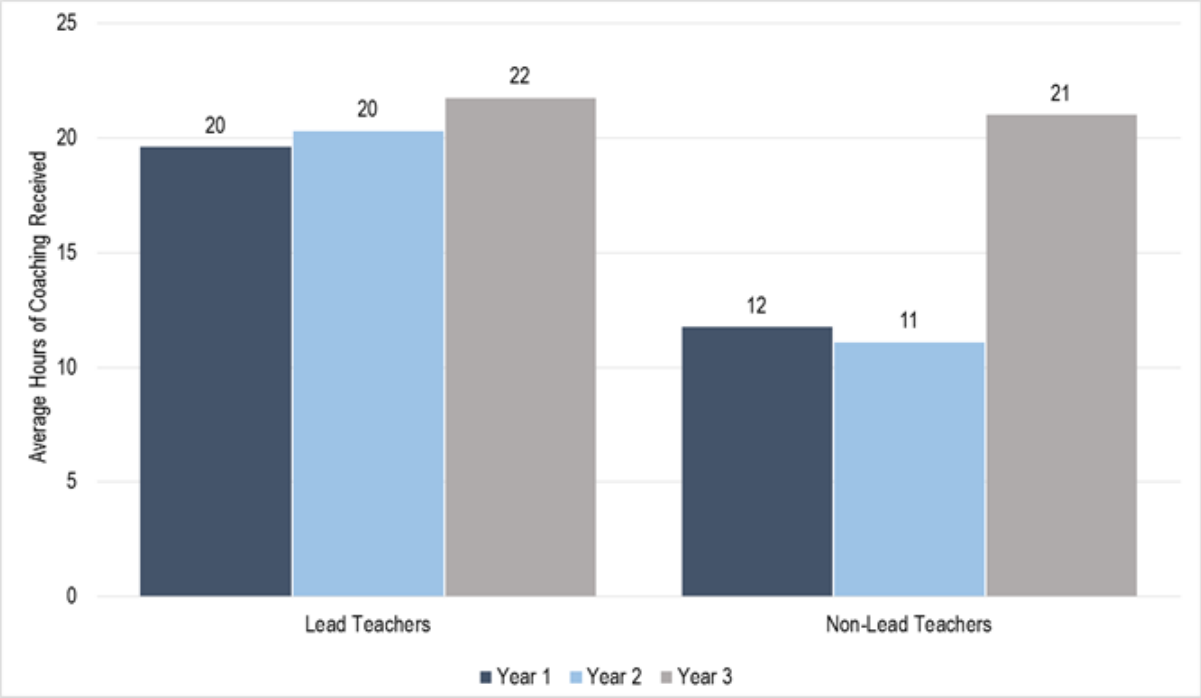
PEG lead teachers reported receiving a substantial amount of training; on average, teachers reported receiving an average of almost 3 full days of training (23 hours) in the first year of the program, which increased to an average of almost 4 days (30 hours) by the third year (Exhibit E.2). Assistant teachers reported receiving fewer hours of professional training, although an average of 14 hours in the first year increased to 3 days by the end of the third year. The two topic areas that at least half of teachers reported that was "very effective" were supporting children's socio-emotional development/behavior and on engaging families. Overall, the proportion of teachers who reported the PEG professional training was useful increased from 64 percent in the second year of the program to just over 80 percent in the third year of the program.

Exhibit E.2. Hours of Training Received by PEG Lead and Non-Lead Teachers, Years 1-3



A second form of professional supports was coaching, primarily provided by coaches employed by the public school districts. Lead teachers reported receiving about 2.5 days of coaching per year in each of the first three years of the program. Although initially non-lead PEG teachers received substantially fewer hours of coaching compared to lead teachers (1.5 days on average), by the end of Year 3, non-lead teachers received closer to the same amount of coaching as lead teachers (Exhibit E.3). The highest proportion of teachers reported that they received coaching on general instructional content and supporting children's socio-emotional development. Overall, the majority of teachers found the PEG coaching to be useful, with the percentage rising from 75 percent in the second year of the program to 81 percent in the third year of the program.

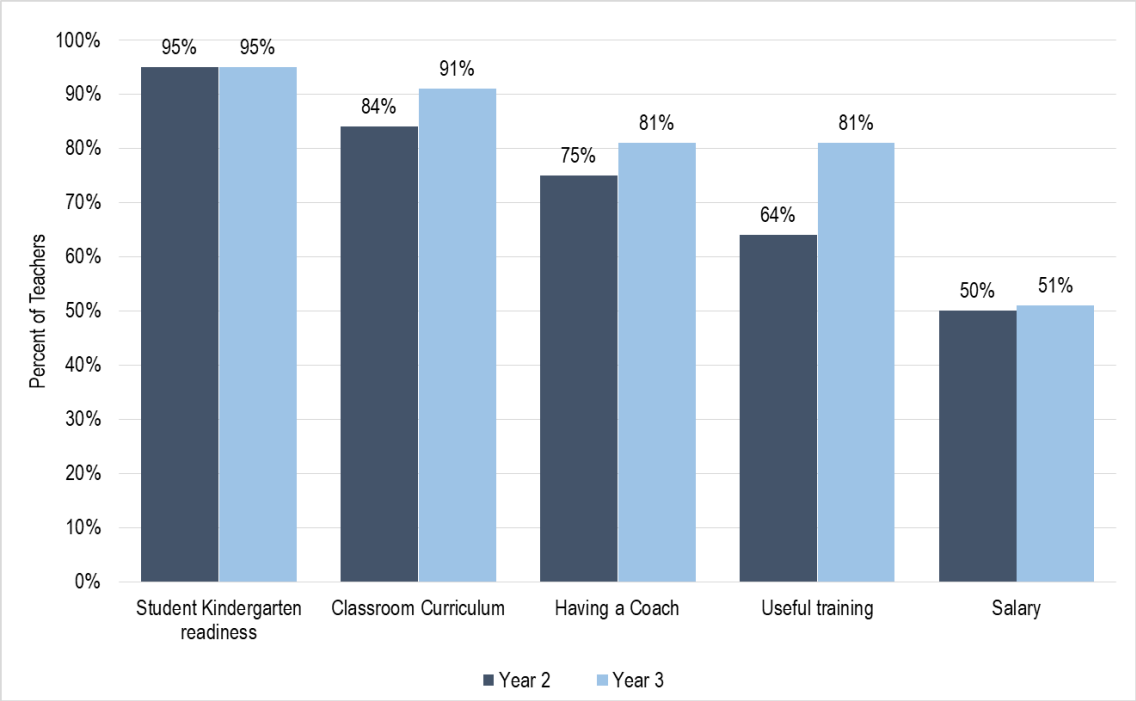
Exhibit E.3. Hours of Coaching Received by PEG Lead and Non-Lead Teachers, Years 1-3



A third form of professional support provided to PEG teachers was paid release time for planning. Lead teachers and non-lead teachers reported receiving on average two hours of paid release time per week in the first year of the program, which increased to nearly 3 hours of paid release time for lead teachers and 2.4 hours of paid release time for non-lead teachers.

Almost all PEG teachers were satisfied with the outcomes of their students and classroom curriculum, and most teachers were satisfied with the professional supports they received (Exhibit E.4). There is no definitive evidence in the field about a threshold level of professional supports for teachers that is associated with higher program quality. The PEG evaluation did find that the amount of training and coaching received by the PEG teachers was substantially higher than that received by non-PEG teachers in subsidy funded early childhood programs that also served low-income children.

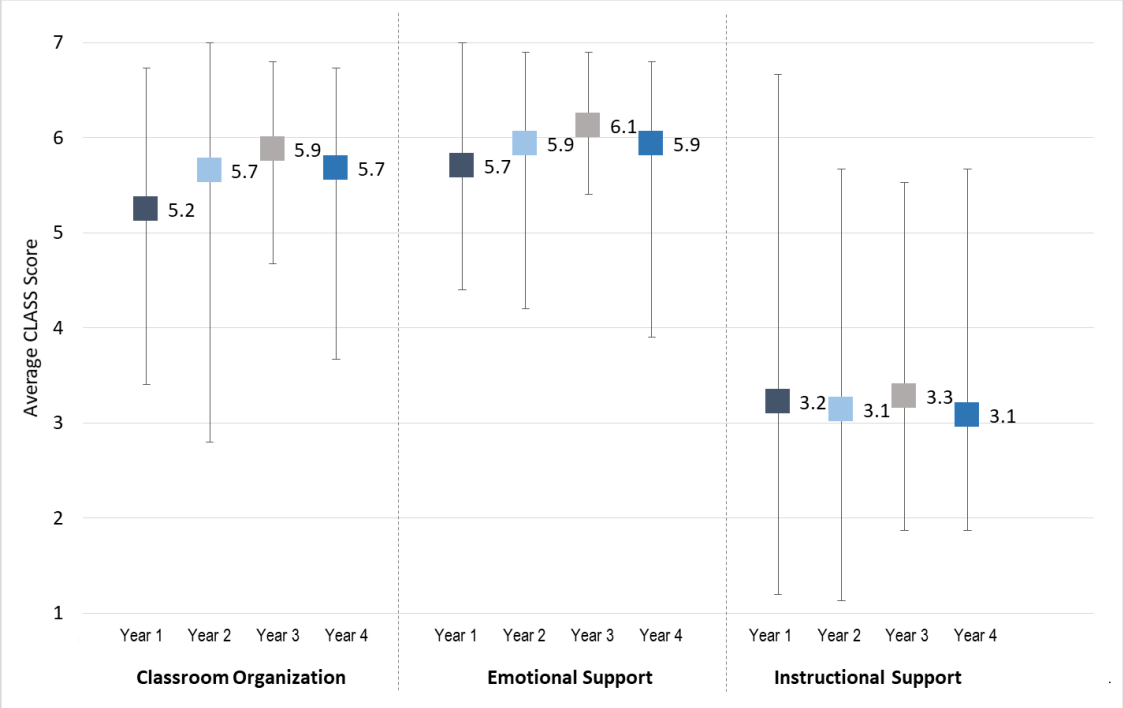
Exhibit E.4. PEG Lead Teacher Satisfaction with Aspects of Job, Years 2-3



Classroom Quality

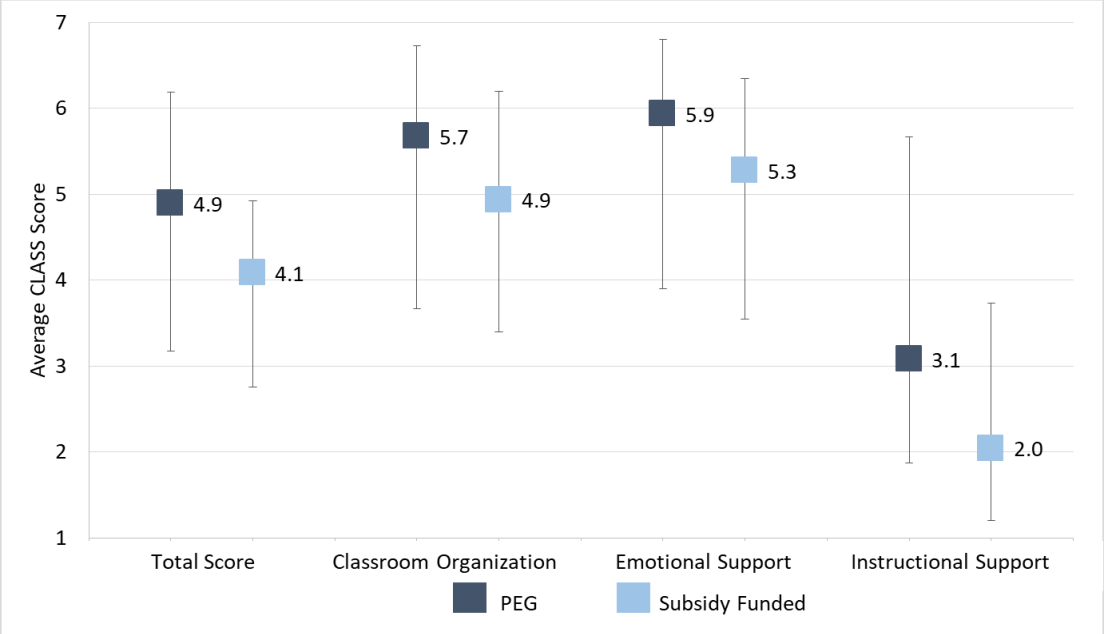
Instructional quality in PEG classrooms was measured using the Classroom Assessment Scoring System (CLASS), which focuses on interactions between teachers and students in the classroom. For two of the domains of the CLASS, Classroom Organization and Emotional Support, average PEG classroom scores were in the moderate to high range during all four years of the program and furthermore, scores improved significantly from Year 1 to Year 4 (Exhibit E.5). For the third domain, Instructional Support, PEG classroom scores were in the moderate range during all four years, and there was no significant change in scores over time.

Exhibit E.5. Average PEG CLASS Scores for All 47 Classrooms, Years 1-4



In addition, CLASS observations were conducted in 20 non-PEG (subsidy funded) classrooms in community-based centers overseen by the same agencies and communities as the PEG classrooms. The subsidy funded classrooms were chosen to be as similar to PEG classrooms in terms of types of children served; the two sets of programs differed primarily in the resources and supports provided to programs and educators in the PEG programs. The average total and domain CLASS scores were significantly higher for the PEG classrooms than the comparable subsidy-funded classrooms ($p<.05$) (Exhibit E.6).

Exhibit E.6. Average CLASS Total and Domain Scores for PEG and Comparable Subsidy Funded Classrooms, Year 3



Notes. MA PEG-funded sample=47 classrooms; MA subsidy-funded sample=20 classrooms. Each square shows the average score across classrooms on the CLASS 1-7 scale, and the vertical lines show the range between the minimum and maximum individual classroom score in that group. For example, the first two boxes show that, on average, PEG classrooms across Massachusetts scored 4.9 out of 7 points on the total CLASS score, with seven representing the highest observed quality, while subsidy-funded classrooms scored 4.1 out of 7 points.

Family Supports and Outcomes

In addition to providing resources and supports to educators and programs to support high-quality instruction for PEG children, PEG also engaged families in the program and their children's education as a way to help parents understand how to support and extend at home what their children were learning. This work with parents represents a second pathway to improved outcomes for children, in addition to their experiences in the PEG program. Family engagement activities included parent-teacher conferences, home visits, newsletters, regular parent coffees, and enhanced programming for family events that moved away from more traditional (often holiday-themed) celebrations to more focused programming intended to increase parents' capacity to support their children's learning. Many PEG programs incorporated home visits into their approach as well in order to build relationships and better understand children's needs.

PEG also provided comprehensive health and social services to families through a combination of program and referral-based staff, including linking parents and children to services in community agencies and in some cases providing services on-site, especially mental health support services. Finally, PEG programs offered kindergarten registration events that aligned with and/or were hosted by the public school district.

PEG parents did not appear to change their attitudes or behavior with their children from the beginning to the end of the PEG program. The majority of parents felt very connected to the PEG program at the beginning and at the end of the program. Overall, there was no significant change to PEG families' social connections during the preschool year, in terms of meeting socially with others or having regular conversations with neighbors and adults at their child's school. There was also no change in parents' levels of self-efficacy and expectations for how far their child would progress in school at the beginning and end of the preschool year.

On the other hand, there were changes in family economic outcomes from the beginning to the end of the PEG program, perhaps because the PEG program offered full-time, full year no-cost programming, which allowed parents to have more consistent and full-time employment. The average family income was significantly higher at the end of the year than at the beginning ($p<.05$), although a very small proportion (3-4%) of family incomes were above $50,000 at either time point. Father employment status was also significantly higher at the end of the PEG year, and families reported more job stability. These improvements in family economic status provide children with more protective factors and may contribute to long-term benefits and outcomes for both parents and children beyond the scope of this evaluation.

Children's Skills: Program Impact and Longitudinal Outcomes

Three separate studies examined PEG children's outcomes. The *Regression Discontinuity Design (RDD) Study* found that PEG had a positive and statistically significant impact on children's early literacy and early math achievement and on vocabulary comprehension. The largest impact was on children's early literacy skills and the smallest effect was on vocabulary development. PEG did not appear to have a significant impact on children's executive function skills, although the evaluation only measured two specific skills within this larger domain (Exhibit E.7). PEG impacts were larger for children whose home language was not English and children who did not have any formal child care experience before entering the PEG program (Exhibit E.8).

Exhibit E.7. PEG Impact on Child Outcomes (in Standard Deviations)

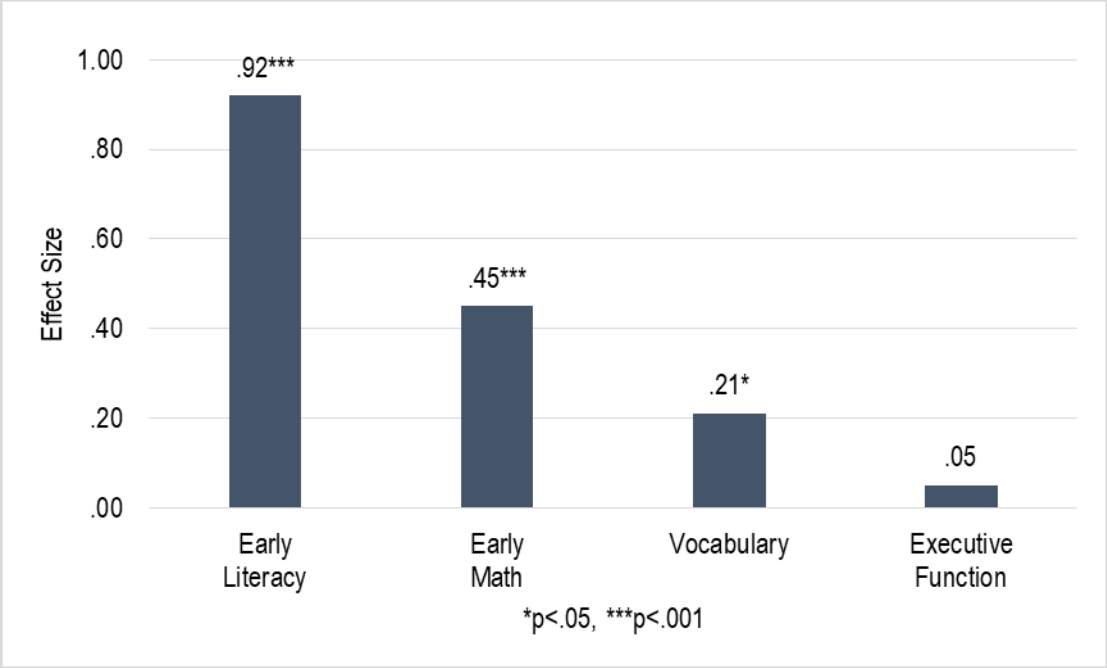
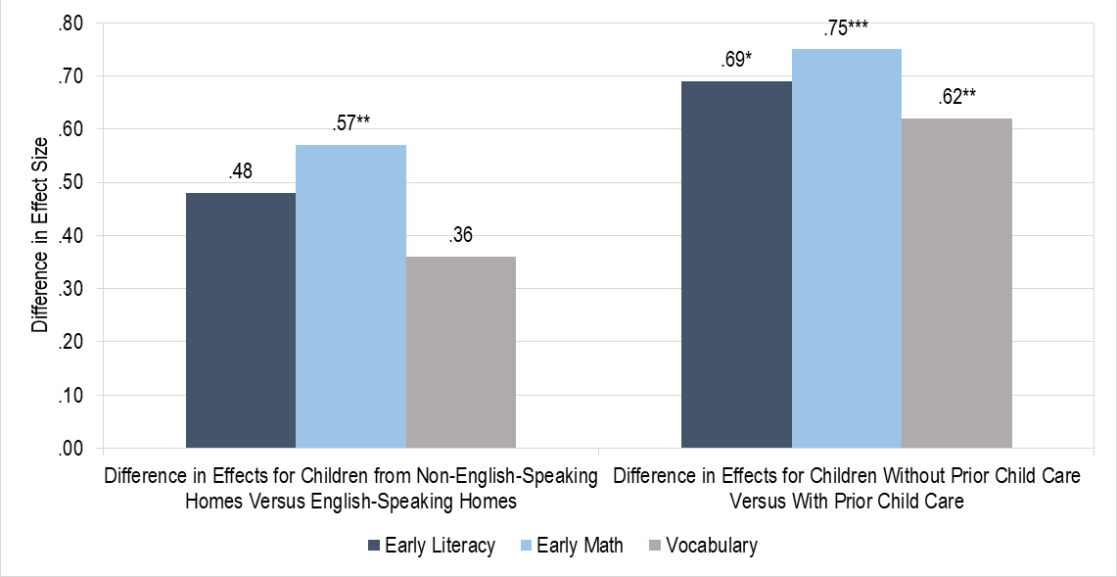


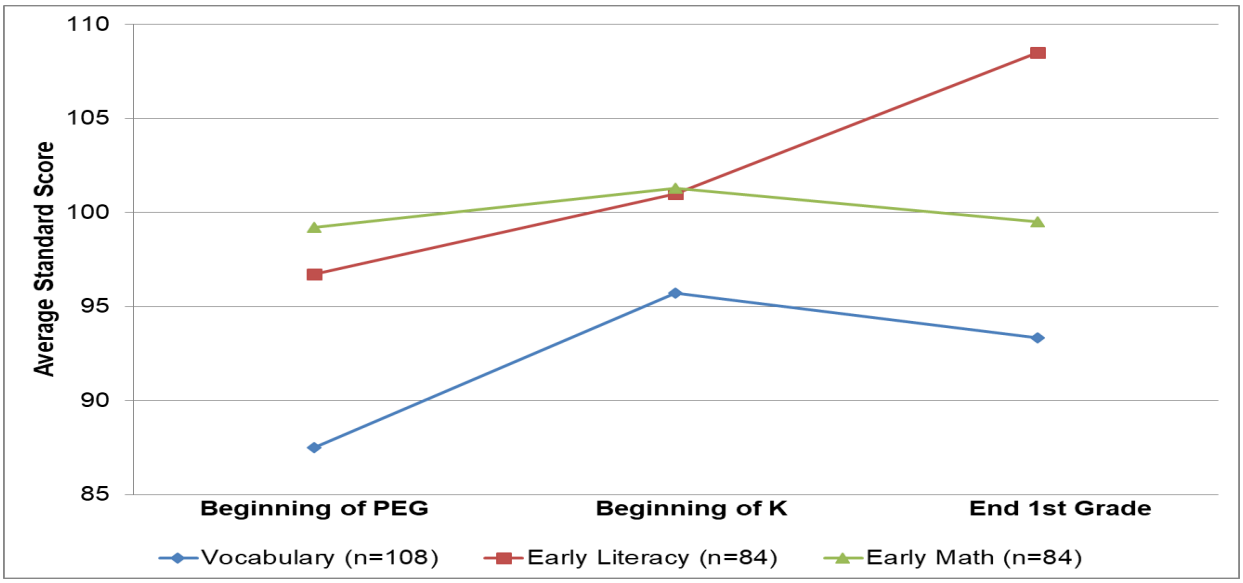
Exhibit E.8. Difference in PEG Impact by Subgroup



Of note, the impacts of PEG are very similar in size to the the effects of other (primarily public school based) pre-kindergarten programs studied using the same design (RDDs) on children's early literacy and math achievement, although the effects on vocabulary achievement are smaller for PEG. The effect sizes for the impact of PEG on children's early math and literacy skills are considerably larger than a meta-analysis of over 300 effect sizes from 38 evaluations of center-based early childhood education programs, while the effect sizes for the PEG impacts on vocabulary and executive function skills are lower.

The *Longitudinal Study* examined the performance of PEG children in preschool, kindergarten and first grade, relative to the norm groups for the outcome measures (Exhibit E.9). Over the preschool year, PEG children improved in their early literacy, early math, and vocabulary comprehension; in all areas, children ended their PEG year closer to the national average compared to when they entered preschool. PEG children's early literacy skills continued to improve relative to the norm as they progressed through kindergarten and first grade, whereas for math, children stayed close to the national norm. There was little growth in vocabulary skills relative to the norm after preschool, and growth was largest for children whose home language was not English.

Exhibit E.9. Early Academic Skills for Year 2 PEG Children from Beginning of PEG to End of First Grade



The *State Outcomes Study* focused on how PEG children look on standard educational indicators collected by the state—such as attendance and use of special education—in kindergarten and first grade compared to non-PEG children in the same school districts. When students entered kindergarten and first grade, PEG children were less likely than other disadvantaged students in the same districts to be chronically absent than other low income children, less likely to receive special education services, and less likely to be designated as having Limited English Proficiency.

PEG Costs

The average PEG per-child cost per year was $18,237. PEG per-child costs were on average allocated as follows: 40% classroom staff; 30% for operational expenses; 12% for family comprehensive services and engagement for children and families; 11% for program management; and 7% for professional development.

Conclusions

The Massachusetts PEG program achieved its primary goal of improving the learning and development of at-risk children to improve their kindergarten readiness. PEG also appeared to have sustained benefits for children when they are in kindergarten and first grade. PEG delivered high-quality instruction, which was one of the key mediators of effects on children. The ability to produce changes in parent outcomes was more limited, although PEG families reported gains in the areas of employment and income, which could have long-term benefits for the academic and social success of the children.

PEG is a promising model in terms of delivering high quality early childhood education through a mixed delivery system. The PEG evaluation confirmed the effectiveness of this model, and demonstrated the feasibility of obtaining significant impacts in classrooms operated by community-based organizations as opposed to public school districts, the focus of most prior rigorous research. This is an important finding in light of the fact that in many states, expansion of state preschool is hindered by the lack of space in district buildings. PEG demonstrates that high-quality programming is possible in a mixed delivery environment (classrooms operated by community-based programs with support from local school districts), when particular quality elements are in place such as teacher salaries commensurate with preschool teachers in public schools, teachers with bachelor degrees, strong professional development supports, and local collaboration between public school districts and community-based programs.

1 Introduction and Context

Research demonstrates that early education is a cost-effective investment that can improve the long-term school achievement and engagement outcomes for young children, particularly for those at risk of adverse outcomes due to growing up in poverty (Campbell, Ramey, Pungello, Sparling, & Miller-Johnson, 2002; Schweinhart et al., 2005; Yoshikawa et al., 2013). In the last decade, in addition to investments in early childhood education by the federal government, many states and municipalities have also provided funding to expand the availability of center-based early childhood education, with promising results (Gormley, Gayer, Philips, & Dawson, 2005; Weiland & Yoshikawa, 2013; Wong, Cook, Barnett, & Jung, 2007).

In 2014, the U.S. Departments of Education (ED) and Health and Human Services (HHS) jointly administered new Preschool Development Grants to support state and local efforts to develop and/or expand high-quality prekindergarten programs and increase access for children from low- and moderate-income families. The grants supported 18 states to (1) build or enhance their infrastructure to provide high-quality preschool programs (Preschool Development Grants) or (2) expand high-quality preschool programs in high-need communities (Preschool Expansion Grants). Each state grantee used their funds in a unique way to extend and expand high-quality preschool.

States receiving federal preschool grants were expected to:

- Provide voluntary, high-quality prekindergarten programs for eligible children through subgrants to two or more high-need communities;
- Increase the number of children in high-quality prekindergarten programs by creating new slots for underserved and high-needs children in high-quality programs or by increasing slots in existing state prekindergarten programs; and
- Deliver these prekindergarten programs through a mixed-delivery system of providers including schools, licensed child care centers, Head Start programs, and community-based organizations.

Aligned with the research on features of high-quality programs, the federal guidelines specified that programs should have high staff qualifications, low child-staff ratios and small class sizes, a full-day program, and comprehensive services for children. Additionally, programs should have in place early learning and development standards; a comprehensive early learning assessment system, including screening measures, formative assessments, measures of environmental quality, and a kindergarten screening assessment; comprehensive services, including health screenings, family engagement activities, and nutrition services; and services coordinated with school districts and other organizations providing services for children with special needs.

In late 2014, EEC was awarded a federal Preschool Expansion Grant (referred to in this report as the Massachusetts PEG program) of $15 million per year to expand high-quality early education to four-year-old children whose families earned under 200 percent of the federal poverty line. As part of the PEG program, EEC invested in a rigorous multi-year evaluation. The Massachusetts PEG evaluation was conducted by an independent research firm, Abt Associates Inc. The evaluation included four main components (Exhibit 1).

Exhibit 1. PEG Evaluation Components by Year

	Year 1 2015-16	Year 2 2016-17	Year 3 2017-18	Year 4 2018-19
Implementation study of the PEG quality components	✓	✓	✓	✓
Longitudinal study of outcomes for PEG children and families		✓	✓	✓
Impact study of effects on PEG children		✓		
Cost study		✓		

An extensive amount of primary data were collected over the course of the evaluation including program director, teacher, and parent surveys, coach interviews, teacher ratings of children's development, classroom observations, and child assessments. The evaluation team also collected extant data from EEC (primarily participant characteristics and cost data) and the Massachusetts Department of Elementary and Secondary Education (ESE) (early elementary education indicators).

This report is a compilation of findings from all components and years of the evaluation and organized into the following chapters:

- Overview of the Massachusetts PEG model and PEG children's characteristics (Chapter 1);
- Professional supports provided to PEG program leaders and teachers (Chapter 2);
- PEG family supports and outcomes (Chapter 3);
- PEG classroom quality (Chapter 4);
- PEG leader and teacher experiences and classroom quality compared to subsidy funded classrooms (Chapter 5);
- PEG children's skills (both program impacts and longitudinal outcomes) (Chapter 6); and
- PEG costs (Chapter 7).

Report Appendices include additional data findings and technical details. Additional reports and briefs focused on particular components of the evaluation are also available at: https://www.mass.gov/lists/department-of-early-education-and-care-general-reports#preschool-expansion-grant-reports-

2 Massachusetts PEG Model and Child Demographics

The PEG grant provided the Commonwealth of Massachusetts with a unique opportunity to increase access to high quality preschool through a mixed delivery system[1] and allowed EEC to pilot a model that, if successful, could be replicated more widely across the Commonwealth. The grant supported PEG classrooms in five underserved communities across Massachusetts. In each community, local education agencies (LEAs) were granted the funds and subcontracted with EEC-licensed early learning providers (ELPs) to operate the classrooms and provide direct services to preschool children and families.

2.1 PEG Model

Massachusetts used its PEG grant to fund 48 classrooms[2] in Boston, Holyoke, Lawrence, Lowell, and Springfield to expand access to free full-day, full-year prekindergarten for four-year-old children. To determine local PEG fund allocations, the state used the Chapter 70 foundation per child allocation for preschool as a baseline and then adjusted upwards to account for the PEG model's extended hours per day and increased services. The design of the funding mechanism ensured a minimum investment in the smallest community (Holyoke) and a corresponding ceiling—adjusted for the high cost of living—for the largest community (Boston). Exhibit 2 shows the amount awarded per community in 2016-17 (Year 2 of the program), along with the number of ELPs, centers, classrooms, and preschool slots.

Exhibit 2. Number of PEG Participating Organizations and Classrooms by Community, 2016-17

Public School District	Grant Award	# of ELPs	# of PEG Centers	# of PEG Classrooms	# Preschool Slots/Year
Boston Public Schools	$4,061,250	8	12	15	280
Holyoke Public Schools	$1,425,000	2	4	4	76
Lawrence Public Schools	$2,351,250	2	2	10	130
Lowell Public Schools	$2,850,000	2	1[b]	8	156
Springfield Public Schools	$3,562,500	3	4[c]	11	195
Overall	**--**	**16[a]**	**24**	**48**	**837**

[a] One ELP operated PEG classrooms in two communities (Springfield and Holyoke).
[b] In Lowell, two ELPs jointly operated one center.
[c] In Springfield, three ELPs jointly operated one of the four centers.

Beginning in September 2015, ELPs began to operate PEG classrooms, although full enrollment was not required until December 2015. Most PEG classrooms were managed by a single ELP, though two communities (Springfield and Lowell) established new centers in which multiple ELPs shared space. Prior to the PEG grant, all participating ELPs had experience administering preschool classrooms and managing the licensing of facility space.

In four of the five communities (except Boston), the PEG classrooms were new classrooms. These four PEG communities targeted and primarily served children who had never been enrolled in licensed early education (including both center-based programs and licensed family child care homes) in the prior year.

In Boston, PEG funding was used to support existing preschool classrooms that implemented the PEG operating schedule (i.e., extending the programs to offer full-day, full-year care in Head Start sites) and all elements of the PEG instructional model. As a result, the majority of the PEG children in Boston classrooms had already experienced formal early education prior to their PEG experience, often in the same program.

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1 The mixed delivery system for the purpose of the PEG grant refers to community-based child care centers, Head Start programs, and public school districts.

2 Two of the original PEG classrooms consolidated into one classroom in one community prior to Year 4.

EEC staff actively collaborated with the designated LEAs and ELPs in the planning and implementation, especially in the local planning for professional development activities; the support was ongoing throughout all four years and particularly intensive in Years 1 and 2. EEC provided local technical assistance and support for participation in collaborative leadership meetings that included educational leaders, district staff, coaches and program directors through a partnership with the Ounce of Prevention.

The designated ELPs worked together with their LEA around the selection and implementation of curriculum, coordination and provision of comprehensive services, family engagement supports, and inclusive services for special populations, as well as joint professional development.

To be eligible for PEG, children were required to meet several criteria:

- The child must have reached his/her fourth birthday by the beginning of their preschool year and not yet have turned five years of age;
- The child must be eligible for kindergarten in the following September;
- Their family must reside within the boundaries of the public school district;
- The family income must be less than 200 percent of the federal poverty level; and
- In four of the five communities (except Boston), the programs prioritized children who had not previously been enrolled in a licensed early learning setting.

The PEG model aimed to achieve a high level of quality in instructional and emotional supportiveness, classroom organization, and learning resources, while also being responsive to local needs. Each PEG community was encouraged to design a program that adhered to certain quality-focused requirements (Exhibit 3), with a goal of ensuring consistently high quality learning environments while also allowing for local variation.

Exhibit 3. PEG Model Quality Elements

1	A collaborative decision-making structure designed to oversee implementation and work on systems coordination for all children in the community
2	Full-day, full-year programming (at least 8 hours/day, 12 months/year)
3	A maximum class size of 20
4	A maximum child-teacher ratio of 10:1
5	A curriculum/a aligned with the MA Preschool Standards and Guidelines (curriculum/a may vary by grantee)
6	The use of Teaching Strategies Gold® as a formative assessment tool
7	One educator in each classroom with a bachelor's degree in a relevant field
8	Salaries for lead educators commensurate with comparable positions in public schools within the respective community
9	Joint professional development training and coaching for teaching staff, and other supports for planning and implementation of curriculum, in collaboration with the LEA
10	Family engagement activities, including support for kindergarten transition and resources about child development
11	Comprehensive services including services addressing health, mental health, and behavioral needs for all families
12	Inclusion of students receiving special education support
13	Efforts to build linkages with services for children from birth to age 3 as well as connections with elementary schools

Source: Massachusetts Department of Early Education and Care

By the end of the grant period (2018–19), PEG centers were expected to attain the highest rating (Level 4) in the Massachusetts Quality Rating and Improvement System (QRIS) or QRIS Level 3 coupled with National Association for the Education of Young Children (NAEYC) accreditation.

Within the PEG model framework, LEAs and ELPs had flexibility regarding the specific approaches they take to implement each quality element. As a result, PEG communities implemented each component in a variety of ways; for example, communities (and sometimes programs within communities) used different

curricula and located services; some ELPs co-located all PEG classrooms within one center, whereas others provided services in centers across the community.

Despite the freedom to develop different models, PEG programs showed some consistency in how they addressed three key components of the grant:

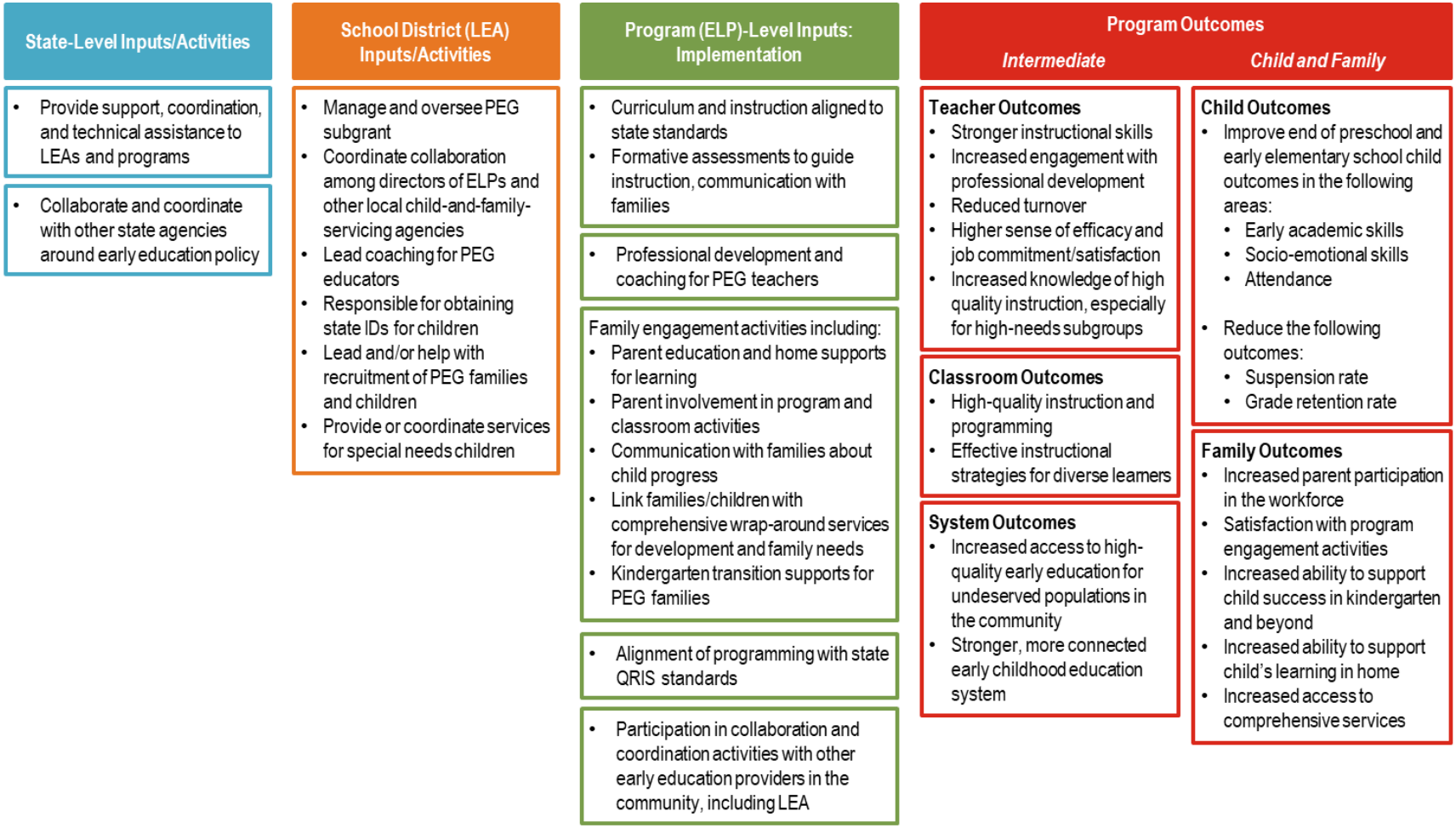
- Collaborative decision making structures (Quality Element 1):
  - Shared governance was established through regularly meeting steering committees and executive boards with representation from all partner agencies.
  - Steering committees planned the program and implemented ongoing course adjustments to ensure quality and alignment.
  - Data collected on an ongoing basis as part of the evaluation were used to support continuous quality improvement.
  - Communities developed enrollment processes that ensured both access and choice for families, often incorporating the public school kindergarten enrollment office in a referral role.
- Investment in educators (Quality Elements 8, 9):
  - Compensation recognized high levels of teacher qualification and was commensurate with public school salaries.
  - Each community planned training and coaching offerings to ensure high quality and aligned supports for educators in all PEG classrooms.
  - Coaching and job-embedded professional supports were provided. These included joint trainings across PEG classrooms and with public school educators.
  - Most communities found a three teacher per classroom structure facilitated consistent teacher participation in professional learning. In a full day program, educators do not have time outside of teaching hours to engage in professional learning; three teachers assigned to each classroom allowed more scheduling flexibility for activities outside of the classroom, such as coaching meetings, trainings and regular time for curriculum planning.
- Supports for vulnerable families (Quality Elements 10, 11, 12, 13)
  - Most programs determined they needed dedicated family engagement staff to coordinate the work with families, particularly case management.
  - The family engagement staff were available to provide case management and referrals to mental health and other social services.
  - Extensive outreach was necessary to identify and enroll eligible families, often requiring door-to-door outreach.
  - Most communities also offered home visits to families, generally as a relationship-building tool early in the school year or case management opportunity throughout the year.
  - Programs also worked to message the importance of both enrollment in prekindergarten and regular attendance.

The teacher-focused supports that PEG LEAs and ELPs provided were expected to lead to greater professionalism such as job satisfaction and improved self-efficacy for teachers, and the ability for programs to better recruit and retain high-quality educators. The educator supports were believed to lead to sustained improvements in classroom quality and thus child outcomes. Chapters 2, 3, and 4 summarize evaluation findings about the implementation of teacher supports and classroom quality in PEG classrooms over time.

The family engagement activities and comprehensive services were expected to lead to improved parent and child outcomes, including greater family stability, better child behavior and attendance, and less need for services in elementary school. Chapter 6 discusses the implementation of family supports and some family outcomes.

The links between the required ingredients and both short- and long-term outcomes are shown in the PEG theory of change (Exhibit 4).

Exhibit 4. Theory of Change for Massachusetts Preschool Expansion Grant (PEG) Model



2.2 Local Collaboration

As reflected in Exhibits 3 and 4, the PEG model also had an explicit focus on systems building, as represented in the public-private and cross-agency collaboration among the key stakeholders in the early education system in each community. The PEG communities developed distinct collaborative models for implementing PEG, informed by their community's unique history and context. Each community's model is described briefly below.

Boston

In Boston, the PEG collaboration built off a prior collaboration (called Boston K1DS) between the Boston Public Schools (BPS) and some of the PEG-funded ELPs. The PEG collaboration began with three ELPs and BPS. The LEA and ELPs worked in the winter and summer (2014–15) to design components of the grant, including approaches to family engagement and comprehensive services, as well as birth to grade three alignment activities. As part of this planning process, the ELPs determined that there was not sufficient unmet need in Boston to justify the eligibility requirement that PEG children had no prior preschool. The Boston ELPs instead decided to blend PEG funding with subsidy funds from EEC and focus on improving the quality and extending hours of programs and classrooms that currently existed. Once the three ELPs identified the number of children they could serve, BPS conducted a follow up procurement process to identify additional ELPs to fund with the money that remained; these additional ELPs were selected from the pool that had previously worked with BPS in implementing the K1DS model.

BPS worked with the ELPs to implement the same curricula used in BPS preschool classrooms. BPS provided curricular materials, professional development, and coaching to PEG teachers. Each ELP managed the family supports and comprehensive services relatively independently, although monthly director meetings allowed for sharing of best practices. Executive leadership of each ELP also met quarterly to discuss implementation challenges.

Holyoke

In Holyoke, two ELPs oversaw four PEG classrooms located in Holyoke Public School (HPS) buildings, with each ELP responsible for one classroom in each school. HPS provided coaching and coordinated a larger initiative focused on building early literacy community-wide (Holyoke Early Literacy Initiative or HELI). PEG classrooms have been a key component of the larger plans for the community. PEG teachers participated in professional learning communities with public preschool and kindergarten teachers. Each ELP managed the family engagement and comprehensive service efforts independently and supplemented the professional development provided by HPS. The PEG leadership created a steering committee that met monthly. PEG leaders also participated in workshops organized by HELI.

Lawrence

Two ELPs opted to each start new programs that each ran independently in Lawrence. Lawrence Public Schools (LPS) managed enrollment for the PEG classrooms and aimed to identify ways to increase alignment with public school kindergarten classrooms, recognizing that each public school in Lawrence operates relativley autonomously and there is no one clear model or uniform curriculum for kindergarten in the community. During the course of the first year of PEG, the two ELPs began to consider possibilities for greater alignment across their PEG programs and decided to use the same curriculum starting in the second year, a change that also led to some coordination of professional development and coaching. In year 3, another change in curriculum led to differences across programs again. During this year, the public schools began to provide more intensive supports for the ELPS through coaching by the district early childhood coordinator and professional learning visits by special education teachers to inform PEG educators in inclusive instructional practices.

Lowell

Lowell Public Schools (LPS) decided to open one new early childhood center jointly run by two PEG-funded ELPs. Although the two ELPs maintained separate licenses for the classrooms they operated, the

program was viewed as one and decisions were highly collaborative across the ELPs. Lowell Public Schools provided coaching and coordinated supports with other district departments as needed and a management committee met monthly. The committee formed subcommittees as needed to address issues that arose, such as choosing a curriculum, coordinating outreach, and strategizing about the need for transportation. An executive committee provided updates to the executive management of each ELP quarterly.

Springfield

During the planning of the PEG grant, Springfield Public Schools (SPS) purchased a building to serve as an early childhood center, where PEG classrooms run by three ELPs were co-located with other SPS preschool and Early Head Start classrooms. To address the lack of transportation resources, each ELP also opened classrooms located within one or two of their other existing sites in the city. All PEG classrooms used the same curriculum used by public school preschool classrooms, and SPS provides professional development and coaching focused on the curriculum. Each ELP managed the family engagement supports and comprehensive services provided to children and families in their classrooms, and monthly management meetings for all ELPs supported efforts to align these supports. SPS has also funded an occupational therapist, a speech pathologist and a behavioral specialist to consult with PEG teachers and provide additional comprehensive service supports. Subcommittees were formed to address particular areas of focus, such as family engagement.

2.3 Child Demographics

Per the grant requirements, the children enrolled in PEG were from low-income families (below 200% of the federal poverty threshold); in fact, the majority of families earned well below the poverty threshold. For example, 66 percent of Year 2 PEG families reported incomes below 100 percent of the 2016 federal poverty level for a family of four ($24,300); the average family income was $19,203 per year.

In addition to growing up in a low-income household, almost all PEG children were from racial and/or ethnic minority groups (Exhibit 5a). Furthermore, a notable proportion of PEG children lived in households where English was not the primary language spoken (Exhibit 5b).

Exhibit 5a. Demographic Characteristics of PEG Children, Years 1-3

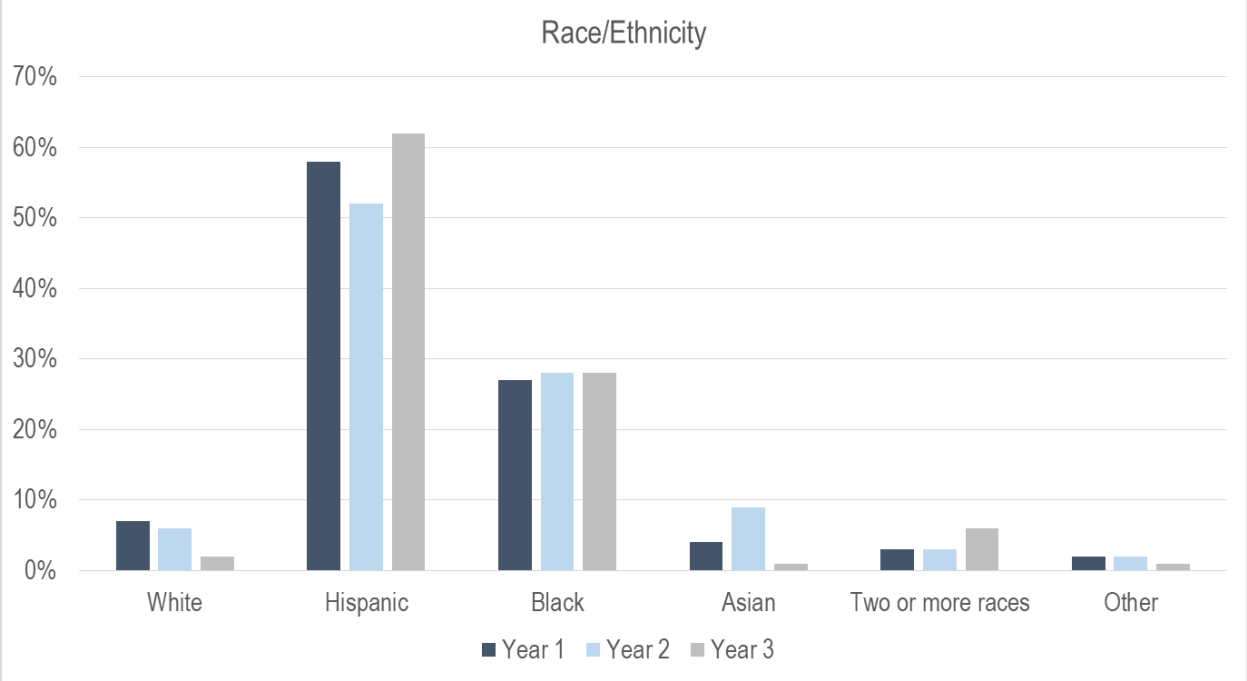
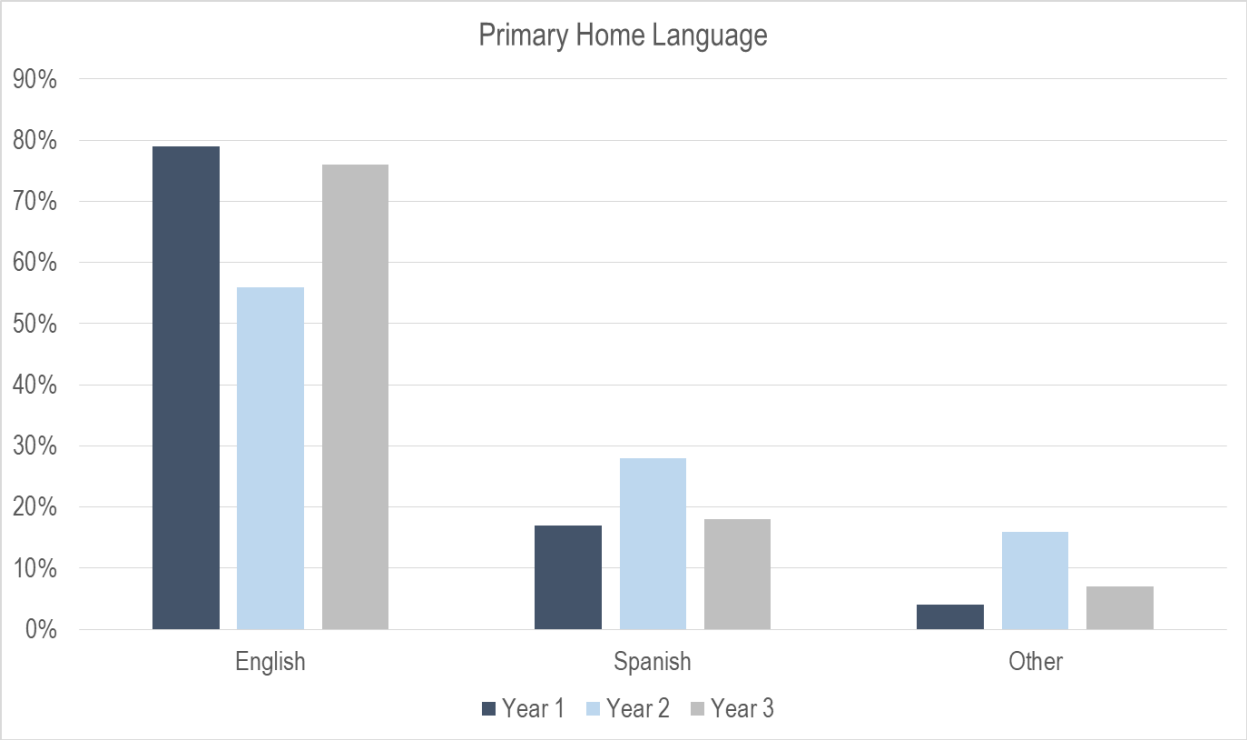


Exhibit 5b. Primary Home Language of PEG Children, Years 1-3



Source: Data obtained from the Massachusetts Department of Early Education and Care for all 48 PEG classrooms during Fall 2016. Percentages may not add up to 100 because numbers are rounded to the nearest whole.
[a] Other common languages included (primarily in Boston) Cape Verdean, Chinese, and Haitian Creole, and (primarily in Lowell) Portuguese, Vietnamese, and Arabic.

PEG classrooms served a small population of children with Individualized Education Program (IEP) plans, formal plans developed by public school special education staff to guide special education services received by eligible children. The goal was to target enrollment so that at least seven percent of the children in each PEG classroom have an IEP; at the end of the 2016-17 PEG year, almost six percent of children had one in place, although these numbers dropped in later years.

3 PEG Professional Supports

3.1 Key Findings

- Two-thirds of PEG classrooms retained the same lead teacher across all four years of the grant.
- On average, PEG teachers reported receiving more training, coaching, and paid planning time over the course of the four years of the grant.
- Most PEG lead and non-lead teachers reported satisfaction with various aspects of their jobs and perceived their organizational climate positively.
- In Year 3 of the program, a higher percentage of PEG lead and non-lead teachers reported having Master's degrees, and a higher percentage of non-lead teachers reported having Bachelor's degrees than in prior years.

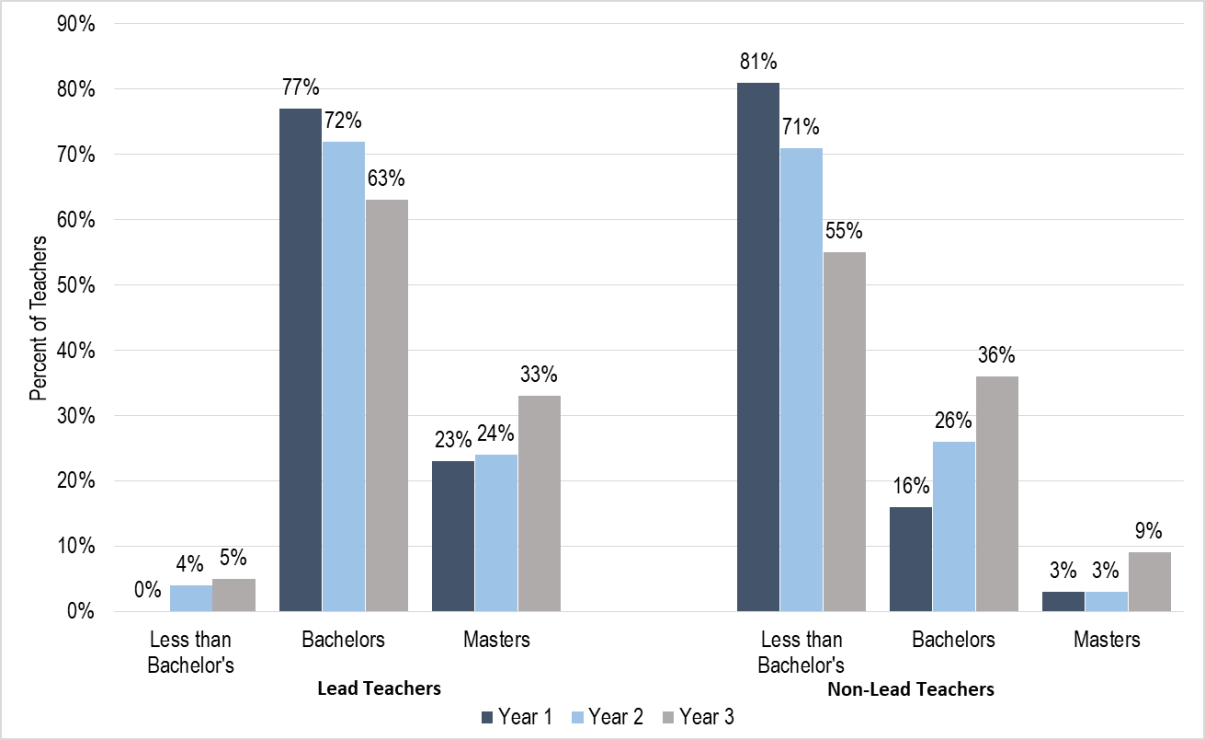
The PEG program model sought to provide high-quality instruction and learning environments through effective systems, structures, and practices. To this end, PEG programs employed well-educated staff and levels of compensation that maintained parity with the local school districts. Districts and community-based programs worked together to build the instructional capacity of PEG educators through multiple job-embedded professional learning opportunities, including training and coaching, and paid release time for instructional planning and collaboration.

This chapter draws on survey data collected from PEG educators (lead and non-lead teachers) and program directors from the participating community-based organizations about their experiences and perceptions. Along with background characteristics, data were collected about different educator supports, educator perceptions of those supports, educators' overall feelings of self-efficacy and job satisfaction, perceptions of organizational culture, and director reports about their use of time, responsibilities, and supports. Where possible, information is reported over time, in cases where it was consistently gathered across surveys.

3.2 Characteristics of Teaching Staff

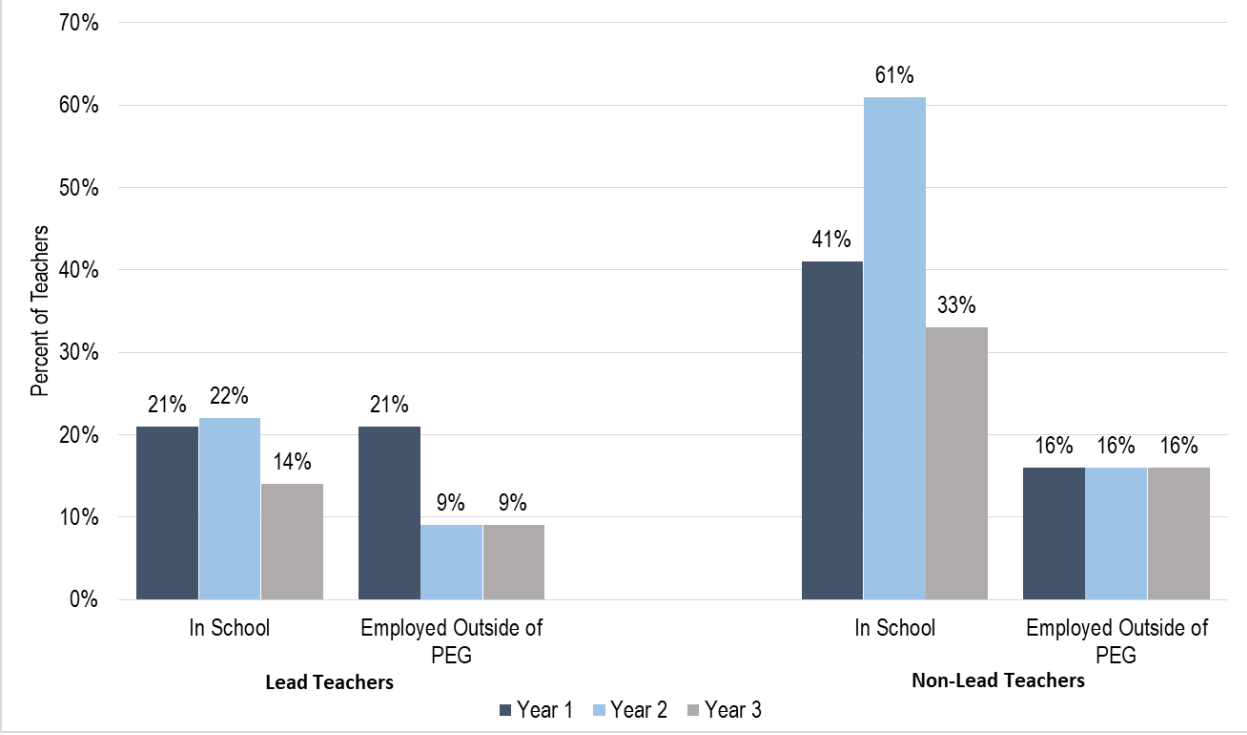
In Year 3, a higher percentage of both lead and non-lead teachers reported having Master's degrees, and a higher percentage of non-lead teachers reported having Bachelor's degrees than in prior years (Exhibit 6). In Year 3, teachers also reported more preschool teaching experience than respondents in Year 2.

Exhibit 6. Highest Educational Credentials of PEG Teachers, Years 1-3



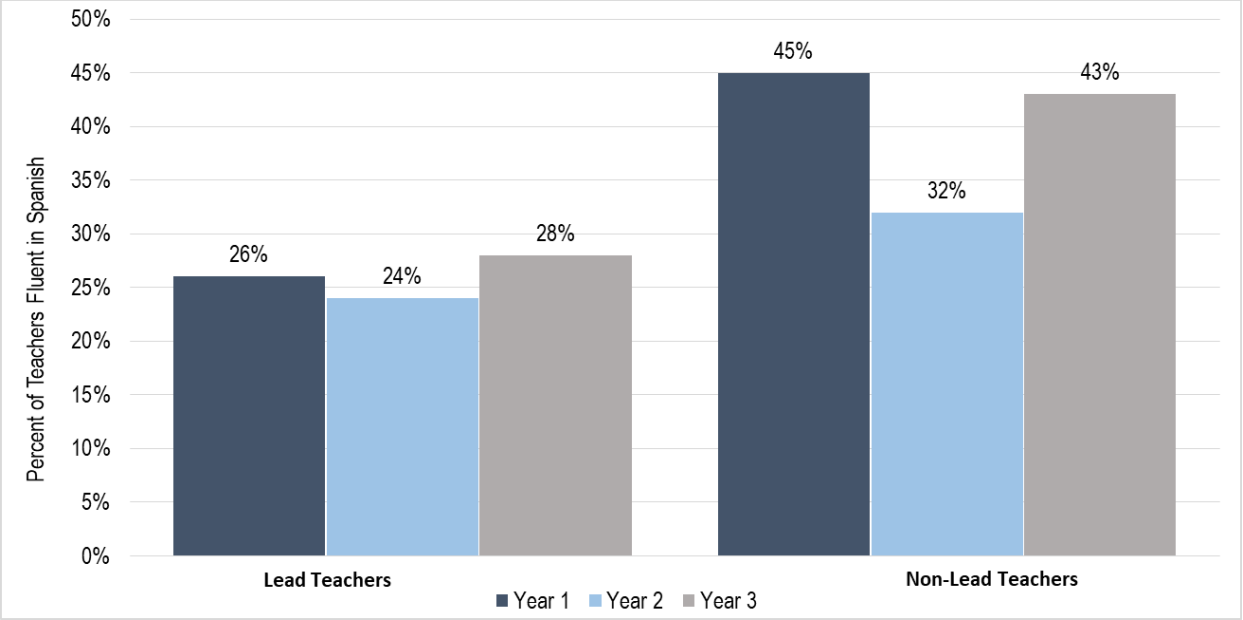
A lower percentage of lead and non-lead teachers reported that they were currently taking higher education courses in Year 3 than in Years 1 and 2 (Exhibit 7). It is possible that the some of those who took classes in prior years while working in the classroom finished their continuing education.

Exhibit 7. Higher Education Course Taking and Other Employment of PEG Teachers, Years 1-3



About one-quarter of PEG teachers reported fluency in Spanish in each of the first three years of the program. A higher proportion of non-lead teachers reported Spanish fluency compared to lead teachers (Exhibit 8). Overall, almost half of PEG children served were from homes where the primary language was Spanish.

Exhibit 8. Spanish Fluency of PEG Teachers, Years 1-3



3.3 Training Received

Lead and non-lead PEG teachers reported receiving more training over time. The mean number of annual hours of training reported by lead teachers increased from 23 in Year 1 to 30 in Year 3, while the mean hours of training reported by non-lead teachers increased from 14 to 24 over the same period. Around half of lead teachers reported receiving at least 21 hours of training in Year 2; that percentage increased to 70 percent in Year 3.

Exhibit 9 shows the proportion of PEG teachers who reported that various training topics were very effective at influencing their classroom instruction and practices. Generally, areas related to the classroom environment and social-emotional development were rated among the most useful topics by both lead and non-lead teachers.

Exhibit 9. Usefulness of Different Training Topics to PEG Teachers, Year 3

Training Topic	% Lead PEG Teachers Who Received Training and Rated Training as "Very Effective"	% Non-Lead PEG Teachers Who Received Training and Rated Training as "Very Effective"
Curriculum/content area instruction		
Curriculum-specific training	56%	57%
General content instruction (language/literacy/math instruction)	54%	45%
Alignment between content taught in preschool and elementary school	39%	41%
Cognitively-demanding tasks	32%	41%
Classroom environment and interactions		
Guiding and interacting with young children	60%	69%
Language-rich interactions with children	54%	63%
Understanding child development	53%	56%
Classroom organization and learning environments	46%	57%
Socio-emotional development		
Supporting children's social/emotional development	64%	59%
Behavior management	58%	56%
Working with children with diverse needs		
Supporting learning of English Language Learners	45%	52%
Supporting children with special needs in the classroom	45%	44%
Special education referrals	34%	36%
Working with diverse populations	45%	56%
Children/families with trauma	40%	49%
Child and classroom assessment		
Training in using particular tools to understand the classroom environment (ECERS, CLASS, etc.)	43%	42%
Training in using particular assessment tools (i.e., ASQ, TS Gold, DIBELS)	41%	45%
Conducting formative child assessments through observation, child screening, and/or assessments	56%	44%
Working with families		
Family engagement	54%	52%
Other		
Health, safety, and nutrition	50%	54%
Leadership development	57%	49%
Training on state and national standards	38%	50%

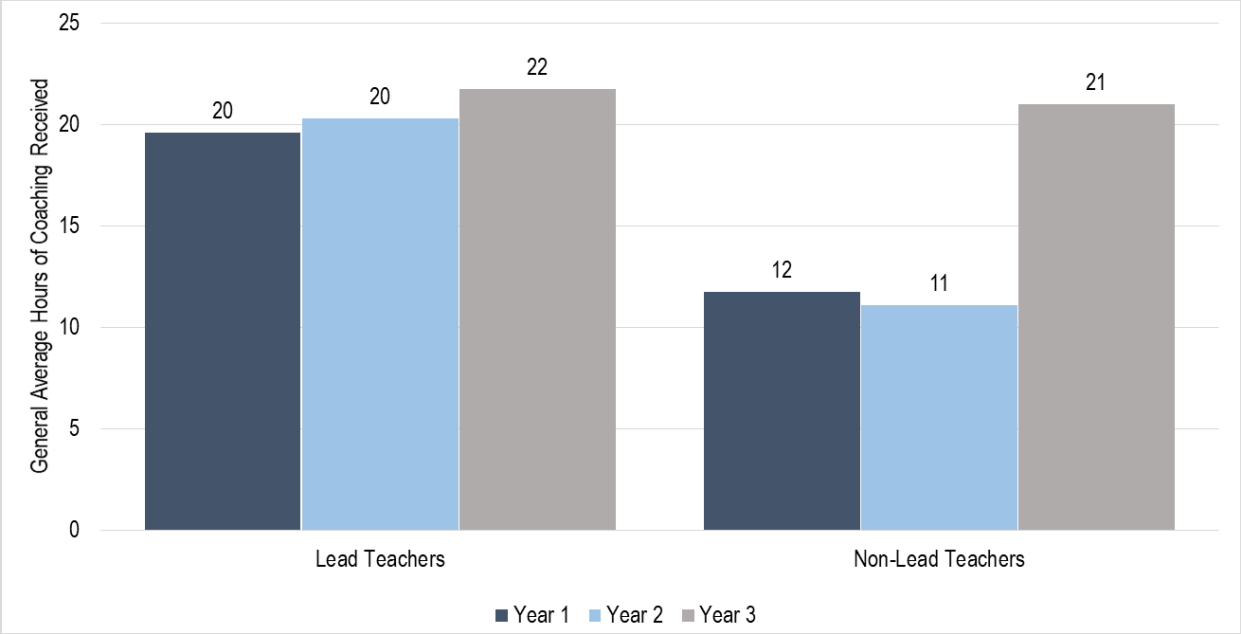
Note. Percentages represent the percentage of teachers who reported receiving at least some training on a given topic and rated its effectiveness; at least 11 lead and 37 non-lead PEG teachers received training on each of the topics in the table and rated its effectiveness.

3.4 Coaching Received

PEG communities were expected to provide regular coaching to teachers; the PEG coaches were typically employed and supported by the LEAs. As shown in Exhibit 10, the amount of coaching teachers reported receiving remained relatively stable between Year 1 and Year 2 (around 20 hours on average for lead

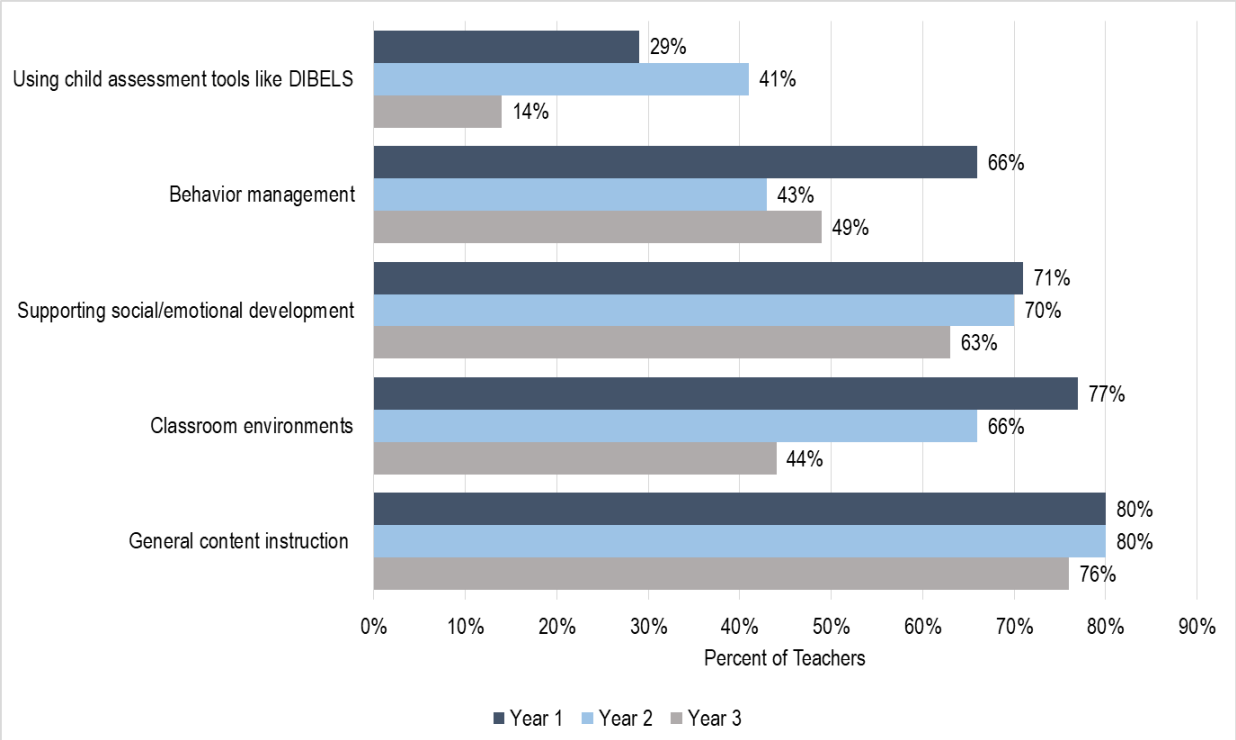
teachers and 11-12 for non-lead teachers) and then increased slightly in Year 3 for lead teachers (22 hours) and more dramatically for non-lead teachers (21 hours).

Exhibit 10. Average Number of Hours of Coaching Received by PEG Teachers, Years 1-3



Coaching focused on curriculum; a sizeable majority (close to 80 percent) of lead teachers reported receiving coaching on curriculum or content area instruction each year (Exhibit 11). Other focus areas were not as consistently covered over time; for example, social emotional development was a more prevalent focus in Year 1 than in Year 3.

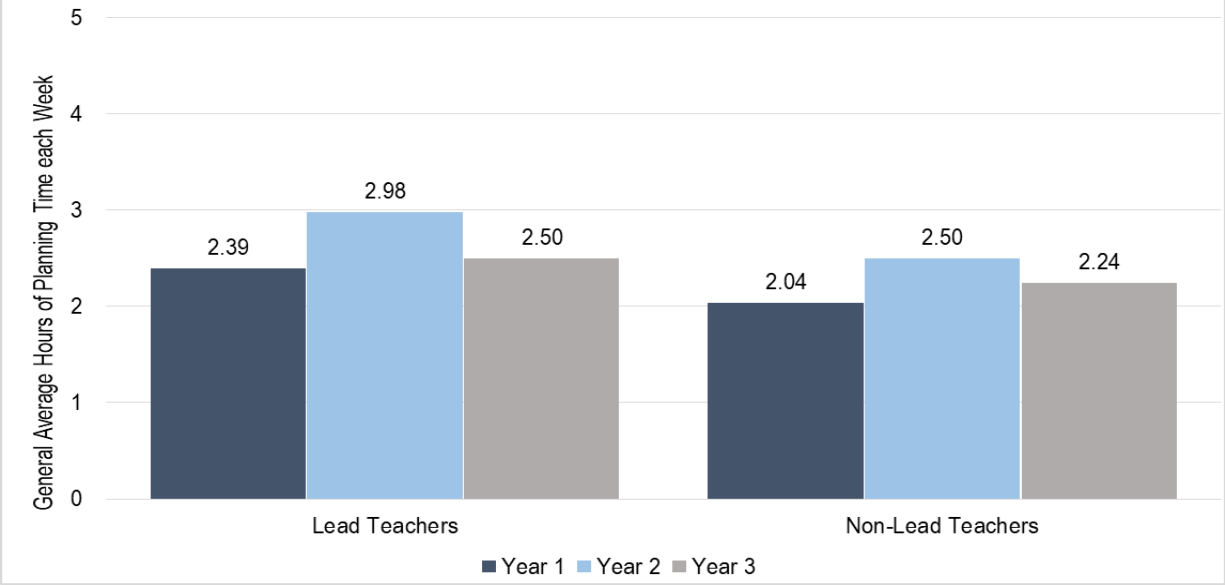
Exhibit 11. Topics of Coaching Received by Lead PEG Teachers, Years 1-3



3.5 Paid Release Time for Instructional Planning

There was an increase in the amount of paid release time for instructional planning that both lead and non-lead PEG teachers reported receiving in Years 2 and 3 compared to Year 1, although there was a slight drop in the average number of hours from Year 2 to Year 3 (Exhibit 12).

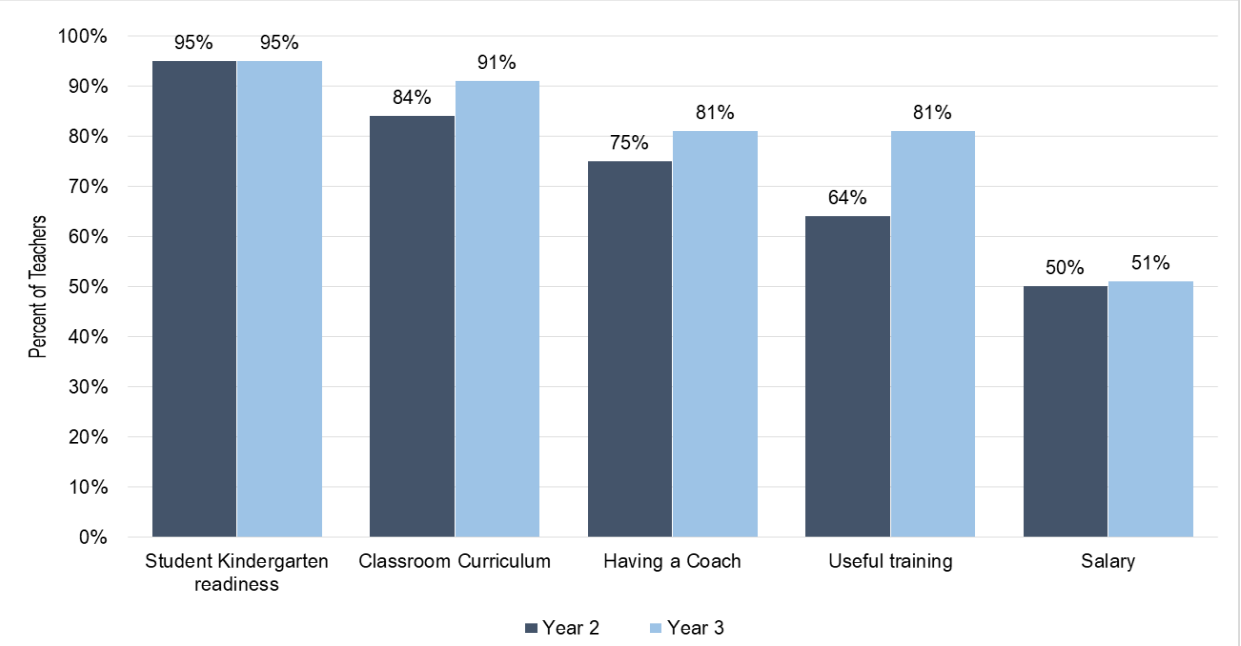
Exhibit 12. Average Number of Hours of Paid Release Time for PEG Teachers, Years 1-3



3.6 Teacher Job Satisfaction and Retention

A higher proportion of lead and non-lead teachers reported satisfaction with various aspects of their jobs in Year 3 than in Year 2, including satisfaction with their classroom curriculum, with having a coach, and with their professional development (Exhibit 13). Furthermore, a higher proportion of non-lead teachers reported satisfaction with their salaries in Year 3 (61%) than in Year 2 (48%).

Exhibit 13. Lead Teacher Satisfaction with Aspects of Job, Years 2-3



Of the 47 PEG classrooms that were operating all four years of the program, 66% of the classrooms retained the same lead teacher all four years. Turnover varied by program; some programs had no turnover across the four years, while others had over 65% of their classrooms experience lead teacher turnover at least once.

3.7 Organizational Culture

To better understand organizational culture and climate, in Year 3 teacher surveys included questions that the Ounce of Prevention Fund and UChicago Consortium co-developed called the *Early Education Organizational Essentials*.[3] The PEG evaluation focused on three key *Essentials*, comprised of 16 *Dimensions* under which were organized multiple *Items* to which teachers responded:[4]

- Collaborative Teachers (which includes dimensions such as Socialization of New Teachers, Reflective Dialogue, Teacher Collaboration, Collective Use of Assessment Data, etc.);

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[3] The Ounce of Prevention Fund & the University of Chicago Consortium on School Readiness (2018). *Early Education Essentials Teacher and Parent Surveys.* Chicago, IL.

Ehrlich, S. B., Pacchiano, D. M., Stein, A. G., & Luppescu, S. (2016). *Essential organizational supports for early education: The development of a new survey tool to measure organizational conditions*. Chicago, IL: University of Chicago Consortium on School Research and the Ounce of Prevention Fund.

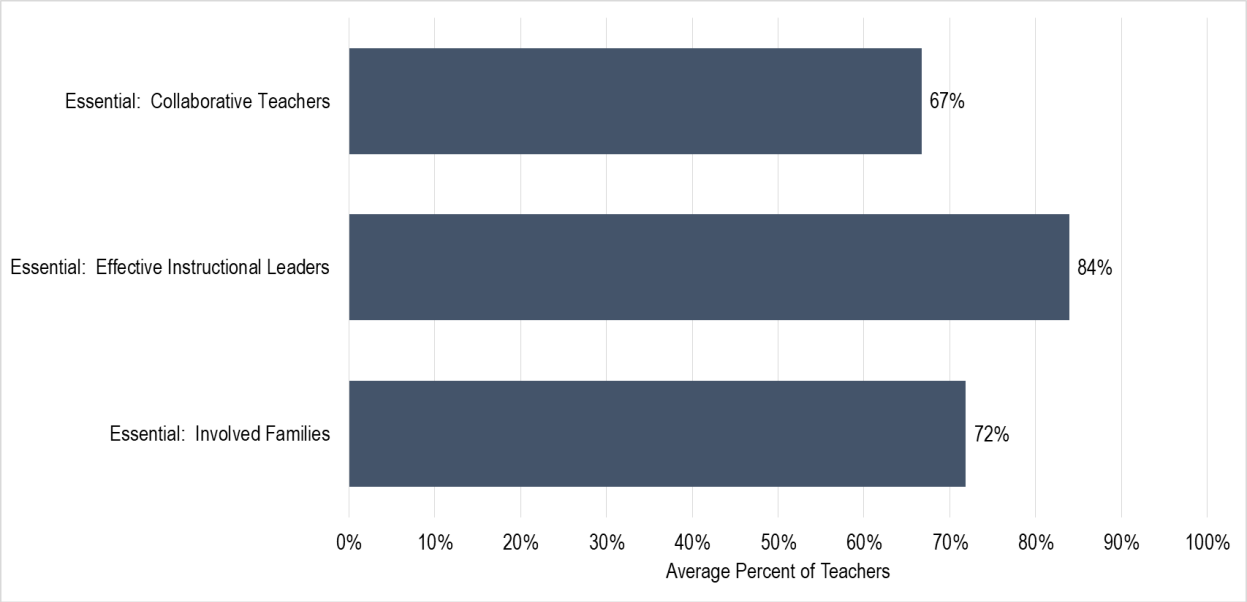
[4] Essentials are higher-order categories of organizational supports and are comprised of multiple *Dimensions*. Dimensions capture survey respondents' beliefs or experiences of a single construct and are comprised of multiple *Items*.

- Effective Instructional Leaders (which includes dimensions such as Teacher-Leader Trust, Instructional Leadership, Teacher Influence, and Program Coherence); and
- Involved Families (which includes dimensions such as Teacher-Parent Trust, Parent Involvement, and Parent Influence).

Specific items are listed in Appendix A.

Exhibit 14 shows the average proportion of PEG teachers who endorsed items related to strong teacher collaboration, effective instructional leadership, and family involvement. For example, about two-thirds (67 percent) of PEG teachers indicated highly positive practices, on average, on items related to Collaborative Teachers The Collaborative Teachers Essential includes practices such as: experienced teachers inviting new teachers into their rooms to observe, faculty making a conscious effort to make new teachers feel welcome, new teachers being assigned a mentor teacher when they first begin working at a program, and frequency of conversations with colleagues about managing classroom behavior and helping children learn. The endorsement level differed by and within Essentials, although overall PEG teachers reported positively about their organizational climate.

Exhibit 14. PEG Teacher Endorsement of Early Education Organizational Essentials, Years 3



4 PEG Family Supports and Outcomes

4.1 Key Findings

- Average family income and father's employment status was significantly higher at the end of the PEG year than at the beginning.
- PEG children, on average, had significantly higher numbers of protective factors at the end of PEG than at the beginning, such as more job stability, higher family income, and stable household composition.
- Overall, there was no significant change to PEG families' social connections during the preschool year, in terms of meeting socially with others or having regular conversations with neighbors and adults at their child's school.
- Overall, PEG parents reported high and relatively similar levels of self-efficacy and expectations for how far their child would progress in school at the beginning and end of the preschool year.
- There was no significant change in families' connectedness to the PEG program over time. The majority of parents felt very connected to the PEG program at both time points.

The family engagement component of the PEG model reflects the importance of the family in the child's education and learning, beginning in preschool and continuing into the child's school years. Parent engagement efforts were intended to help parents understand what and how their child is learning, as well as to help communicate ways that parents can support and extend classroom learning at home. Family engagement activities may have been particularly important for PEG families because this program was often the family's first experience with formal early education.

This chapter first describes some of the family engagement activities offered by PEG programs, based on information from interviews with family support specialists and program administrators and teacher surveys, and then describes some PEG family outcomes based on parent surveys. The evaluation gathered more detailed implementation data during the first two years of the grant program (therefore the description of family supports below is based on interviews and surveys from Years 1 and 2) in order to inform program improvements and gathered outcome-focused information from parents at the beginning and end of the program during Year 3.

4.2 Overview of PEG Family Supports

Most PEG ELPs employed family support specialists to help promote and provide education and engagement opportunities as well as connect families to needed supports. In four communities, family support specialists operated at a community-wide level even though they were employed by a specific ELP; they coordinated efforts across ELPs to provide consistent family and community engagement activities. In the fifth community, there was less coordination across ELPs, although monthly PEG meetings were reportedly an avenue for discussions of availability of resources across the community.

Family engagement activities included:

- Parent-teacher conferences;
- Home visits;
- Newsletters;
- Regular parent coffees; and

- Enhanced programming for family events that moved away from more traditional holiday-themed celebrations toward more focused programming intended to increase parents' capacity to support their child's learning.

PEG offered the following comprehensive services to families through a combination of program, district- and referral-based staff:

- Linked parents and children to a range of health and social services;
- Provided more services on-site, especially mental health support services; and
- Used external mental health agencies and consultants to work directly with families on ways to reduce stress.

In general, family support specialists identified a high need for services among PEG families. The specialists identified a number of challenges faced by families, most directly related to their lack of income. PEG families reportedly faced frequent unemployment, housing instability, and transportation challenges. In two communities, specialists reported that increased numbers of families were facing homelessness or having to double up with other family members. Many PEG families lived in neighborhoods with high levels of violence. Some PEG families struggled with mental health and physical health challenges. In two of the communities, family support specialists described families as having increased fears about deportation, which both negatively affected families' willingness to get involved with the PEG program and increased the likelihood of the families disappearing suddenly.

Formal strategies that PEG programs used to assess needs included intake or enrollment surveys, parent-teacher meetings, and home visits. For example, in one community, the process of assessing family needs began during the enrollment appointment, when parents' concerns about their children were recorded. The family support specialist in this community followed up with families about these concerns by phone or during a home visit. During the home visit, the family support specialist conducted a formal Parent Interest Survey that gauged interest in family engagement activities and used a Family Assessment tool that provided information about the comprehensive services that a family might need. The Family Assessment tool asked the parents to rate how they feel about their housing, exposure to community violence, financial well-being of the family and involvement with the criminal justice system. Using this tool, the family support specialist helped families develop goals for each month of the school year. Teachers played an important role in signaling when a child may need more services by submitting a formal referral. In response to these referrals, a comprehensive services team from the school district, which included an educational therapist and behavioral support staff person, began working with the child and family. In other communities, less systematic methods were used to learn about family needs. In these communities, parents were asked about their needs in certain areas during home visits and face-to-face meetings in the PEG classrooms.

PEG programs also offered kindergarten registration events that aligned with or were hosted by the public school district. PEG programs in at least two communities offered more targeted support to families in preparing kindergarten registration forms. Family support specialists and other available staff often sat with families and completed the registration forms together. In at least one community, program directors invited kindergarten teachers to visit the PEG classrooms and arranged for some children to visit kindergarten classrooms in a nearby elementary school.

4.3 Family Outcomes

Parents/guardians of PEG children were surveyed at the beginning of the Year 3 (2017-18) preschool year, and again during the summer following the school year in order to examine changes in outcomes over time. This section includes survey data findings from the 212 parents who responded to both the fall and summer surveys. The outcomes include:

- Child health characteristics;
- Family outcomes including parent education, employment and income, family protective factors, comprehensive services received, family social connections, and family-child activities;
- Parent attitudes and self-efficacy; and
- Parent connectedness to the PEG program.

Child Outcomes

There were no significant changes to children's health status across the year such as regular check-ups, up-to date immunizations, and overall health. Almost all parents reported positively about these indicators at both time points (Exhibit 15).

Exhibit 15. Child Health Characteristics, Year 3 (Fall 2017 and Summer 2018)

	Fall 2017	Summer 2018
Regular check-up in last year	98%	99%
Up-to-date on immunizations	96%	96%
Health rated as very good or excellent	90%	91%

Note. n=209-210

Family Outcomes

Parent education and mother's employment status did not change significantly over the course of the year (Exhibit 16). The average family income was significantly higher at the end of the year than at the beginning ($p<.05$),[5] although a very small proportion (3-4%) of family incomes were above $50,000 at either time point. Father employment status was also significantly higher at the end of the PEG year.

Exhibit 16. Parent Education, Employment, and Income, Year 3 (Fall 2017 and Summer 2018)

	Fall 2017	Summer 2018
Parent education of respondent (mother or father)		
Less than a high school diploma/GED*	15%	11%
High school diploma or GED*	39%	46%
Vocational/technical degree	13%	13%
Associate's degree	15%	15%
Bachelor's degree	14%	13%
Master's degree	1%	1%
Doctoral degree	4%	3%
Mother job status		
Stay-at-home parent	17%	15%
Looking for work/laid off	10%	9%
In school	3%	2%
Part-time employed	24%	22%
Full-time employed	47%	51%
Not Applicable (child does not have this type of guardian)	0%	1%

[5] All tests of statistical significance were conducted using paired sample t-tests.

	Fall 2017	Summer 2018
Father Job Status*		
Stay-at-home parent	2%	4%
Looking for work/laid off*	10%	4%
In school	2%	0%
Part-time employed	11%	11%
Full-time employed*	62%	74%
Not Applicable (child does not have this type of guardian)	14%	8%
Annual Family Income*		
20,000 or less	50%	45%
20,000-35,000	35%	32%
35,000-50,000*	12%	19%
More than 50,000	3%	4%

Note. n=133-207; *p<.05 66666777

Children on average had significantly higher numbers of protective factors at the end of PEG than at the beginning, such as more job stability, higher family income, and stable household composition (Exhibit 17).

Exhibit 17. Family Protective Factors , Year 3 (Fall 2017 and Summer 2018)

	Fall 2017	Summer 2018
Parent had at least an Associate's degree	30%	28%
At least 1 full-time working parent	66%	71%
No parent was laid off/left job in last year	69%	79%
Family income of at least $30,000	29%	36%
1 or 0 changes of address in last year	94%	94%
No change in household composition in last year	71%	76%
3 or more protective factors	83%	86%
Average # protective factors/child*	3.58	3.85

Note. n=211; *p<.05

Overall, similar percentages of parents reported receiving different comprehensive services at the beginning and end of the PEG year (Exhibit 18). The percentages of families receiving each type of services varied. There was a significant decrease (nine percentage points) in the percentage of families that received family nutrition/meal guidance; it is unclear whether this change should be interpreted as positive or negative.

Exhibit 18. Comprehensive Services Received, Year 3 (Fall 2017 and Summer 2018)

	Fall 2017	Summer 2018
Medical/dental	73%	74%
Family nutrition/meal guidance*	49%	40%
Social Services	10%	7%
Transportation	8%	6%
Mental health/behavioral support	6%	5%
Physical, occupational, or speech therapy	3%	4%
GED Preparation/Adult Literacy Support	1%	1%
Parenting	1%	1%
No services received	10%	15%

Note. n=203; *p<.05

There was no overall significant change to PEG families' social connections during the PEG year in terms of meeting socially with others or having regular conversations with neighbors and adults at their child's school (Exhibit 19). There was a significant (seven percentage point) decrease in the percentage of parents that had at least one close friend from the beginning to the end of the PEG year.

Exhibit 19. Family Social Connections, Year 3 (Fall 2017 and Summer 2018)

	Fall 2017	Summer 2018
I agree that I…		
Have at least one close friend.*	84%	77%
Meet socially with friends, relatives, or other work colleagues at least once a week.	58%	56%
Regularly stop and talk with adults at my child's school.	47%	51%
Regularly stop and talk with people in my neighborhood.	43%	49%

Note. n=196-199; *p<.05

At the end of the PEG year, parents were slightly more likely to report various activities with their child including telling a story, involving their child in household chores, playing a game/sport, and teaching songs/music (Exhibit 20). Parents were somewhat less likely to report playing counting games or reading books with numbers, taking their child with them during errands, and teaching their child songs/music. Generally, changes over time were small and activities were at lower frequencies; parents were more likely to do activities 1-2 times per week and less likely to do them 3-4 times/week over time. Though frequencies changed slightly, the percentage of parents who did these activities at all did not significantly change.

Exhibit 20. Family-Child Activities in Past Week, Year 3 (Fall 2017 and Summer 2018)

In the past week, I or someone in my family…	Fall 2017				Summer 2018			
	Never	1-2 Times	3-4 Times	At All	Never	1-2 Times	3-4 Times	At All
Read to child	3%	48%	49%	97%	3%	52%	46%	98%
Talked with child about what happened at school	0%	11%	90%	100%	2%	16%	83%	99%
Played with toys or games indoors with child	2%	34%	64%	98%	3%	34%	63%	97%
Told child a story	9%	55%	36%	91%	5%	57%	38%	95%
Played counting games or read books with numbers with child	3%	40%	57%	97%	5%	46%	49%	95%
Took child along while doing errands	6%	32%	62%	94%	8%	35%	58%	93%
Involved child in household chores	6%	37%	57%	94%	4%	44%	52%	96%
Played a game, sport, or exercised with child	9%	53%	39%	92%	5%	49%	46%	95%
Talked with child about TV or videos	7%	52%	42%	94%	5%	47%	47%	94%
Taught child songs or music	6%	51%	43%	94%	8%	48%	44%	92%
Worked on arts/crafts with child	14%	56%	30%	86%	16%	57%	27%	84%

Note. n=194-203

Parent Attitudes and Self-Efficacy

At the end of the PEG year, parents had similar expectations for how far their child would go in school and the substantial majority of parents expected their child to attend college or beyond (Exhibit 21). Furthermore, almost all parents viewed daily attendance as very important for school success at the beginning and end of the PEG year (Exhibit 22).

Exhibit 21. Expectations for How Far in School Child Will Go, Year 3 (Fall 2017 and Summer 2018)

When you think about the future, how far in school do you believe your child will go?	Fall 2017	Summer 2018
Graduate from high school	5%	4%
Attend some college (2+ years)	12%	9%
Earn a 4-year college degree	33%	37%
Earn a higher degree than college like a PhD	50%	50%

Note. n=192. In addition, 3% of parents at the beginning of PEG and 6% at the end of PEG responded that they did not know how far their child would go in school.

Exhibit 22. Family Attitudes toward Child's Regular Daily Attendance, Year 3 (Fall 2017 and Spring 2018)

How important do you think it is for your child's school success that your child attend school every day?	Fall 2017	Summer 2018
Very important	91%	85%
Somewhat important	0%	4%
Neutral	1%	0%
Somewhat unimportant	0%	0%
Very unimportant	8%	11%

Note. n=205

Overall, parents reported relatively similar and high levels of self-efficacy at both time points, which indicated that they felt like they knew how to communicate with their children about school, answer their children's questions about what they were learning in school, and communicate effectively with their child's teacher (Exhibits 23 and 24).

Exhibit 23. Family Self-Efficacy Overall Score (n=204), Year 3 (Fall 2017 and Summer 2018)

Average Score Across Questions	Fall 2017	Summer 2018
High Self-Efficacy (4-5)	93%	91%
Moderate Self-Efficacy (3-4)	5%	7%
Slightly Low Self-Efficacy (2-3)	1%	2%
Low Self-Efficacy (less than 2)	2%	0%

Note. Low self-efficacy indicates that the respondent often disagreed (somewhat or strongly) with the 5 statements in Exhibit 11; and high self-efficacy indicates that the parent agreed somewhat or very strongly, on average, across questions.

Exhibit 24. Family Self-Efficacy by Indicator, Year 3 (Fall 2017 and Summer 2018)

	Fall 2017	Summer 2018
I know how to communicate effectively with my child about school every day.		
Agree very strongly	76%	77%
Agree somewhat	18%	14%
Neutral	3%	8%
Disagree somewhat	0%	0%
Disagree very strongly	3%	1%
I know how to explain things to my child If they have questions about what they are learning in school.		
Agree very strongly	68%	73%
Agree somewhat	26%	21%
Neutral	4%	5%
Disagree somewhat	1%	1%
Disagree very strongly	3%	1%
I know enough about the things my child is learning to be able to help him/her.		
Agree very strongly	71%	72%
Agree somewhat	20%	17%
Neutral	6%	9%
Disagree somewhat	1%	2%
Disagree very strongly	3%	1%
I know how to communicate effectively with my child's teacher.		
Agree very strongly	74%	82%
Agree somewhat	20%	13%
Neutral	3%	4%
Disagree somewhat	0%	1%
Disagree very strongly	2%	0%
I feel confident that I can communicate with my child's program/school to get him/her what they need to be successful in school.		
Agree very strongly	80%	86%
Agree somewhat	16%	9%
Neutral	2%	4%
Disagree somewhat	0%	1%

	Fall 2017	Summer 2018
Disagree very strongly	1%	0%

Note. n=200-205

Parent Connectedness to the PEG Program

Over half of PEG families reported that they did not receive any home visits from preschool program staff during the school year (Exhibit 25). Almost one-quarter of families reported receiving one visit and two visits (each).

Exhibit 25. Number of Home Visits, Year 3

Number of times staff from preschool program visited my home this year	Summer 2018
No Visits This Year	53%
1 Visit This Year	24%
2 or More Visits This Year	23%

Note. n=179

There was no significant change in families' connectedness to the PEG program over time (Exhibit 26). The majority of parents felt very connected to the PEG program at both time points.

Exhibit 26. Family Feelings of Connectedness to PEG, Year 3 (Fall 2017 and Summer 2018)

How connected do you feel to your child's preschool program this year?	Fall 2017	Summer 2018
Very connected	67%	74%
Somewhat connected	22%	19%
Neutral	9%	5%
Somewhat disconnected	2%	0%
Very disconnected	1%	2%

Note. n=207

5 PEG Classroom Quality

5.1 Key Findings

- The overall average classroom quality score (as measured by the CLASS) in all years of PEG was in the moderate-to-high range.
- PEG classroom quality improved significantly from Year 1 to Year 4 of the program for both the Classroom Organization and Emotional Support domains of the CLASS, on average across all PEG classrooms. For the Instructional Support domain, there was no significant change over time.
- There was no statistically significant change in observed early language and literacy practices, as measured by the ELLCO from Year 1 to Year 4, on average across all PEG classrooms.

The PEG program worked to provide high-quality learning environments and instruction to its students. This chapter draws on classroom observation data collected by Abt staff in PEG classrooms over the four years of program operation. Observations involved the use of two widely used measures of instructional quality, the Classroom Assessment Scoring System™ (CLASS; Pianta, LaParo, & Hamre, 2008) and the Early Language and Literacy Classroom Observation Tool (ELLCO; Smith, Brady, and Anastasopoulos, 2008).

5.2 Instructional Quality

This section presents CLASS data from the 47 PEG-funded classroom observations[6] over the four years of the PEG program.

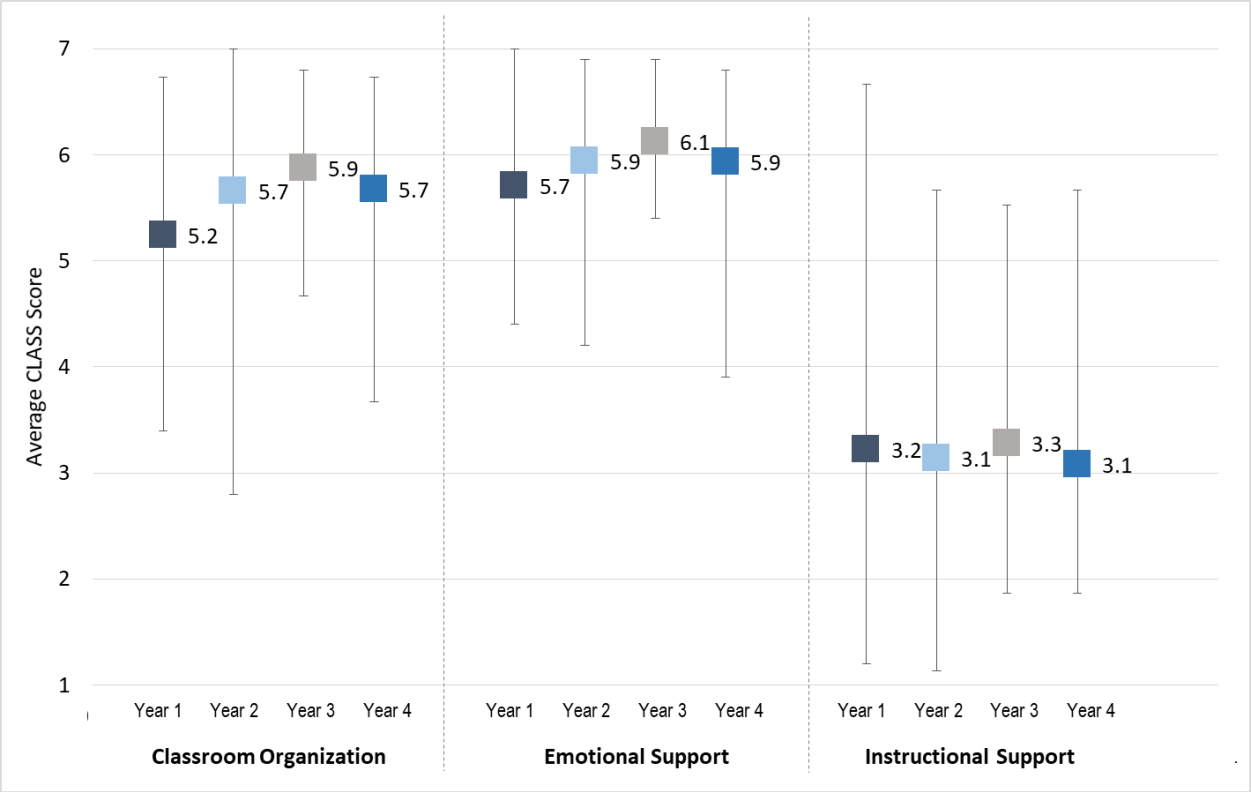
The CLASS measures overall instructional quality with a focus on interactions among teachers and students in the classroom. The CLASS produces four scores, an overall score and a score for each of three domains. Each score ranges from 1 to 7. A score of 1-2 is "low" quality in that aspect of teacher-child interaction. Scores of 3-5 are "moderate," and scores of 6-7 are "high" quality.

- ***Total Score***: The total score combines the scores from the three domains listed below.
  - ***Instructional Support Domain***: This domain encompasses how well the teachers use instruction to help children learn in the three dimensions of Concept Development, Quality of Feedback, and Language Modeling.
  - ***Emotional Support Domain:*** This domain involves how well teachers promote a positive climate through their interactions in the four dimensions of Positive Climate, Negative Climate, Teacher Sensitivity, and Regard for Student Perspectives.
  - ***Classroom Organization Domain***: This domain focuses on how well the classroom is organized to facilitate learning in the three dimensions of Behavior Management, Productivity, and Instructional Learning Formats.

Exhibit 27 shows the mean CLASS domain scores over time for the full sample of 47 PEG classrooms. The range of scores for individual classrooms is denoted with vertical bars. PEG classrooms improved their CLASS scores significantly from the first to the fourth year of the program for both the Classroom Organization and Emotional Support domains. Though Instructional Support scores decreased slightly from Year 1 to Year 4, the change was not statistically significant.

Exhibit 27. PEG CLASS Scores in All 47 Classrooms, Years 1-4

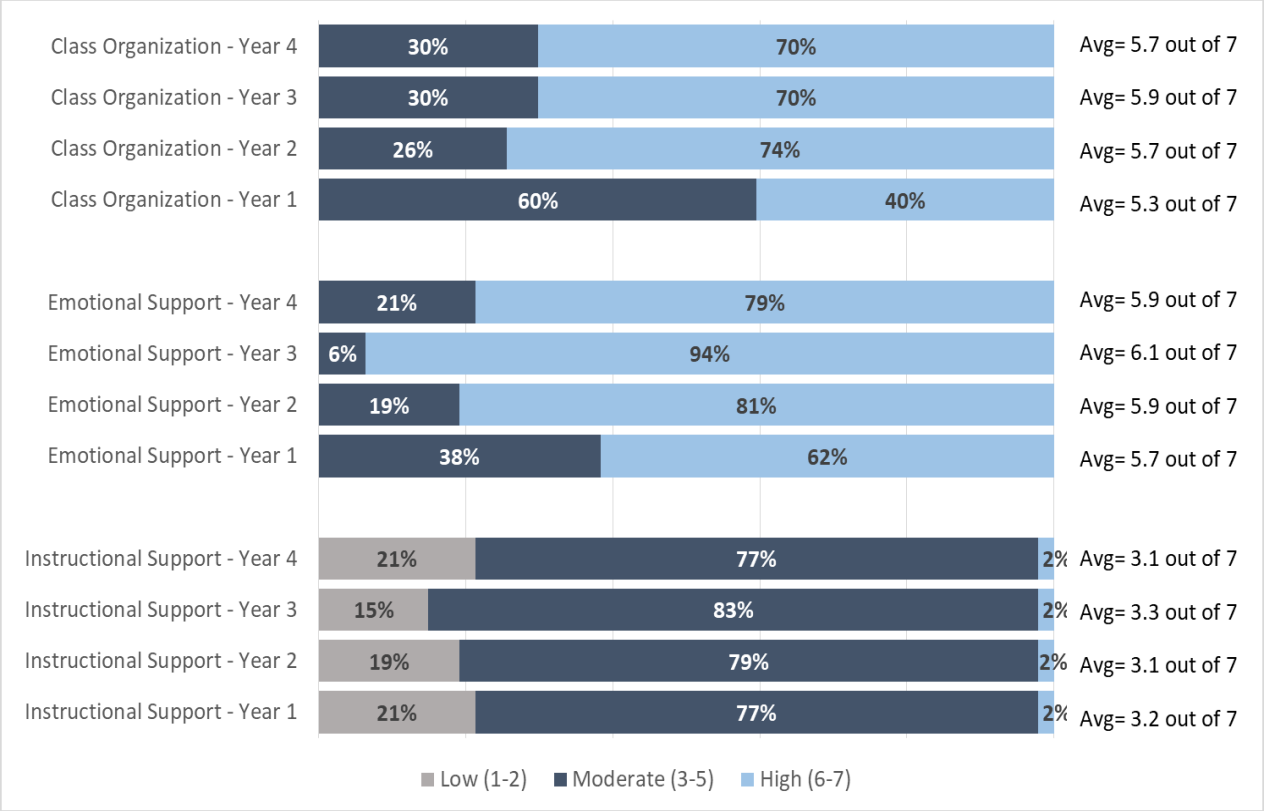
[6] Prior to the 2018-19 school year, there were 48 operating PEG classrooms. In the 2018-19 year, one classroom no longer operated as a separate classroom. For accurate comparison of quality over time, data from that classroom was not included in this analysis.



Another way to examine the change over time in CLASS scores is to categorize levels of quality based on CLASS scores, with Low Quality defined as a score of 1 or 2, Moderate Quality as a score of 3-5, and High Quality as a score of 6 or 7. Using these levels, the change over time is in terms of the percentage of classrooms in each year scoring at each of these three levels of quality. Exhibit 28 shows the percentages of all classrooms at each level of quality in each year. The pattern of change over time differed for the three domains:

- For the Classroom Organization and Emotional Support domains, the percentage of classrooms scoring at a high level of quality changed markedly from Year 1 to Year 2.
  - For Emotional Support, there was continued marked improvement between Year 2 and Year 3, with a decrease in the percentage of high-scoring classrooms in Year 4.
  - For Classroom Organization, the growth from Year 1 was sustained, but did not continue to increase from Year 2 to Year 3 to Year 4.
- For the Instructional Support domain, there was no substantial change from Year 1 to Year 2 in the percentage of classrooms with high quality. Though there was a smaller percentage of low quality classrooms in Year 3, the distribution of classrooms across quality categories was the same in Year 4 as it was in Year 1.

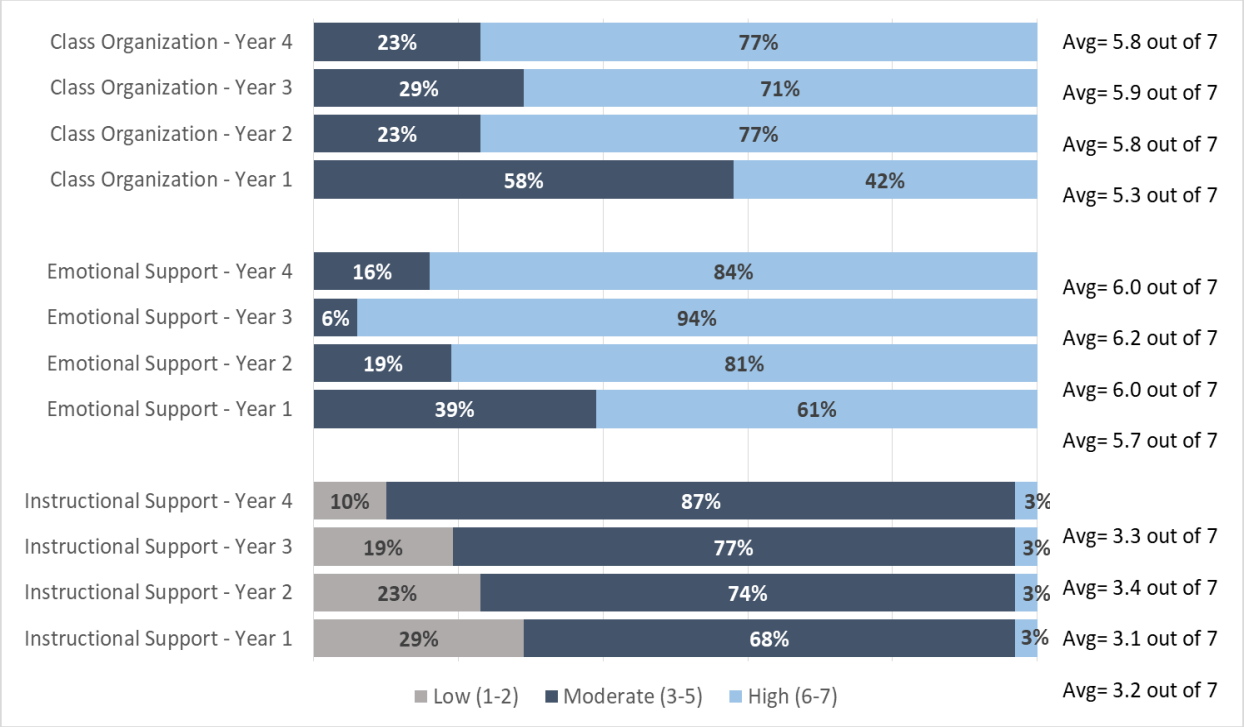
Exhibit 28. Change over Time in Percentage of PEG Classrooms in CLASS Quality Categories by Domain, Years 1-4



Notes. Each bar shows the percent of the 47 PEG classrooms (Boston=15, Holyoke=4, Lawrence=10, Lowell=8, Springfield=10) that fell into the different CLASS quality ranges according to their observed scores in Year 1, 2, 3, and 4. For example, the bottom four bars show that 79% of Massachusetts PEG classrooms scored in the 'Moderate' or 'High' quality category on Instructional Support in Year 4, compared to 85% in Year 3, 81% in Year 2, and 79% in Year 1.

When the same analysis is conducted with the subset of 31 classrooms with the same lead teacher across all four years, a similar pattern is observed for all three CLASS domains (Exhibit 29). However, there were increasingly fewer classrooms in the lowest quality category for Instructional Support, suggesting that continuous and increased PEG supports over time may have led to increased Instructional Support as measured by the CLASS.

Exhibit 29. Change over Time in Percentage of PEG Classrooms in Quality Categories by CLASS Domain, 31 Classrooms with Same Teacher All 4 Years



Notes. Each bar shows the percent of the 31 PEG classrooms (Boston=11, Holyoke=2, Lawrence=7, Lowell=5, Springfield=6) with the same lead teacher in the first four years of PEG that fell into different CLASS quality ranges according to their observed scores in Year 1, 2, 3, and 4. For example, the bottom four bars show that 90% of those 31 classrooms scored in the 'Moderate' or 'High' quality category on Instructional Support in Year 4, compared to 80% in Year 3, 77% in Year 2, and 71% in Year 1.

5.3 Language and Literacy Support

This section presents ELLCO data from the 47 PEG-funded classroom observations[7] over the first four years of the PEG program (2015-16, 2016-17, 2017-18, and 2018-19).

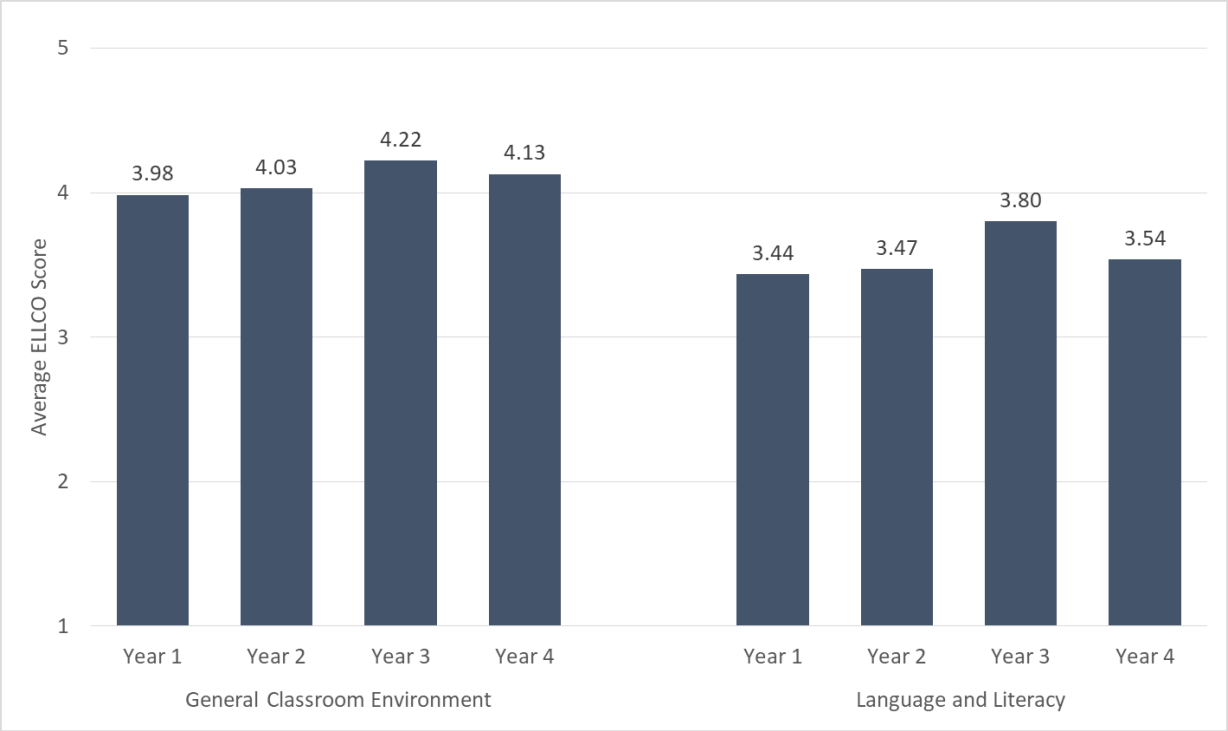
The ELLCO measures the quality of support for language and literacy development, including support for diversity of languages, abilities, and cultures. The ELLCO produces three scores: an overall score and a score for each of two subscales. Each score ranges from 1 to 5. A score of 1 is described as "deficient" evidence of quality. A score of 2 is described as "inadequate," a score of 3 is described as "basic," a score of 4 is described as "strong," and a score of 5 is described as "exemplary."

- ***Total Score***: The total score combines the scores from the two subscales listed below.
  - ***General Classroom Environment Subscale***: This subscale pertains to how well the classroom is organized and promotes general learning across the two domains of Classroom Structure and Curriculum.
  - ***Language and Literacy Subscale***: This subscale focuses on how teachers and students engage in literacy and language activities across the three domains of Language Environment, Books and Book Reading, and Print and Early Writing.

[7] Since in Year 4, one PEG classroom merged with another PEG classroom; in order to accurately compare quality over time, data from the classroom that closed was not included in this analysis.

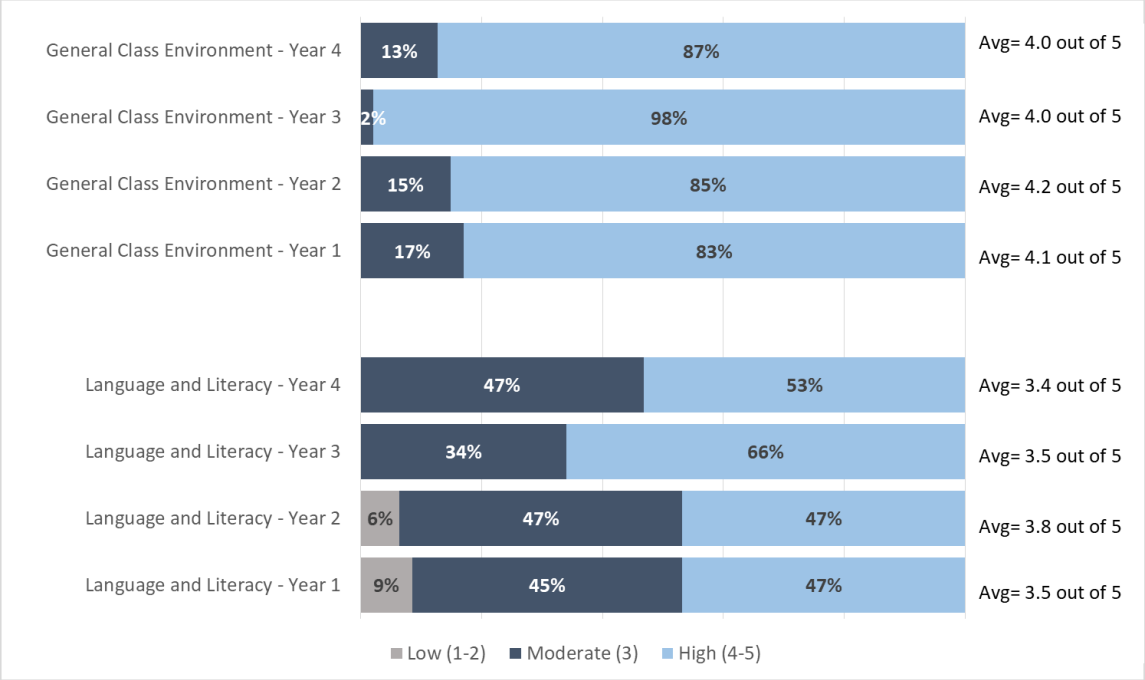
Exhibit 30 shows the mean ELLCO subscale scores over time for the full sample of 47 classrooms. There was no statistically significant change on ELLCO scores from Year 1 (2015-16) to Year 4 (2018-19), on average across all PEG classrooms.

Exhibit 30. Change over Time in Average ELLCO Scores in All 47 Classrooms, Years 1-4



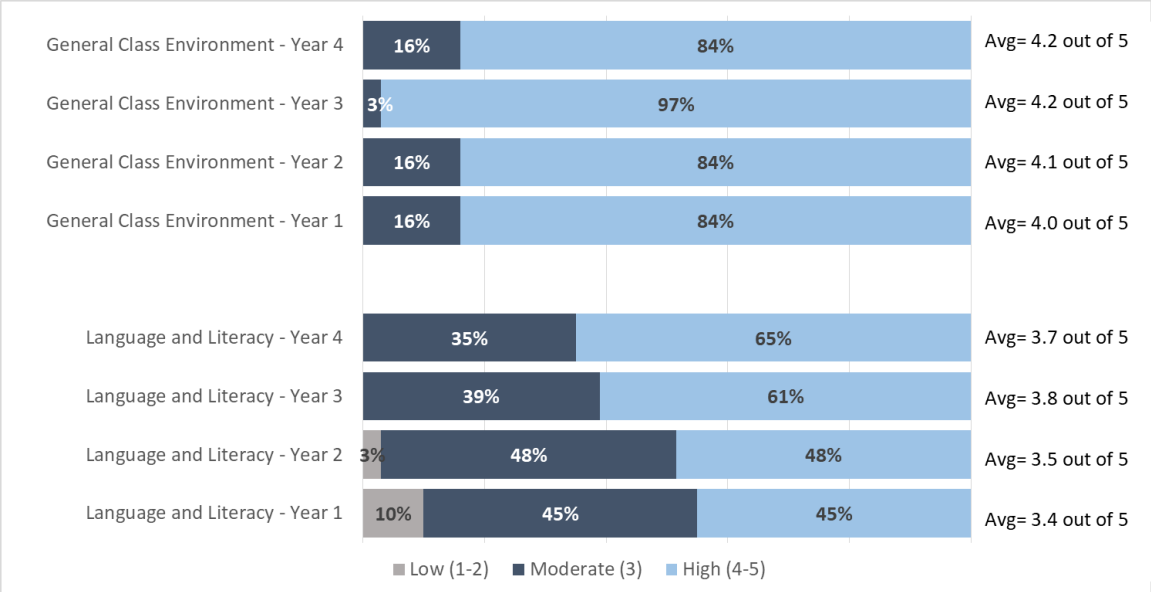
Change over time in ELLCO scores was examined in terms of the level of quality based on the ELLCO scores, with Low Quality defined as a score of 1 or 2, Moderate Quality as a score of 3, and High Quality as a score of 4 or 5. Using these levels, the change over time can be described in terms of the percentage of classrooms in each year scoring at each of these three levels of quality. Exhibit 31 shows the percentages of all classrooms at each level of quality in each year. For both subscales, the bulk of the improvement in classroom quality happened between Years 2 and 3. The percentages of classrooms in the high quality category in Year 4 decreased slightly in both subscales, although overall quality is higher for the General Classroom Environment subscale across years than for the Literacy and Language subscale. The pattern of change was similar in the full sample of 47 classrooms and the subset of 31 classrooms where the teacher was the same across all three years (Exhibit 32).

Exhibit 31. Change over Time in Percentage of PEG Classrooms in ELLCO Quality Categories by Subscale, All 47 Classrooms, Years 1-4



Notes. Each bar shows the percent of the 47 PEG classrooms (Boston=15, Holyoke=4, Lawrence=10, Lowell=8, Springfield=10) that fell into ELLCO quality ranges according to their observed scores in Year 1, 2, 3, and 4. For example, the bottom four bars show that 100% of Massachusetts PEG classrooms scored in the 'Moderate' or 'High' quality category on Language and Literacy in Years 3 and 4, compared to 94% in Year 2 and 92% in Year 1.

Exhibit 32. Change over Time in Percentage of PEG Classrooms in ELLCO Quality Categories by Subscale, 31 Classrooms with Same Teacher All 4 Years



Notes. Each bar shows the percent of the 31 PEG classrooms (Boston=11, Holyoke=2, Lawrence=7, Lowell=5, Springfield=6) with the same lead teacher in the first four years of that fell into ELLCO quality ranges according to their observed scores Year 1, 2, 3, and 4. For example, the bottom four bars show that 100% of those 31 classrooms scored in the 'Moderate' or 'High' quality category on Language and Literacy in Years 3 and 4, compared to 96% in Year 2 and 90% in Year 1.

6 PEG Versus Comparable Subsidy Funded Programs

6.1 Key Findings

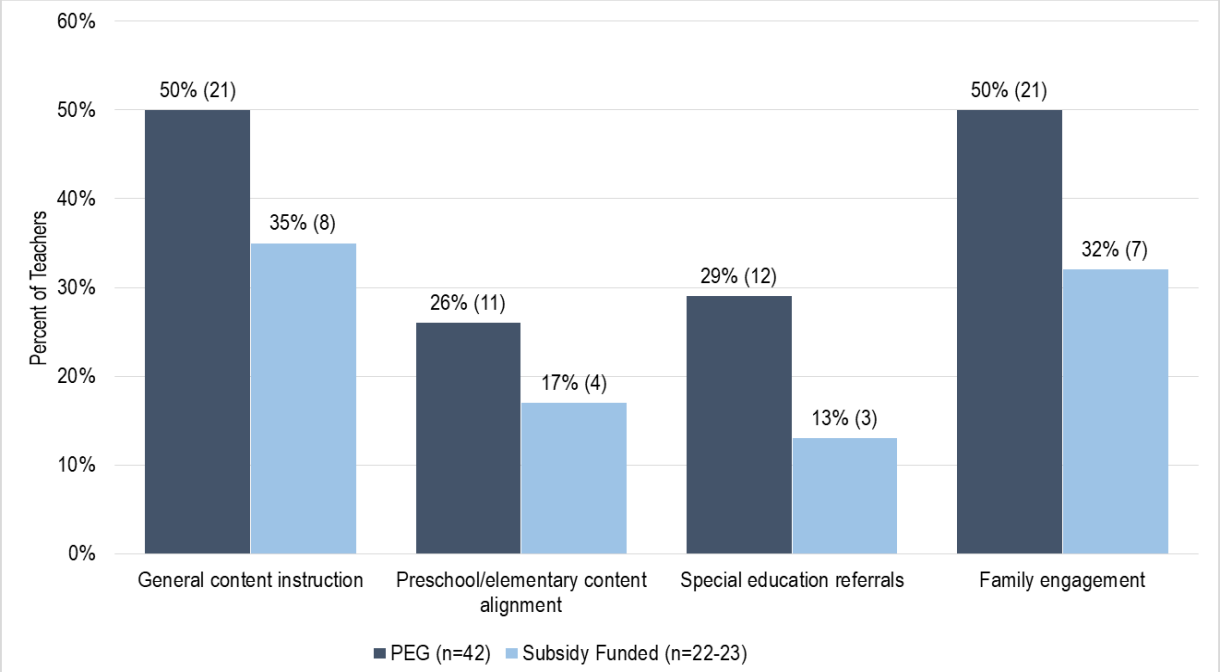
- PEG teachers reported receiving nearly double the number of hours of training per year and were more positive about the usefulness of training compared to teachers from comparable subsidy funded programs.
- Both lead and non-lead PEG teachers were more likely to report receiving coaching and paid release time for planning than teachers from comparable subsidy funded programs.
- PEG teachers were more positive about their program organizational culture than teachers from comparable subsidy funded programs.
- PEG program directors were generally more positive about the trainings received than directors from compable subsidy funded programs. Program directors from comparable subsidy funded programs also reported feeling less supported than PEG directors.
- Classroom quality, as measured by the CLASS and ELLCO measures, was significantly higher on average for the PEG classrooms than the classrooms from comparable subsidy funded programs.

This chapter presents survey data collected during the summer of 2018 (end of Year 3) from PEG and comparable subsidy funded program teachers and directors and observation data collected from PEG and comparable subsidy funded programs during the winter of 2018. The 20 subsidy funded classrooms were from the same agencies and communities as the PEG classrooms. The primary difference between the two groups of classrooms is the existence of PEG resources and supports provided to programs and educators in the PEG program.

6.2 Teacher and Director Experiences and Perceptions

PEG lead teachers reported receiving an average of 30 hours of training per year (not including individual coaching), compared with 18 hours reported by teachers from comparable subsidy funded programs. Exhibit 33 shows the percentages of lead teachers that reported that various training topics were very effective at influencing their classroom instruction and practices; PEG teachers were more positive about the usefulness of training than teachers from comparable subsidy funded programs.

Exhibit 33. Usefulness of Different Training Topics Reported by Teachers from PEG and Comparable Subsidy Funded Programs, Year 3



Note. Numbers on the top outside of columns represent the number of respondents and the percentage of respondents in that group. For example, the numbers above the first column on the left indicate that 21 lead PEG teachers, or 50% of PEG teachers who responded to the question about whether they received training on this topic and how effective it was, said that their training in general content instruction was very effective.

Both lead and non-lead teachers in PEG programs were more likely to report receiving coaching than teachers from comparable subsidy funded programs (Exhibit 34).

Exhibit 34. Number of Hours of Coaching Received by Teachers from PEG and Comparable Subsidy Funded Programs, Year 3

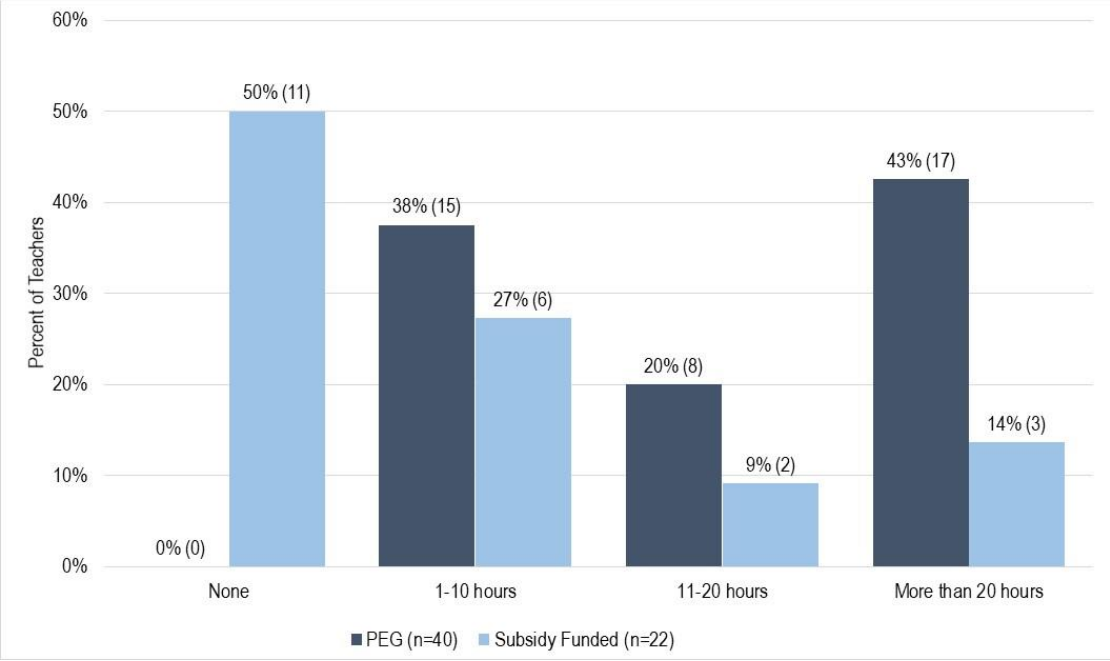
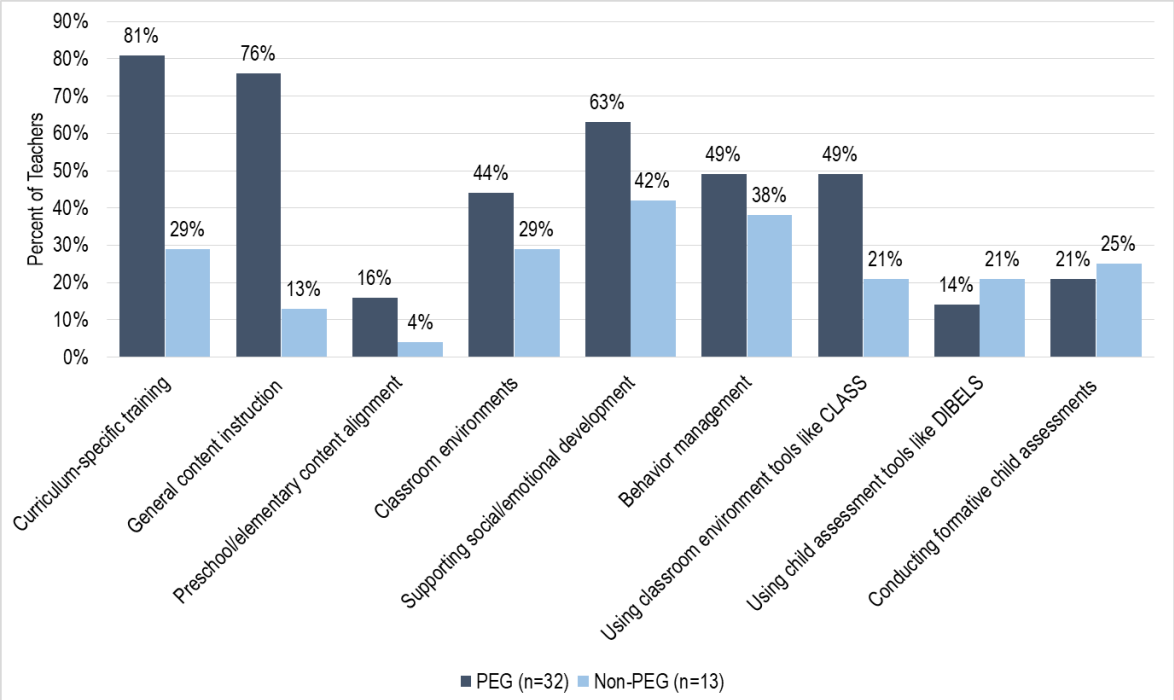


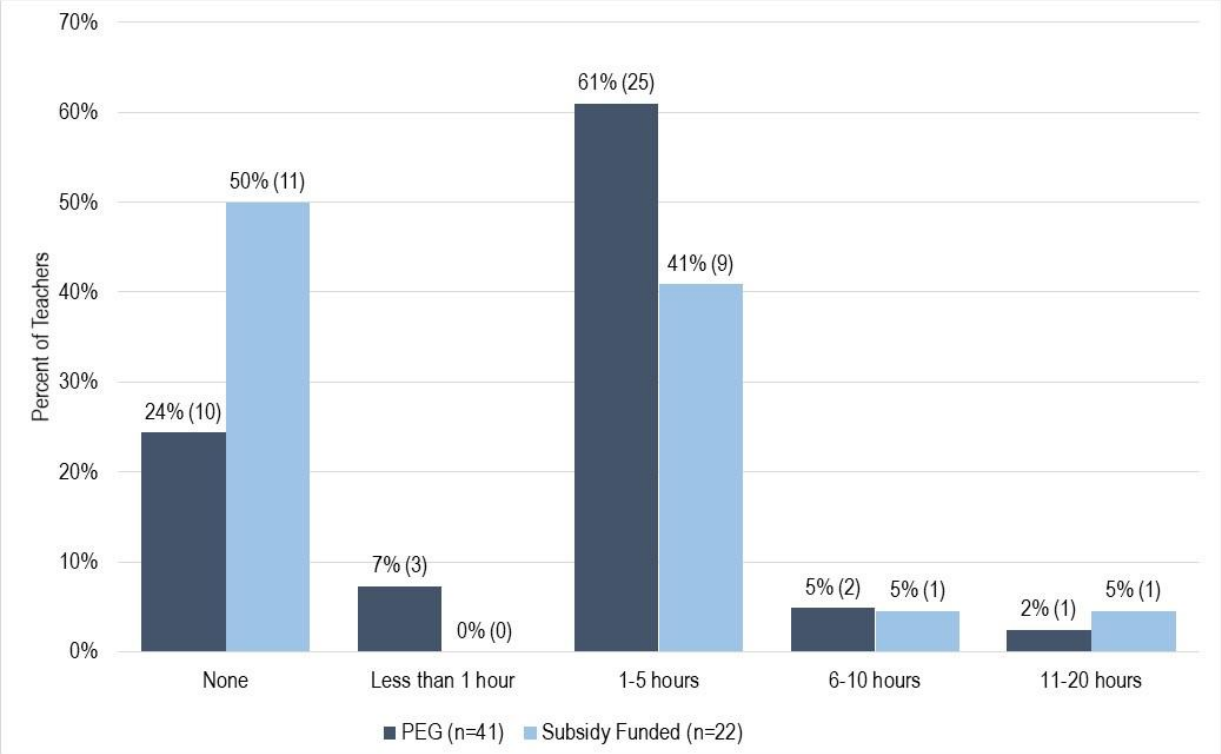
Exhibit 35 highlights areas of coaching instruction received. Of note, 81 percent of PEG lead teachers reported receiving coaching on curriculum training compared to 29 percent of teachers from comparable subsidy funded programs. With the exception of using child assessment tools like DIBELS, more PEG lead teachers reported receiving coaching on each topic.

Exhibit 35. Select Topics of Coaching Received by Lead Teachers from PEG and Comparable Subsidy Funded Programs, Year 3



Lead teachers in PEG programs were more likely than lead teachers in comparable subsidy funded programs to receive paid release time for planning (Exhibit 36), although the amount of time dedicated to planning, when paid release time existed, was similar across the two groups.

Exhibit 36. Amount of Weekly Planning Time Received by Lead Teachers from PEG and Comparable Subsidy Funded Programs, Year 3



Lead teachers in PEG programs were more likely teachers from comparable subsidy funded programs to indicate highly positive practices across items in each Early Education Organizational Essential (Exhibit 37).

Exhibit 37. Organizational Culture Reported by Lead Teachers from PEG and Comparable Subsidy Funded Programs, Year 3

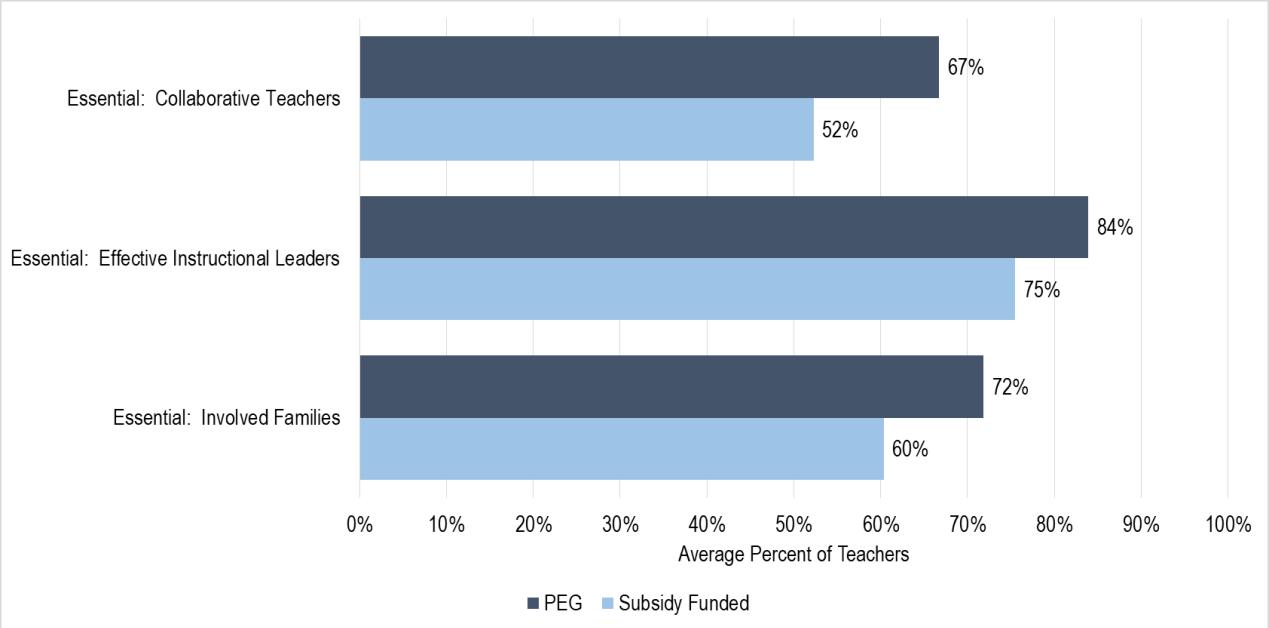
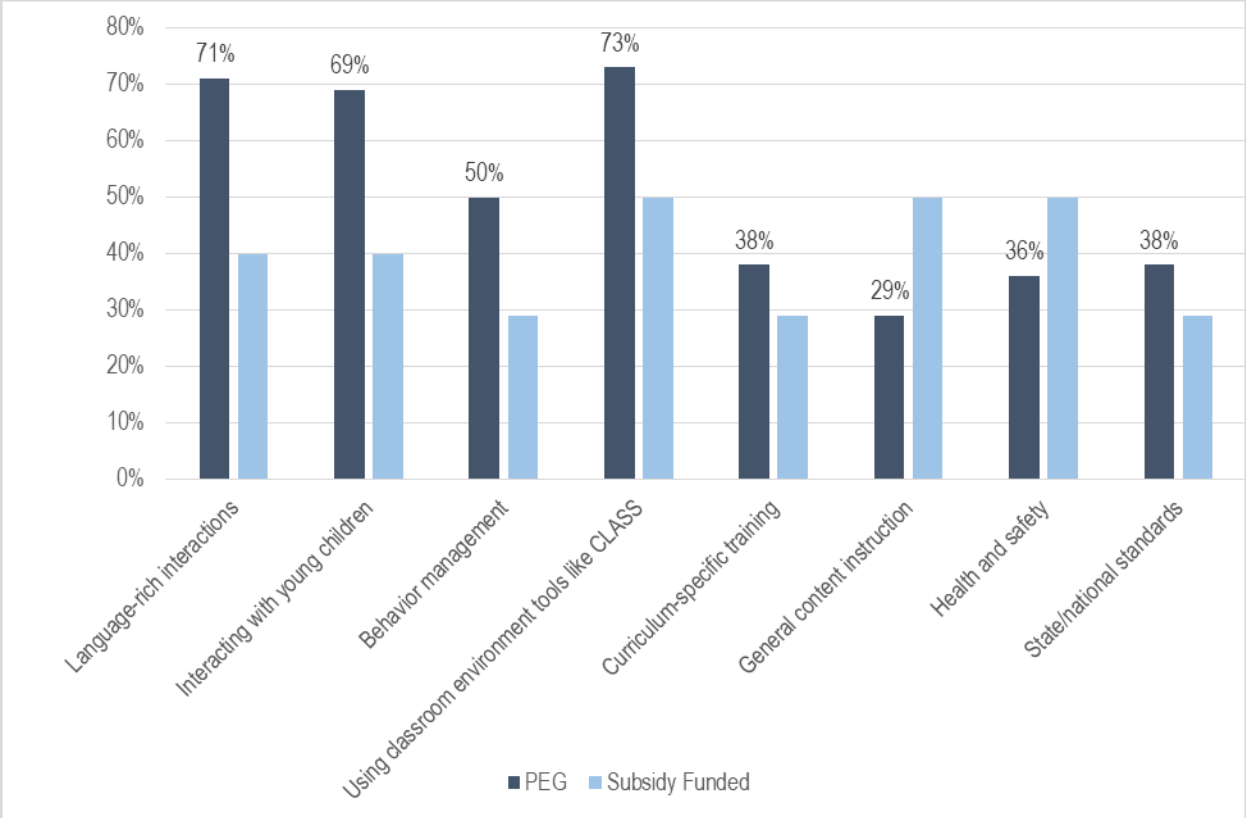


Exhibit 38 shows the percent of program directors who reported that various training topics were very effective at supporting/improving their leadership practices. PEG directors were generally more positive about the trainings received than directors from comparable subsidy funded programs. These data should be interpreted with caution as the number of program directors that reported receiving certain topics of training was sometimes very small.

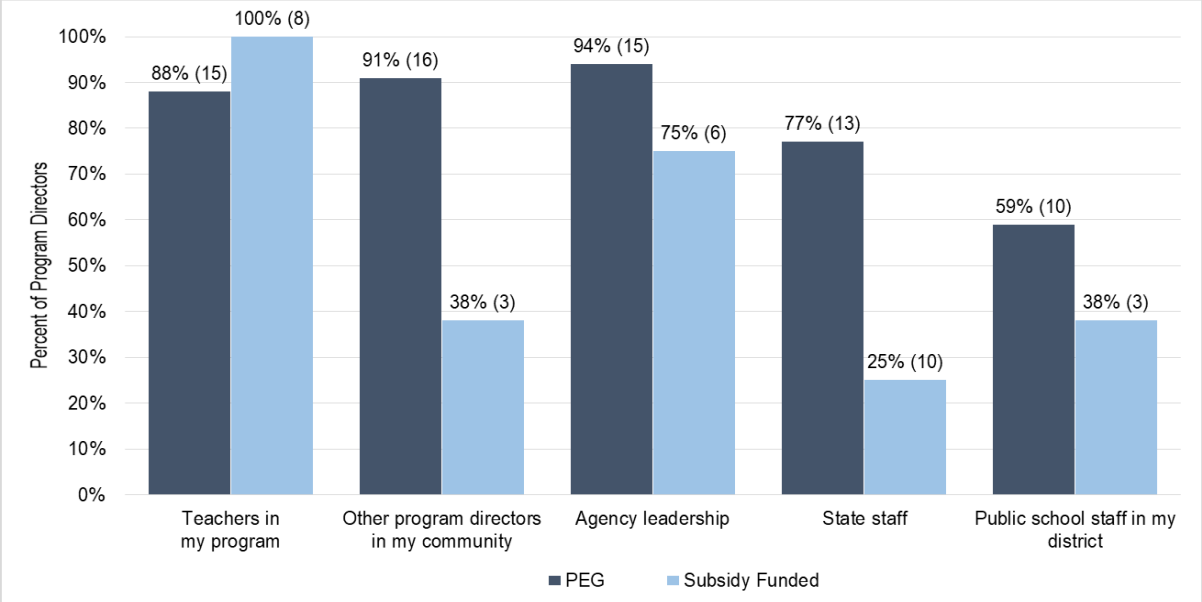
Exhibit 38. PEG and Comparable Subsidy Funded Program Director Reported Usefulness of Different Training Topics, Year 3



Note. Numbers on the top outside of columns represent the percentage of respondents in that group who reported receiving training and found it very effective. For example, the numbers above the first column on the left indicate that 70% of the PEG program directors who reported receiving training on this topic found it to be very effective.

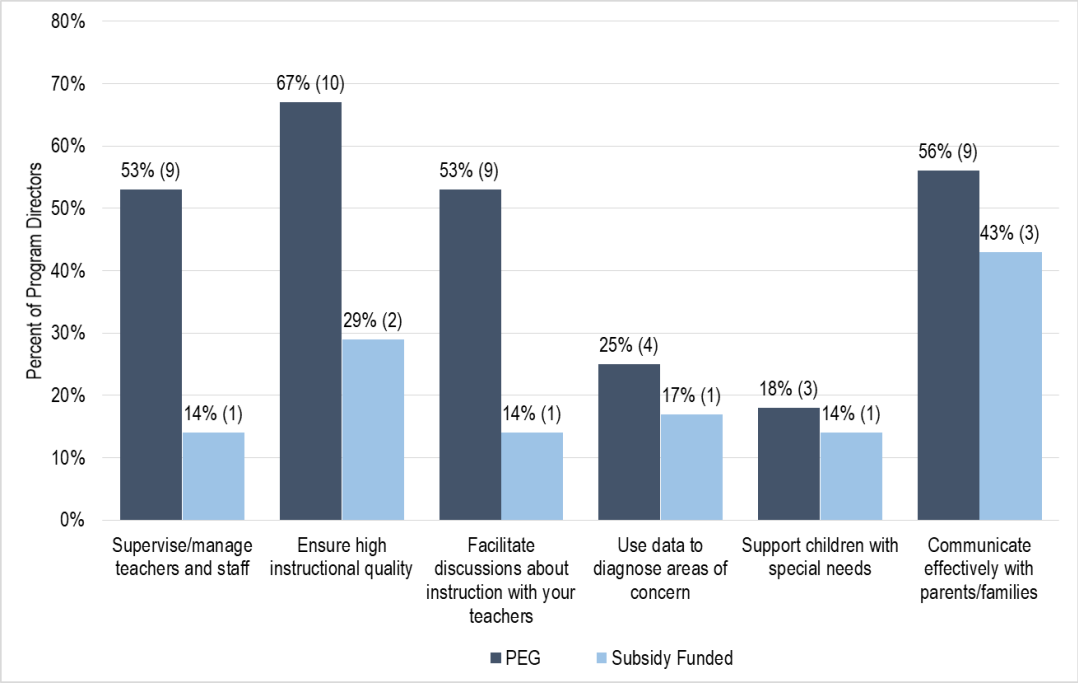
Program directors of comparable subsidy funded programs reported feeling less supported than PEG program directors (Exhibit 39), with the exception of support from their teachers.

Exhibit 39. PEG and Comparable Subsidy Funded Program Director Reported Support from Colleagues, Year 3



PEG directors reported more sufficient supports than directors of comparable subsidy funded programs on a variety of important topics (Exhibit 40).

Exhibit 40. PEG and Comparable Subsidy Funded Program Director Reported Sufficiency of Available Supports, Year 3

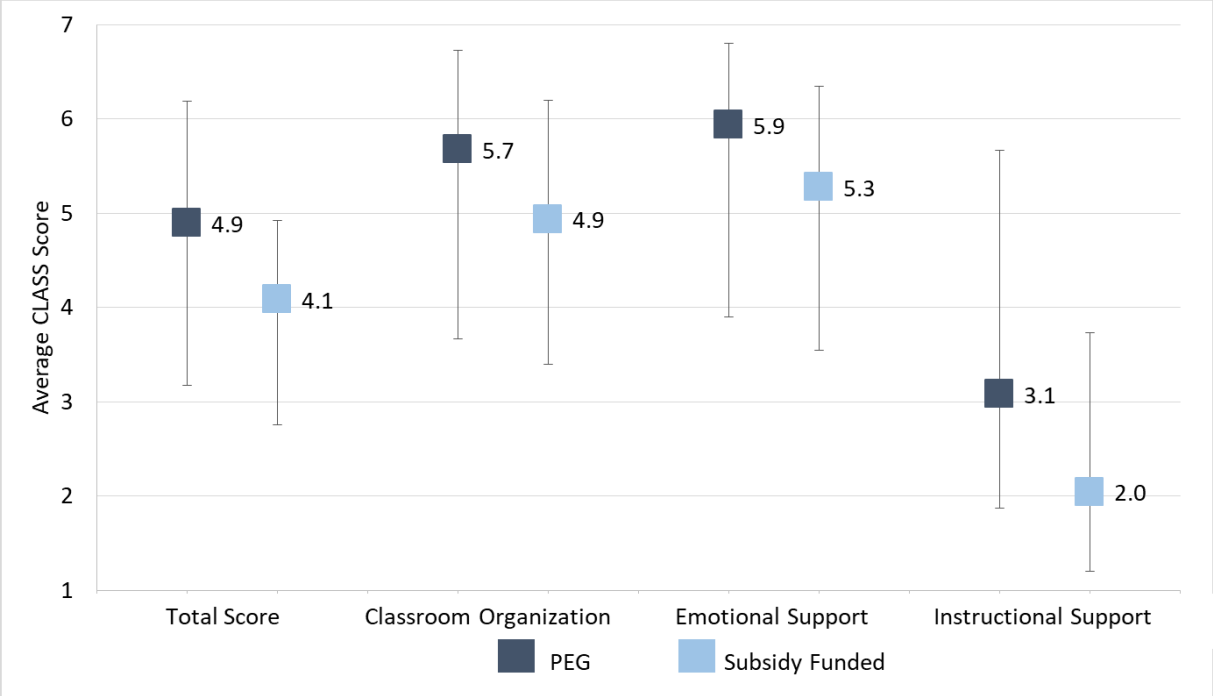


Note. Teachers were responding to the question stem "I feel that my supports are at least somewhat sufficient to enable me to do the following things well…" Occasionally the same number of respondents represents a different percentage because of the total number of people responding to that individual question.

6.3 Classroom Quality

Exhibit 41 shows the average total and domain CLASS scores for PEG and the same subsidy-funded classrooms. The average total and domain CLASS scores were significantly higher for the PEG classrooms ($p<.05$).

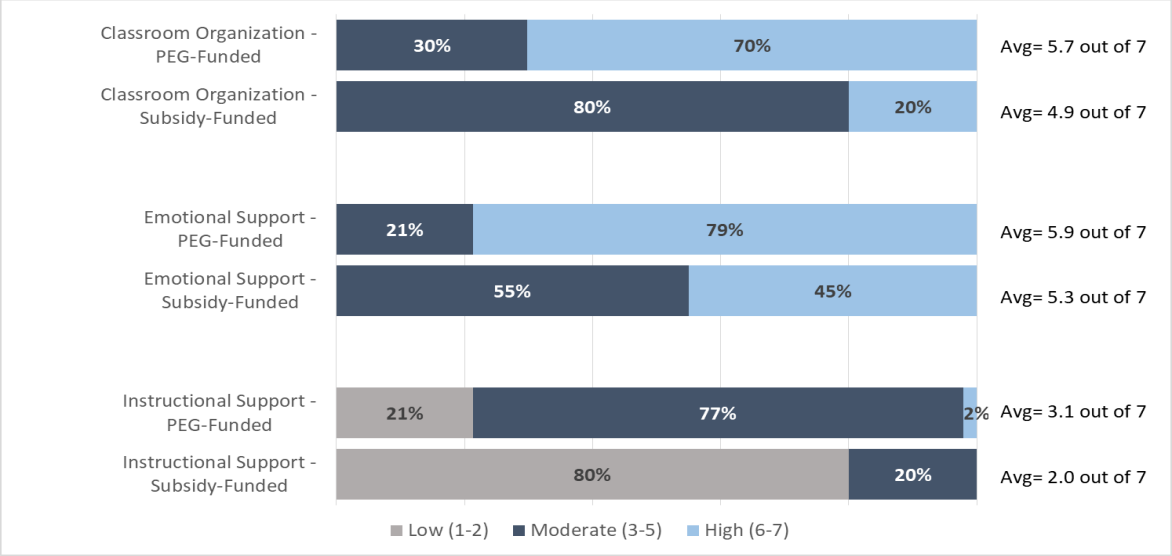
Exhibit 41. Average Scores for CLASS Total and Domain Scores for PEG and Comparable Subsidy Funded Classrooms, Year 3



Notes. MA PEG-funded sample=47 classrooms; MA comparable subsidy funded sample=20 classrooms. Each square shows the average score across classrooms on the CLASS 1-7 scale, and the vertical lines show the range between the minimum and maximum individual classroom score in that group. For example, the first two boxes show that, on average, PEG classrooms across Massachusetts scored 4.9 out of 7 points on the total CLASS score, with 7 representing the highest observed quality, while comparable subsidy funded classrooms scored 4.1 out of 7 points.

Another way to examine CLASS scores is by creating levels of quality based on CLASS scores, with Low Quality defined as a score of 1 or 2, Moderate Quality as a score of 3-5, and High Quality as a score of 6 or 7. Using these levels, the distribution of scores can be described in terms of the percentage of classrooms scoring at each of these three levels of quality. Exhibit 42 shows the percentages of all classrooms in the PEG and comparable subsidy funded sample at each level of quality. For all three CLASS domains, more PEG-funded classrooms fell in the 'Moderate' or 'High' categories than comparable subsidy funded classrooms, and the difference was particularly distinct for Instructional Support.

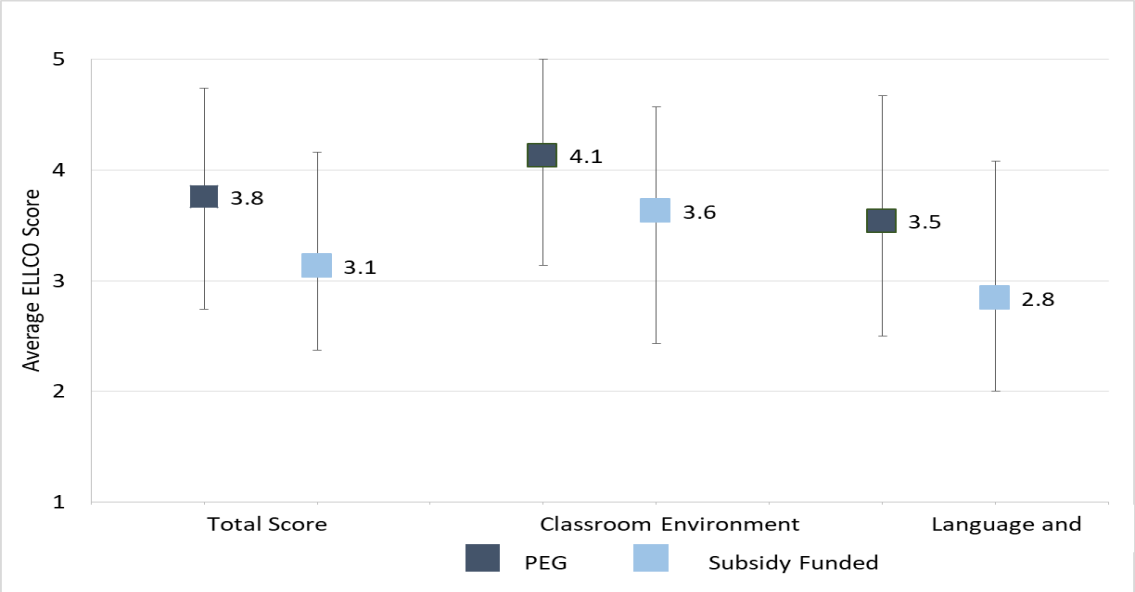
Exhibit 42. Difference in Percentage of Classrooms in Quality Categories by CLASS Domain for PEG and Comparable Subsidy Funded Classrooms, Year 3



Notes. Each bar shows the percent of the 47 PEG classrooms and 20 comparable subsidy funded classrooms in different CLASS quality ranges. For example, the bottom two bars show that 79% of Massachusetts PEG classrooms scored in the 'Moderate' or 'High' quality category on Instructional Support in 2018, compared to 20% of comparable subsidy funded classrooms.

Exhibit 43 shows the average ELLCO scores for PEG and comparable subsidy funded classrooms in 2018-19. ELLCO is a measure of the quality of and supports for the early language and literacy environment in the classroom. The average total and subscale ELLCO scores were significantly higher for the PEG classrooms ($p<.05$).

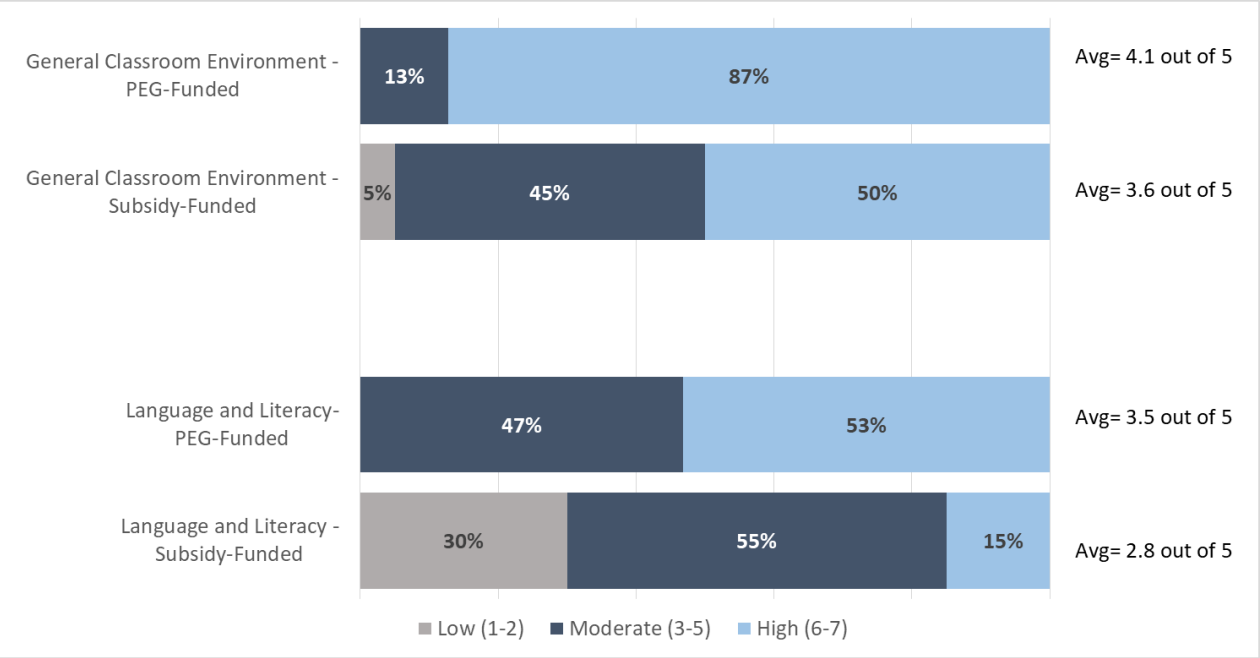
Exhibit 43. Average ELLCO Total and Subscale Scores for PEG and Comparable Subsidy Funded Classrooms, Year 3



Notes. PEG-funded sample=47 classrooms; subsidy funded sample=20 classrooms. Each square shows the average score across classrooms on the ELLCO 1-5 scale, and the vertical lines show the range between the minimum and maximum individual classroom score in that group. For example, the first two boxes show that, on average, PEG classrooms across Massachusetts scored 3.8 out of 5 points on the total ELLCO score, with 5 representing the highest observed quality, while comiparable subsidy funded classrooms scored 3.1 out of 5 points.

ELLCO scores were also examined in terms of the level of quality based on the ELLCO scores, with Low Quality defined as a score of 1 or 2, Moderate Quality as a score of 3, and High Quality as a score of 4 or 5. Using these levels, the distribution of scores can be described in terms of the percentage of classrooms scoring at each of these three levels of quality. Exhibit 44 shows the percentages of all classrooms in the PEG and subsidy-funded sample at each level of quality. For both ELLCO subscales, more PEG classrooms fell in the 'High' category rather than 'Moderate' or 'Low' when compared to comparable subsidy funded classrooms, and the difference was particularly distinct for Language and Literacy Environment.

Exhibit 44. Difference in Percentage of Classrooms in Quality Categories by ELLCO Subscale for PEG and Comparable Subsidy Funded Classrooms, Year 3



Notes. Each bar shows the percent of the 47 PEG classrooms and 20 comparable subsidy funded classrooms in different ELLCO quality ranges according to their observed scores in 2018. For example, the bottom two bars show that 53% of PEG classrooms scored in the 'High' quality category on Language and Literacy, compared to 15% of comparable subsidy funded classroom.

7 Skills and Outcomes of PEG Children

7.1 Key Findings

Regression Discontinuity Impact Study

- The PEG program had a positive and statistically significant impact on children's early literacy and early math, achievement and on vocabulary comprehension. The largest impact was on early literacy skills; the smallest effect was on vocabulary. PEG did not appear to have a significant impact on children's executive function skills.
- PEG program impacts were larger for children whose home language was not English than for those whose home language was English (significantly so for early math skills) and for children who did not have any parent-reported formal care before entering the PEG program.
- The impacts of the PEG program on children's early literacy and math achievement are very similar to effects found in other RDD studies of pre-kindergarten programs. It is notable that most prior studies were limited to public school programs whereas PEG classrooms were operated by community-based programs.

Longitudinal Study

- Over the preschool year, PEG children's early academic skills improved in early literacy, early math, and vocabulary comprehension; in all areas, children ended their PEG year closer to the national average than they were when they entered preschool.
- As PEG children continued into first grade, their early literacy skills continued to improve. For math, children stayed close to the national norm but did not continue to improve relative to the norm.
- For vocabulary comprehension, there were a substantial number of PEG children whose vocabulary proficiency was still a concern at the end of preschool. There was little growth in vocabulary skills after preschool into first grade, and growth was largest for children whose home language was not English.
- PEG children's executive function skills increased during preschool and into first grade.
- The English proficiency of children who entered PEG with few English language skills improved at the end of preschool and continued to improve through the end of first grade.
- The pattern of growth for each of the four PEG communities in which children were assessed at three time points was similar to the overall pattern at the state level.

State Outcomes Study

- One to two years after PEG, when students are in kindergarten and first grade, PEG children were less likely than other disadvantaged students in the same districts to be chronically absent than other low income children, less likely to receive special education services, and less likely to be designated as having Limited English Proficiency.

The PEG evaluation included three separate studies that examined PEG children's outcomes. The studies answer different research questions about outcomes, depending on the time point when the outcomes are measured and whether the sub-study employed an independent comparison group of children or relied on the norms from the standardized tests used to assess outcomes (Exhibit 45). In addition, each of the studies uses different samples of PEG children. The table below summarizes the three outcome studies:

- The Regression Discontinuity Study focuses on outcomes for PEG children at the end of preschool. This study used a rigorous design that allows for causal statements about differences in outcomes for children who experienced PEG versus those who did not. The PEG sample in this study included Year 2 and Year 3 children.

- The Longitudinal Study focuses on outcomes for PEG children after they leave preschool and are in kindergarten and first grade. The study examines the extent to which the improved skills observed in PEG children at the end of preschool continued after PEG. The comparison is to the expected performance of children in the national norm samples for the outcome measures. The PEG sample in this study is the Year 2 children.
- The State Outcomes Study focuses on how PEG children look on standard educational indicators—attendance, use of special education—in kindergarten and first grade compared to non-PEG children in the same school districts. The PEG sample in this study is the Year 1 children.

Exhibit 45. Child Outcomes Research Questions by Study

Primary Question of Interest	Regression Discontinuity Impact Study	Longitudinal Study	State Outcomes Study
What is the impact of PEG on children's skills?	Cohort 2 (compared to Cohort 3 prior to entering PEG)		
What are the outcomes of PEG children at the end of preschool, kindergarten and first grade, relative to the norm groups for the outcome measures? Are gains for PEG children at the end of PEG sustained/extended when the children are in kindergarten and first grade?		Cohort 2 (compared to norms)	
Do PEG children have better outcomes on standard educational indicators in elementary school compared to non-PEG children in the same districts?			Cohort 1 and 2 (compared to other non-PEG children in the same districts)

7.2 Regression Discontinuity Impact Study

The Regression Discontinuity Impact Study examined the following questions:

- What is the impact of the PEG program on children's early academic skills (literacy and math)?
- What is the impact of the PEG program on children's language development (vocabulary)?
- What is the impact of the PEG program on children's executive function skills?

This study involved PEG Cohorts 2 and 3.

Design

The study used an age-cutoff regression discontinuity design (RDD), a widely used methodology for evaluating the impact of preschool programs when true randomization (i.e., randomly assigning children to different preschool programs or to preschool versus no preschool) is not feasible. RDDs can be used to estimate the impact of preschool programs that have a strict age requirement for admittance, such that children who fall on either side of the age cutoff form groups that come close to randomly assigned groups in terms of their assumed similarities. When done correctly, RDDs are generally recognized as

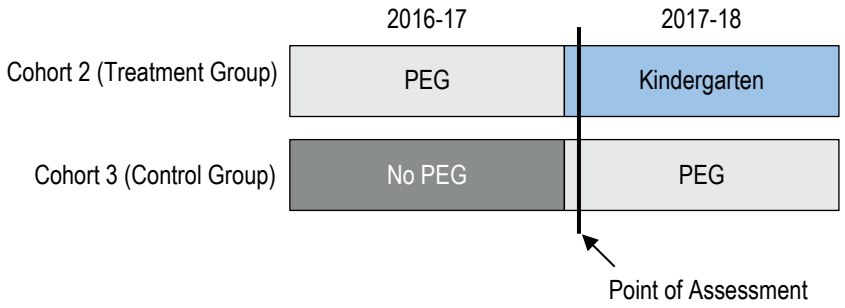
superior to other quasi-experimental (i.e., non-randomized) designs for addressing questions related to program impact[8].

Methods

The RDD takes advantage of the fact that PEG required children to reach their fourth birthday by September 1st of the enrollment year and not yet have reached five years of age by that date. The study contrasted the performance of a cohort of PEG children whose birthdays were just before the September 1 cutoff date for enrollment in 2016-17 (Cohort 2, the treatment group) to the performance of a cohort of children with birthdays just after the cutoff date; that is, they were too young to enroll in PEG that year and instead enrolled in PEG in 2017-18 (Cohort 3, the control group).

In this study, parents of all enrolled children (treatment and control cohort) were contacted for their consent at the time of their children's enrollment in their respective years: the treatment group at the beginning of 2016-17 and the control group at the beginning of 2017-18. Exhibit 46 displays the timeline for the RDD.[9]

Exhibit 46. Timeline for PEG Impact Study



Source: Figure adapted from Lipsey et al., 2015, Figure 1.

The analysis sample included 1,107 children, 582 in the treatment group and 525 in the control group, which represents 81 percent of the consented children (Exhibit 47). The analysis sample includes children from all 48 PEG classrooms. On average, each classroom was represented in the analysis sample by 23 children across treatment and control groups. The number of treatment children per classroom ranged from three to 20 with an average of 12; the number of control children per classroom ranged from five to 18 with an average of 11. There were at least three treatment and three control students in the analysis sample from each classroom.[10]

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[8] To understand the age cut-off RDD approach, imagine two children, one who turns four years old on September 1st and is eligible for PEG, and one who turns four a day later, on September 2nd, and thus is not eligible for PEG until the following year. These two children progress through the 2016-17 year having two different experiences—the former gets PEG and the latter does not. In all other observed and unobserved ways, the two children are assumed to be identical. It is this assumption that allows for an age cutoff RDD to produce an estimate of program impact similar to that produced by a randomized study—the RDD compares children who receive the intervention versus very similar children who have not yet received it. Where a random assignment study would randomly determine which students were in those two groups, an RDD study capitalizes on the existing age cutoff as the method of assignment.

[9] Additional details about the implementation of the RDD are in Appendix B.

[10] The Appendix shows analysis sample numbers by classroom and community for both groups.

Exhibit 47. Analysis Sample for Impact Study

	Treatment Group N (% of consented)	Control Group N (% of consented)	Total N (% of consented)
Total Enrollment	788	783	1571
Total Consented	703	670	1373
Total Analysis Sample	525 (75%)	582 (87%)	1,107 (81%)

Note: Some of the consented children were removed from the analysis sample because they were determined to be ineligible for a variety of reasons including: failure to meet PEG age-eligibility criteria (n=8); late enrollment or early withdrawal (n=62); receipt of consent after the assessment window had closed (n=67), or inability to assess (repeated absences, ultimate parent refusal, unable to locate kindergarten placement, etc. (n=129). Further description and justification for the exclusions from the analysis sample based on different eligibility requirements is provided in the Appendix.

In four of the five communities (except Boston), the PEG classrooms were new classrooms. These four PEG communities targeted and primarily served children who had never been enrolled in licensed early education (including both center-based programs and licensed family child care homes) in the prior year.

In Boston, PEG funding was used to support existing preschool classrooms that implemented the PEG operating schedule (i.e., extending the programs to offer full-day, full-year care in Head Start sites) and all elements of the PEG instructional model. As a result, the majority of the PEG children in Boston classrooms had already experienced formal early education prior to their PEG experience, often in the same program.

Outcomes

The study used standardized norm-referenced measures to assess children's early literacy and math skills and vocabulary; a nonstandard but widely used measure to assess executive function skills. The battery of measures is described below.

Vocabulary. Children's receptive vocabulary knowledge was measured with the Peabody Picture Vocabulary Test—Fourth Edition (Dunn & Dunn, 2007). The test measures children's receptive (listening) vocabulary skills, and is often thought of as an indicator of overall cognitive performance. The child is shown a card with four pictures on it, and selects the picture that best illustrates the meaning of a stimulus word spoken by the assessor.

Early Literacy. Children's early literacy skills were measured with the Woodcock-Johnson III Tests of Cognitive Abilities: Letter-Word Identification Subtest (Woodcock, McGrew, & Mather, 2001). The subtest measures early letter and word reading skills, specifically. The child is asked to identify individual letters and read individual words of increasing difficulty.

Early Math. Children's early mathematics skills were measures using the Woodcock-Johnson III Tests of Cognitive Abilities: Applied Problems Subtest. The subtest measures the ability to count and solve problems related to numeracy and space. The child hears a story problem and is asked to recognize the mathematical procedure that should be used and to perform the appropriate calculation.

Executive Functioning. Children's executive functioning was measured with the Hearts & Flowers Task (previously called the Dots Task; Davidson et al., 2006; Diamond et al., 2007), which measures children's ability to remember rules and to inhibit their response when applying those rules under different contexts. Its three types of tasks range in difficulty (congruent tasks, which are the easiest; incongruent tasks; and mixed tasks, which are the most difficult). Using a tablet, the child is shown either a picture of a heart or a flower on either the left or right side of the screen. The assessor instructs the child to push a button, sometimes on the same side of the screen as the picture and sometimes on the opposite side of the screen as the picture. The rules change as the game progresses.

The impact analyses used raw scores from each of the measures—that is, scores that are not age-adjusted.[11] The three academic measures each produce a single overall score. The Hearts and Flowers measure produces three raw correctness scores; this analysis used only the score for the mixed task, the most difficult of the three.

Findings

Descriptive Statistics

Exhibit 48 presents descriptive information about the demographic characteristics of both the treatment and control groups in the RDD at the time of their enrollment in PEG. On all variables except prior care, the treatment and control samples were nearly identical.[12] Unadjusted scores on outcome measures for both groups are included in the Appendix.

Exhibit 48. Demographics by Condition at Study Enrollment

	Full Sample (n=1107)	Birthday Before Cut-off (Treatment Group; Attended PEG in 2016-17; n=582)	Birthday After Cut-off (Control Group; Attended PEG in 2017-18; n=525)
Demographics	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**
Age at Cutoff (in months)	47 (6.86)	53 (3.47)	41 (3.51)
Female (%)	50%	50%	50%
English Home Language (%)	59%	59%	60%
Black (%)	22%	22%	22%
Hispanic (%)	61%	60%	62%
White (%)	5%	6%	5%
% With Prior Child Care Exposure: 4 Communities that Targeted Those Without Prior Care	7%	3%	12%
% With Prior Child Care Exposure: All 5 Communities	28%	23%	33%

Main Effects

The standardized effect sizes (or the size of the difference in skills between the two groups, in standard deviation units) are presented graphically in Exhibit 49, in descending order of impact size. Full model results can be found in Appendix B.

- On the three measures of early academic performance, PEG had a positive and statistically significant impact on children's achievement. The largest impact was seen for early literacy skills; the smallest effect was for vocabulary. Effects on early literacy and early math skills were large enough to be robust to variations in the analytic model; effects on vocabulary were smaller and less robust but still statistically significant in the main effects model. For these skills, there was a significant benefit of participating in PEG.

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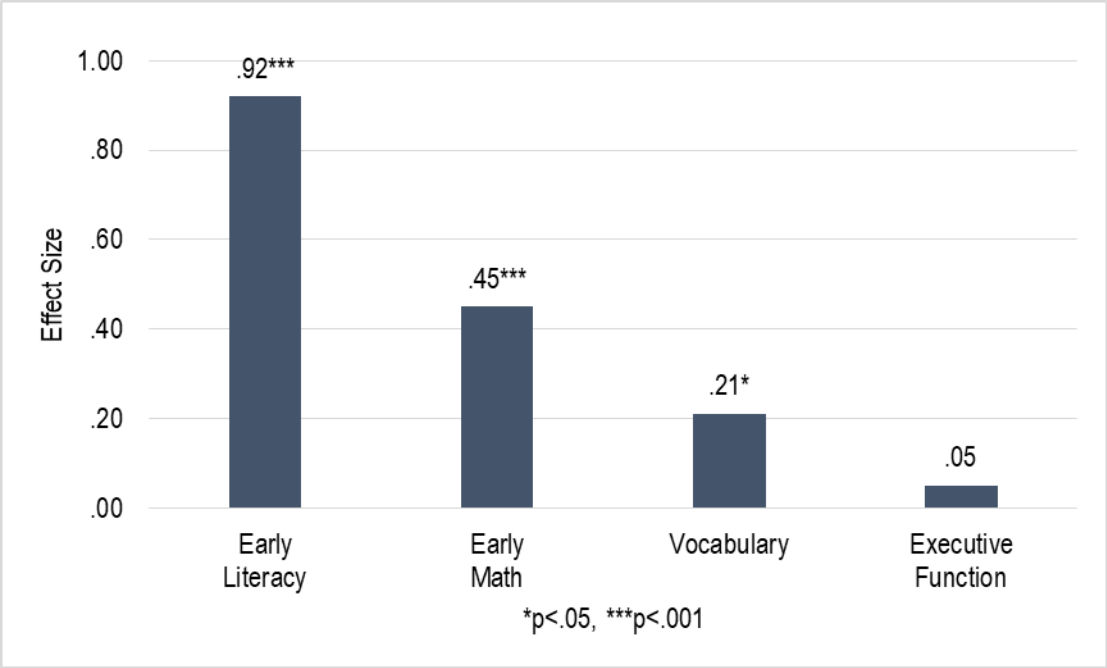
[11] Raw scores were used for the Peabody Picture Vocabulary Test, and W-scores were used for the two Woodcock-Johnson III subtests. W-scores are provided as part of the technical manual. These scores are a linear transformation of the raw score; they are not adjusted for age but provide greater variation than just the raw score distribution.

[12] In 2017-18, a change in state policy led to a slightly higher percentage of families with prior care enrolled in PEG.

- On the executive function task, the effect of PEG was not statistically significant. It is important to note that the evaluation focused on two specific skills (inhibitory control and working memory) and did not evaluate program impact on more general social-emotional functioning such as motivation and organization.

Exhibit 49. PEG Impact across Child Outcomes (in Standard Deviations)



*p<.05, **p<.01, ***p<.001; for all outcomes, positive effect sizes mean that treatment children had higher performance than control children.

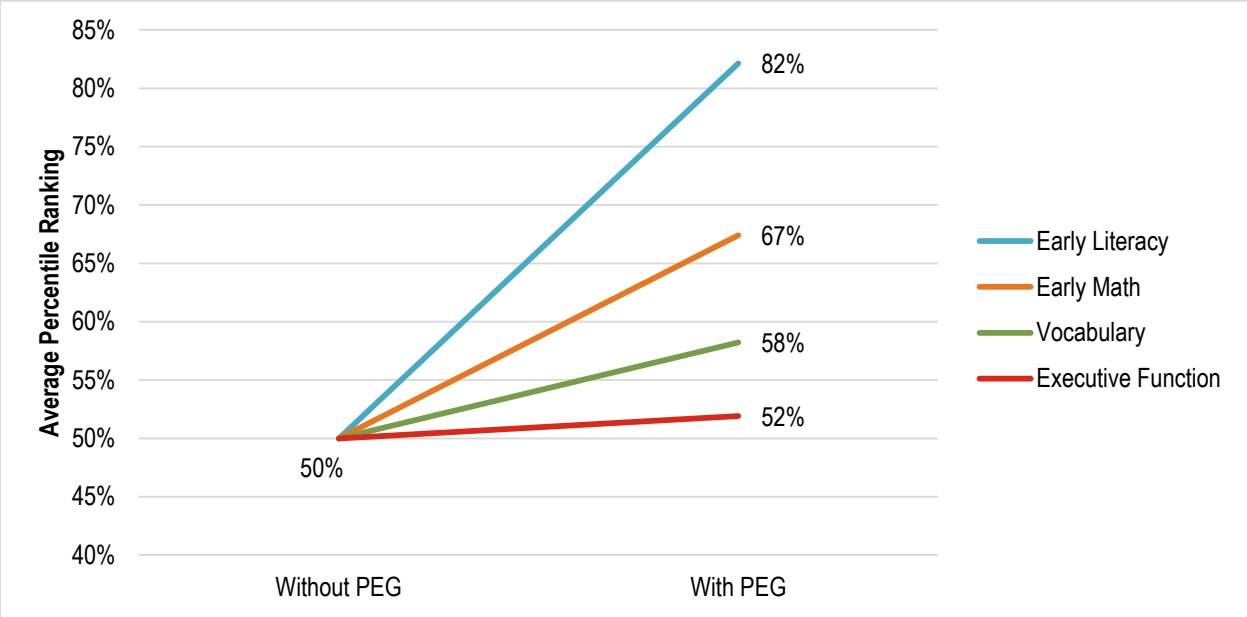
Contextualizing the Effects

Effect sizes are useful because they allow for the valid comparison of impacts across studies regardless of variation in participants, treatment, and outcome scale. However, they often do not provide the context within which to situate the meaningfulness of the impact. To that end, below are three methods of conceptualizing the main effects of the PEG RDD.

Improvement Indices

The What Works Clearinghouse translates effect sizes into "improvement index" values to help contextualize the size of the findings. Exhibit 50 shows the calculated improvement index associated with each of these effect sizes. The improvement index can be interpreted as the expected change in percentile rank for an average control group student if the student received PEG. For example, the improvement index for early literacy is 32.12, which means that PEG moved the performance of the average student from the 50th to the 82nd percentile; the average student would score better than 50 percent of his/her peers on the early literacy assessment if he/she did not experience PEG, but that same student would score better than 82 percent of his/her peers if he/she did attend a PEG program.

Exhibit 50. PEG Effect on Average Student Percentile Ranking



Comparison to What Works Clearinghouse Effects

The What Works Clearinghouse (WWC) reports effect sizes from the research it reviews on various education-related programs. Compared to the average effects reported for 165 studies of early childhood interventions for children age two to six years, the effect sizes for PEG impacts are large. The effect size for the impact of PEG on early literacy (.92) is larger than 88 percent of WWC impacts; the PEG effect size for the impact on early math (.45) is larger than 77 percent of WWC impacts and the impact on children's vocabulary scores (.21) is larger than 61 percent of WWC impacts.

Comparison to Other Studies

The results of this study can also be compared to effect sizes reported in a meta-analysis of over 300 effect sizes from 38 evaluations of center-based early childhood education programs serving children ages 3 to 5 in the United States, conducted between 1960 and 2007 (Bowne et al., 2017, Duncan and Magnuson, 2013). The authors of that meta-analysis reported an average effect size of program impacts on children's socioemotional outcomes of 0.17, and an average effect on cognitive/achievement outcomes of 0.31. The effect sizes for the impact of PEG on children's early math and literacy skills are considerably larger than what the Bowne et al. study reports, whereas the effect sizes for the impacts on vocabulary and executive function skills are lower.

Because other pre-kindergarten RDD studies measured the same early academic skills as were measured for this evaluation, the Massachusetts PEG results can be compared to results from similar studies reported in the literature. The impacts of PEG and the other pre-kindergarten programs studied using RDDs were very similar in size on children's early literacy and math achievement (Exhibit 51). The impact of PEG on vocabulary achievement was similar to the effect from a recent analysis across eight states, yet smaller than the effects reported in the RDD studies in Boston, Tulsa and Tennessee.

Exhibit 51. Effect Sizes on Children's Outcomes in Other Pre-Kindergarten Regression Discontinuity Impact Studies

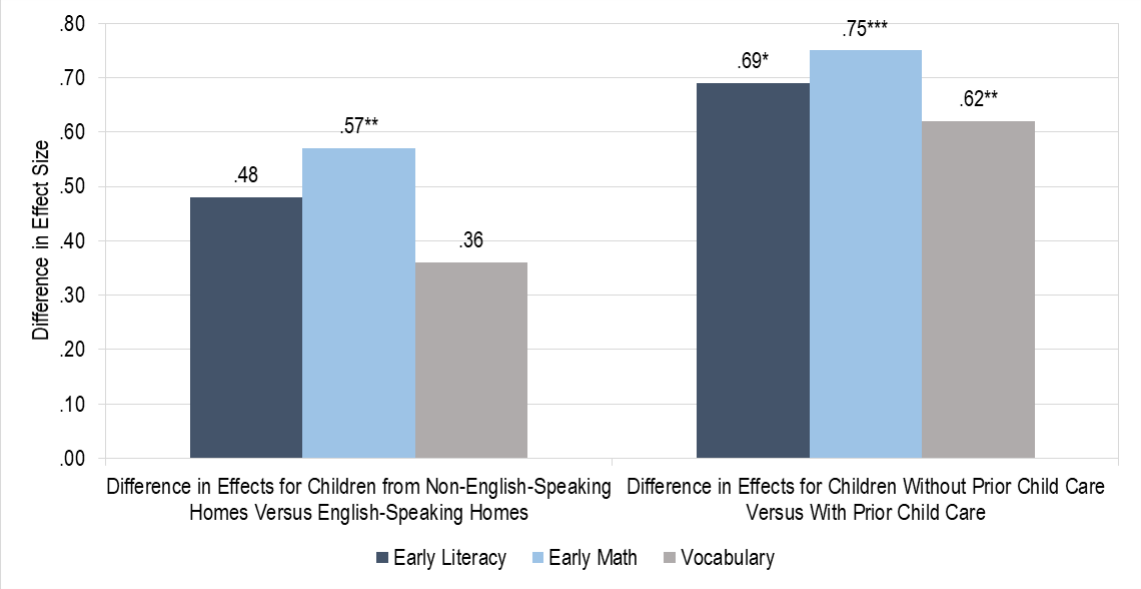
Study	Early Literacy	Early Math	Vocabulary
MA PEG	**.92**	**.45**	**.21**
Boston [a] (Weiland & Yoshikawa, 2013)	.62	.49-.58	.45
Tulsa [b] (Gormley, Phillips, & Gayer, 2008)	.79	.38	n/a
Tennessee [c] (Lipsey, Farran, Bilbrey, Hofer, & Dong, 2011)	.82	.48-.50	.48
Eight State PreK Analysis [d] (Barnett et al., 2018)	1.02	.53	.25

[a] Sample included 2018 students; 69% qualified for free/reduced-price lunch; 50% of the sample was English Language Learners.
[b] Sample included 4716 students; 65% qualified for free/reduced-price lunch; 11-18% were Hispanic.
[c] Sample included 1358 students; majority were from low-income families; 10-14% were English Language Learners.
[d] Sample included over 4,000 students; majority were from low-income families; 10-14% were English Language Learners; income and ethnicity varied widely across the eight states.

PEG Subgroup Effects

The exploratory analyses examining differential program effects by child demographics suggested that PEG was more effective for subgroups defined by home language and prior care, but not by gender (Exhibit 52).[13] Across the three academic outcomes, PEG impacts were larger for children whose home language was not English than for those whose home language was English. Although the differences were apparent on all of the outcomes, the difference was only statistically significant for early math (p=.007). Across all three academic outcomes, PEG impacts were larger for children who did not have any prior formal care and the differences were significant for all three outcomes

Exhibit 52. Difference in PEG Impact by Child Demographic Subgroup



*p<.05, **p<.01, ***p<.001

[13] The Appendix includes tables with all model parameters and impact estimates for each of the child subgroup analyses, including gender.

7.3 Longitudinal Study

The PEG longitudinal study focused on the following question:

- Does the boost in children's kindergarten readiness at the end of PEG continue through first grade?

This study involved Year 2 PEG children.

Design

In order to understand PEG children's outcomes and skill development over time, the skills of a sample of the second cohort of PEG children from four of the five communities were assessed at the beginning of their PEG preschool year (Fall 2016), at the beginning of their kindergarten year (Fall 2017), and again at the end of their first grade year (Spring 2019). Standardized measures were used to assess skills in English vocabulary, early literacy, early math, and executive function for children from each of the 48 PEG classrooms; 113 PEG-eligible children in this cohort were assessed at all three time points with at least one measure included in this report.[14]

Children's scores on standardized measures were "normed" or standardized based on the distribution of scores from large nationally representative samples of children of the same age. The national standardized samples includes children from all income levels, while the PEG sample included only low-income children. By using normed scores, PEG children's performance can be compared to the performance of a typical child of the same *age.* A score of 100 represents the average score for children in the norming sample of a given age. A score below 85 represents a below-average level of performance, and 15 percent of the national sample score below 85.

Findings

Across all areas of early academic skills measured (vocabulary, early literacy, and early math[15]), PEG students improved during the PEG year (significantly so for all three outcomes), with the largest gains shown in vocabulary. [16] In all skill areas, the gap between PEG students and the nationally representative norming sample narrowed from the beginning of preschool to the beginning of kindergarten, though the only area that saw significant growth through first grade was early literacy (Exhibit 53).

When children entered PEG, average standard scores in early literacy and early math (97 and 99, respectively) were close to the average of 100 of the norming sample, and although they grew significantly, PEG children continued to demonstrate, on average, similar academic skills at the beginning of kindergarten as the norming sample (101 for both early literacy and early math). By the end of first grade, PEG children's early literacy skills were well above the average for the norming sample (109). Early math skills did not change significantly and were no longer significantly different from the average at the beginning of PEG, which suggests that children maintained growth in skills on pace with the norming sample, yet did not improve at a faster rate. It is important to keep in mind that maintaining growth in skills still means that children are progressing at an expected rate.

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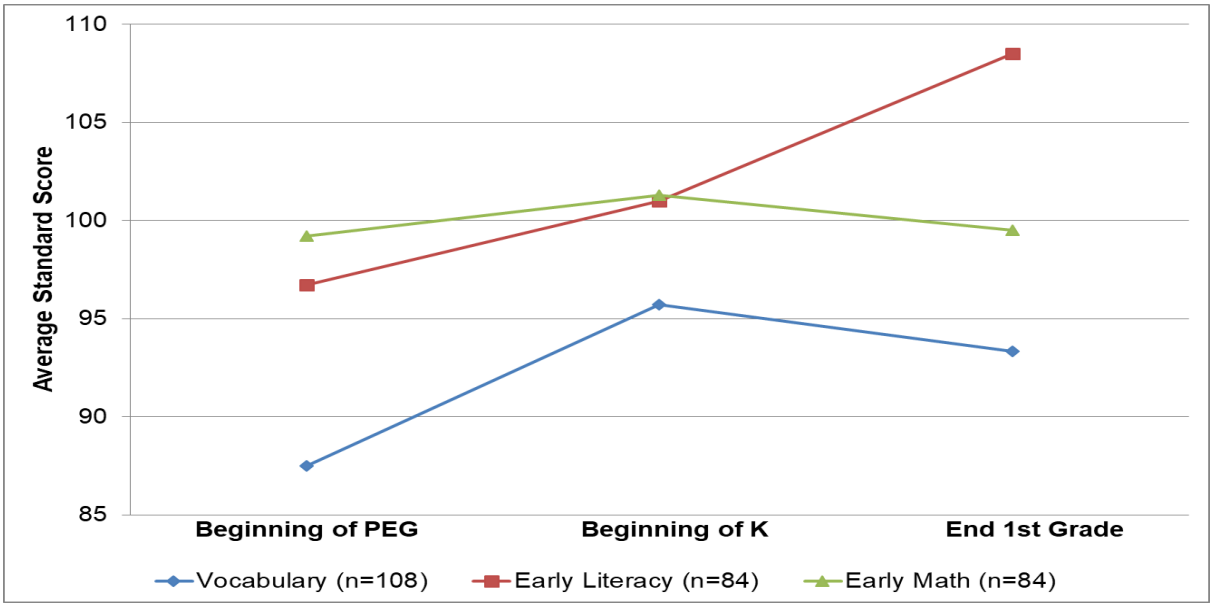
[14] Across the five PEG communities (Boston, Holyoke, Lawrence, Lowell, and Springfield), 583 PEG-eligible children were assessed at the beginning of the PEG year, 489 were assessed at the beginning of the K year, and 205 were assessed at the end of their first grade year. No children from the Boston PEG programs were assessed in first grade because of other evaluation efforts going on within this district.

[15] The same measures described in the first section of this chapter (the RDD study) were used as part of the longitudinal study.

[16] Tests of significance were conducted using paired-samples t-tests. The p-value associated with each of the three tests was <.05.

While PEG children's vocabulary skills improved significantly over the course of the preschool year, they continued to score somewhat lower, on average, than the norming sample by the beginning of kindergarten; the average standard score for PEG children at the beginning of kindergarten on vocabulary (96) was lower than the average normed score (100). At the end of first grade, the average score was still significantly higher than at the beginning of PEG (93 compared to 88), but still below the average normed score and significantly lower than scores at the beginning of kindergarten. Exhibit 54 shows whether the change from each time point was significant for each content area assessed.

Exhibit 53. Early Academic Skills for 2016-17 PEG Children from Beginning of PEG to End of First Grade



Notes. Exhibit 53 represents averages only. To interpret changes in standard scores over time:

- Increase in standard score: Children who scored average or above at the start of preschool and increased their standard score are learning new skills or improving current skills at a faster rate relative to typically-developing children of the same age. Children who scored below average at the start of preschool and increased their standard score narrowed the gap between their own performance and the performance of typically developing child of the same age.
- No change in standard score: The child's ranking relative to typically developing children of the same age has not changed.
- Decrease in standard score: The gap between the child's performance and the performance of typically developing children of the same age has widened.

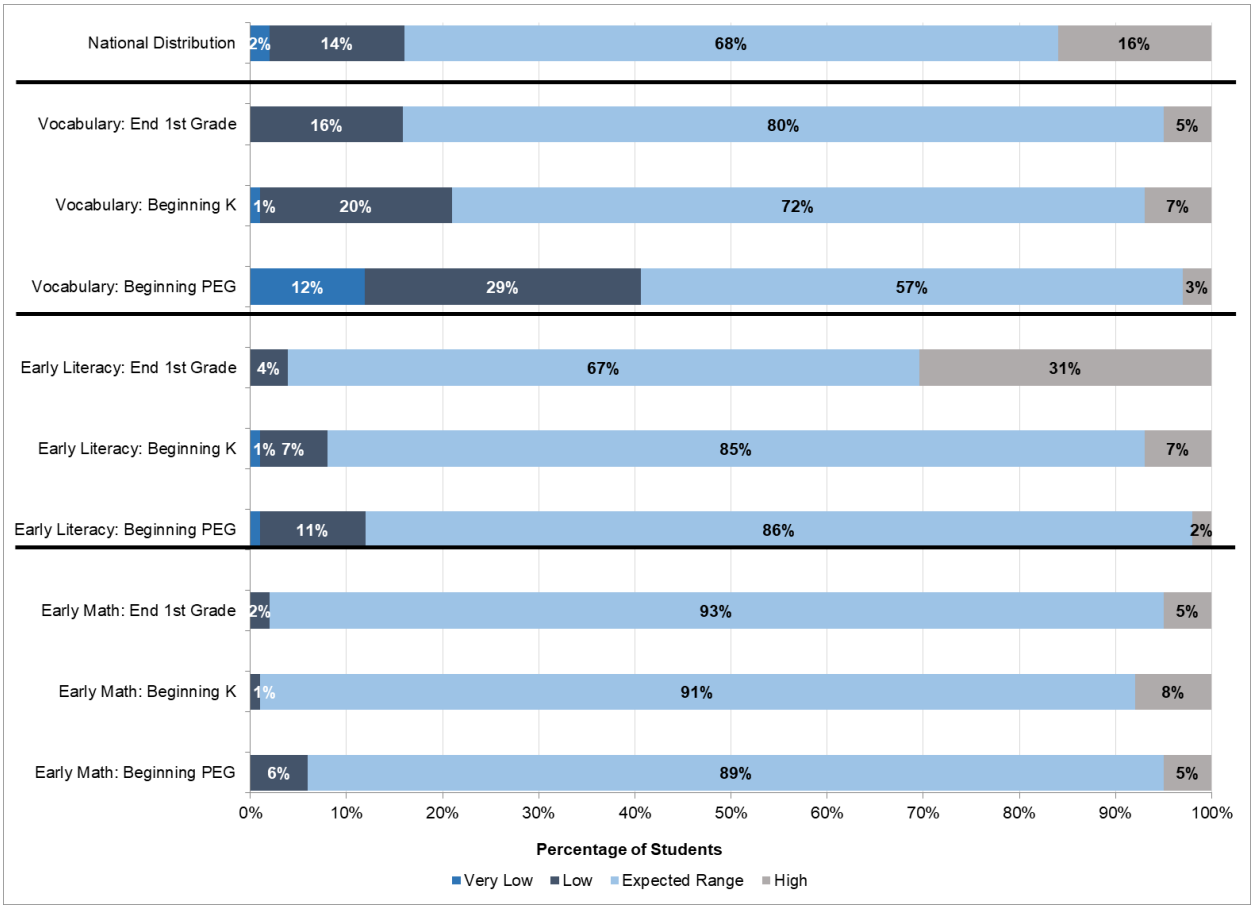
Exhibit 54. Change in Early Academic Skills from Beginning of PEG to End of First Grade

Beginning Time Point	Ending Time Point	Significant Change*
Vocabulary		
Beginning of PEG	Beginning of Kindergarten	+
Beginning of Kindergarten	End of First Grade	-
Beginning of PEG	End of First Grade	+
Early Literacy		
Beginning of PEG	Beginning of Kindergarten	+
Beginning of Kindergarten	End of First Grade	+
Beginning of PEG	End of First Grade	+
Early Math		
Beginning of PEG	Beginning of Kindergarten	+
Beginning of Kindergarten	End of First Grade	(None)
Beginning of PEG	End of First Grade	(None)

A different way of looking at the performance of PEG children is to consider the distribution of scores. In the nationally representative norming sample, 16 percent of children scored below the expected range on standardized assessments at the beginning of kindergarten. For early literacy and early math at the end of first grade, the percentages for PEG children were better than the norming sample percent (fewer children scoring below expected range, more children scoring very high for literacy). On vocabulary, the percentages for PEG children were similar to the norming sample, although fewer children scored above the Average level compared to the national sample (Exhibit 55).

From the beginning of preschool to the end of first grade, there were smaller percentages of PEG children at each time point scoring below Average; for early literacy, each time point saw a larger percentage of PEG children scoring well above average in relation to the national average.

Exhibit 55. Distribution of PEG Children and Children in Nationally Representative Sample on Early Academic Skills at Three Time Points



Notes. All assessments represented were administered in English. The categories are defined as follows:

- Very low: a score more than 2 standard deviations below the mean (<70)
- Low: a score between 1 and 2 standard deviations below the mean (70-84)
- Expected range: a score within 1 standard deviation above or below the mean (85-115)
- High: a score more than 1 standard deviation above the mean (>115)

Another analysis indicates that the majority of assessed PEG children exhibited growth over time or maintained their average or above-average status. Children who began the PEG year scoring below the national normed average and remained at that level by the end of the first grade year, however, might need more targeted support during preschool and early elementary school. Likewise, there may be reason to be concerned about children who fail to maintain their positive performance relative to same-age children in the norming sample. Exhibit 56 shows the percentage of the PEG assessed sample that fall into three categories– either positive improvement, no concern, or high concern (and these categories are described in the Exhibit notes). For each early academic outcome, at least 4% of the assessed children demonstrated a pattern that may be cause for high concern, and this percentage reached 18% for vocabulary.

Exhibit 56. Categories of Growth Profiles for 2016-17 PEG Children from Beginning of PEG to End of First Grade

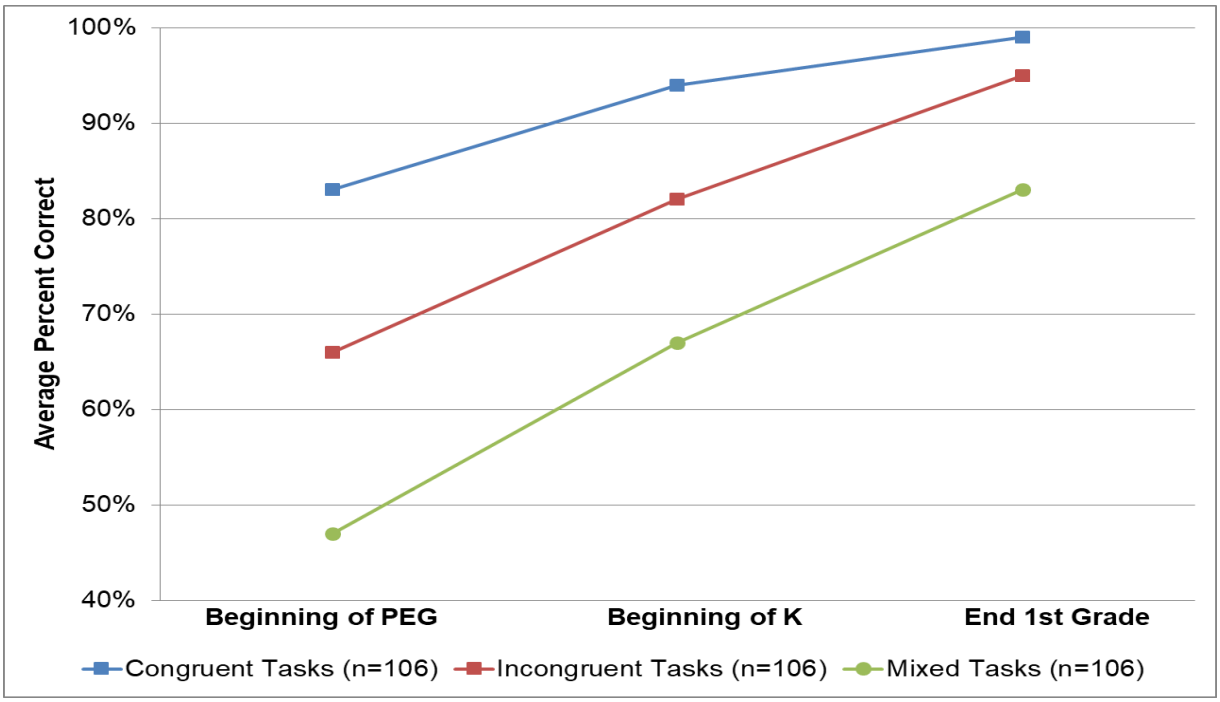
Profiles of Growth from Beginning of Pre-K to End of First Grade For PEG Children Statewide			
	Vocabulary (n=108)	Early Literacy (n=84)	Early Math (n=84)
Positive improvement	31%	37%	10%
No concern	52%	60%	83%
High concern	18%	4%	7%

*Positive improvement indicates that children improved their performance relative to same-age children in the norming sample from the beginning of PEG to the end of first grade with at least average status (standard score greater than 84).
*No concern indicates that children maintained their average (standard score between 85 and 115) or above-average status (standard score greater than 115) relative to same-age children in the norming sample but did not make marked improvements.
*High concern indicates that children either failed to maintain their performance relative to same-age children in the norming sample or began pre-k below average (less than a standard score of 85) and failed to make marked improvements by the end of first grade.
Note. The growth depicted in this table does not account for scores or standing at the beginning of the kindergarten year but only considers the growth between the beginning time point (beginning PEG) and the final posttest (end of first grade).

On the Hearts and Flowers (HF) task, from PEG entry to PEG conclusion, PEG children's executive function skills increased in all areas (Exhibit 57). As is true for other samples of children, the scores on Hearts and Flowers were higher on the easier tasks (congruent and incongruent). For *congruent tasks* (child is required to choose the *same* side as the picture shown) and *incongruent tasks* (child is required to choose the *opposite* side as the picture shown), PEG children were correct on nearly 100 percent of the tasks at the end of first grade. On the most difficult *mixed task*, where the side the child was required to choose changed during the task *based on a set of rules* corresponding to the type of picture, PEG children were correct on 83 percent of the tasks at the end of first grade. Over time, PEG students showed the largest gains in the mixed tasks.

There are no national samples of scores on Hearts and Flowers to use as benchmarks for interpreting the performance of the PEG children. Exhibit 58 shows whether the change from each time point was statistically significant for each content area assessed.

Exhibit 57. Executive Function Skills for 2016-17 PEG Children from Beginning of PEG to End of First Grade



Notes. Exhibit 57 represents averages only; not all children's skills improved over time, but the majority did.

Exhibit 58. Statistically Significant Change in Executive Function Skills from Beginning of PEG to End of First Grade

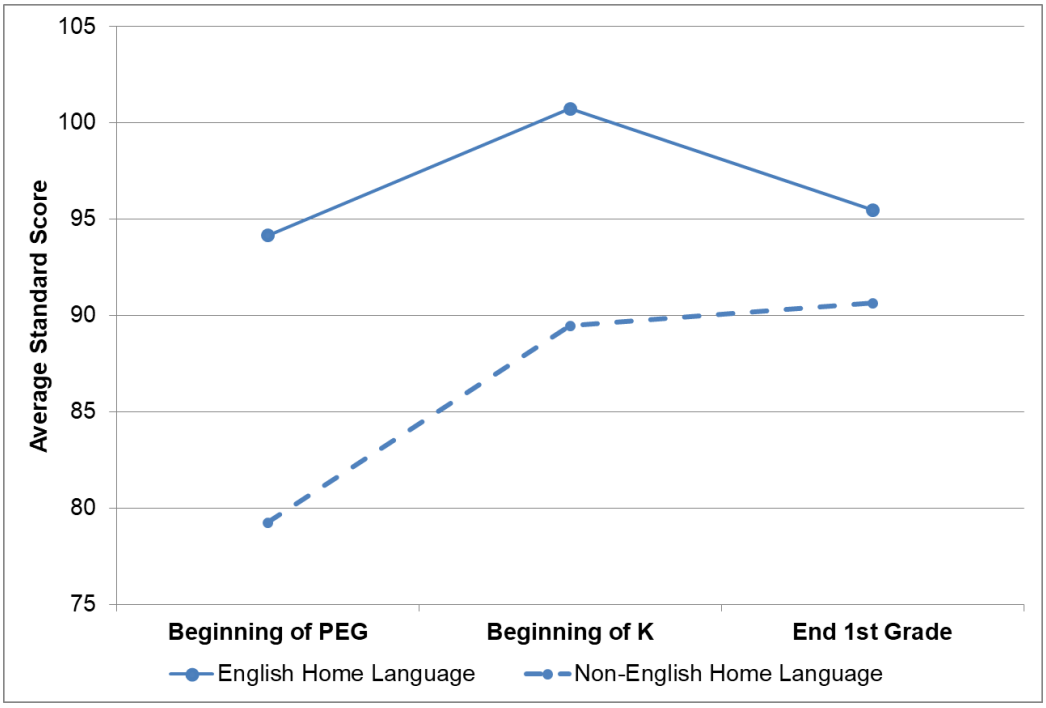
Beginning Time Point	Ending Time Point	Significant Change*
Congruent Trials		
Beginning of PEG	Beginning of Kindergarten	+
Beginning of Kindergarten	End of 1st Grade	+
Beginning of PEG	End of 1st Grade	+
Incongruent Trials		
Beginning of PEG	Beginning of Kindergarten	+
Beginning of Kindergarten	End of 1st Grade	+
Beginning of PEG	End of 1st Grade	+
Mixed Trials		
Beginning of PEG	Beginning of Kindergarten	+
Beginning of Kindergarten	End of 1st Grade	+
Beginning of PEG	End of 1st Grade	+

English Proficiency

The preLAS language screener was administered to 61 children at all three time points (beginning of PEG, beginning of kindergarten, end of first grade). While 29 of those students (48%) failed to pass the language screener at the beginning of PEG, only 5 of those students (8% of the beginning of kindergarten administration sample) continued to demonstrate low English proficiency at the beginning of kindergarten, and no students exhibited low English proficiency at the end of first grade.

To try to disentangle growth over time in English vocabulary for children with home experiences speaking other languages, growth in vocabulary was examined in two groups,[17] those whose home language was English and those whose home language was not English (based on reported home language). Both groups improved their vocabulary skills over time, and that growth was largest for children whose home language was not English (Exhibit 59). Both groups entered PEG with average standard scores lower than the national normed average, and that average was much lower for children whose home language was not English. Although they improved a notable amount, children with non-English home languages still ended the first grade year with an average score much lower than the national average (90.7).

Exhibit 59. Vocabulary Skills for PEG Children from Beginning of PEG to End of First Grade by Home Language



7.4 State Outcomes Study

The State Outcomes Study focused on the following question:

- Do children who attend PEG look different on state education indicators one and two years after PEG compared to similar students who did not attend the PEG program?

The analysis of focus in this report included Year 1 and 2 PEG children.

Design

The evaluation also examined state-collected data from the Massachusetts Department of Elementary and Secondary Education (DESE) to look at key indicators in kindergarten and first grade for children who

[17] Ninety percent of the children in this group from homes where English was not the primary language spoke Spanish; 8% spoke Khmer and 2% spoke French. The evaluation did not examine differential growth by home language for the early literacy and early math outcomes because these measures were administered in Spanish at the beginning of PEG if children whose home language was Spanish did not pass the preLAS screener and so measures administered to these children were not consistent across time. Children who were assessed in different languages over time were not included in the main analyses.

attended a PEG classroom compared to other disadvantaged children in the district. The indicators included attendance, school mobility, grade retention, Limited English Proficiency (LEP) status, participation in English language education, and receipt of special education services. Children's performance in kindergarten represent the one-year follow-up and was measured for two cohorts of PEG children (Years 1 and 2). Children's performance in grade 1 represents the two-year follow-up and, because of timing, could only be examined for Year 1 children.

Data on educational outcomes were obtained for the PEG students who attended public school kindergarten and grade 1 in each of the five PEG communities. The kindergarten data represented 626 PEG students in Cohort 1 and 640 students in Cohort 2. The first grade data represented 561 PEG students in Cohort 1. To help place the performance of the PEG students in context, the status of the PEG children was compared to the status of all of the non-PEG students in the same five school districts, using data from the state on the same educational outcomes. The comparison of the PEG and non-PEG samples was used to examine whether the PEG students had different outcomes than non-PEG students. The analysis was refined by conducting additional comparisons of PEG and non-PEG students using only the subset of non-PEG students, who more closely match the PEG students in terms of family income.

Findings

As shown in Exhibit 60, in both grades, PEG children were significantly less likely to be chronically absent than other low-income children, receive special education services, and be designated as having Limited English Proficiency. There was no significant difference between the two groups for attendance rate, grade retention, or participation in a Sheltered English Immersion program.

Exhibit 60. Summary of Findings Comparing PEG and Non-PEG Students in Kindergarten and Grade 1

	Kindergarten PEG Students (Year 1) Compared to:		Grade 1 PEG Students (Years 1 and 2) Compared to:	
	All Non-PEG	Economically-Disadvantaged Non-PEG	All Non-PEG	Economically-Disadvantaged Non-PEG
Attendance rate				
Likelihood of:				
Chronic absence		Lower		Lower
Changing school during year	Higher	Higher		
Retention in grade				
Receiving special education services	Lower	Lower	Lower	Lower
High level of need	Lower	Lower		
Placement in a separate classroom or school	Lower	Lower		
Non-English home language		Lower	Lower	Lower
Limited English Proficiency	Lower	Lower	Lower	Lower
Participation in Sheltered English Immersion program				

Note. Cells marked "lower" indicate a statistically significant difference – that is a lower likelihood of the educational outcome for PEG students than for the group of non-PEG students. Cells marked "higher" indicate a higher likelihood of the educational outcome (e.g., changing schools) for PEG students than for the group of non-PEG students. Empty cells indicate that there is not a statistically significant difference between PEG students and the group of non-PEG students.

8 PEG Cost Study

8.1 Key Findings

- The average PEG per-child cost was $18,237 per year.[18]
- PEG per-child costs were distributed across components as follows:
  - 40% for classroom staff;
  - 7% for professional development;
  - 12% for family comprehensive services and engagement for children and families;
  - 11% for program management; and
  - 30% for operational expenses.
- The per-child cost was similar across communities, and ranged from $17,034 to $20,919.
- There was between-ELP variation in total per-child cost, ranging from $15,492 to $21,775.

This chapter provides details about the cost of implementing PEG overall and then examines in an exploratory fashion the relationships between the cost of PEG and observed classroom quality and impacts on child outcomes (using the effects generated by the PEG impact study). Costs were estimated using (a) expenditure data from the LEAs in the five PEG communities and (b) data from the PEG ELP PEG expenditure reports.[19] All data were from Year 2 of PEG implementation or 2016-17.

The average total cost per PEG child and per PEG classroom was calculated[20], and the average cost was categorized into five components. Details about how individual line items from expenditure reports were categorized into components, as well as a description of the process of calculating costs, are provided in Appendix C.

One of the five PEG communities (Boston) had a braided funding model that combined PEG resources, subsidy funds, and sometimes Head Start funds to support implementation. Since the braided funding model was not comparable to the model used by the other four communities, the bulk of the analyses focused on the 33 classrooms in the other four communities (Holyoke, Lawrence, Lowell, and Springfield).

Key child-level findings across the 33 classrooms (557 slots) in the communities that did not braid PEG funds with other resources are as follows (Exhibit 61):

- The average PEG per-child cost per year was $18,237.
- The PEG per-child costs were distributed across components as follows:
  - 40% for classroom staff;
  - 7% for professional development;
  - 12% for family comprehensive services and engagement for children and families;

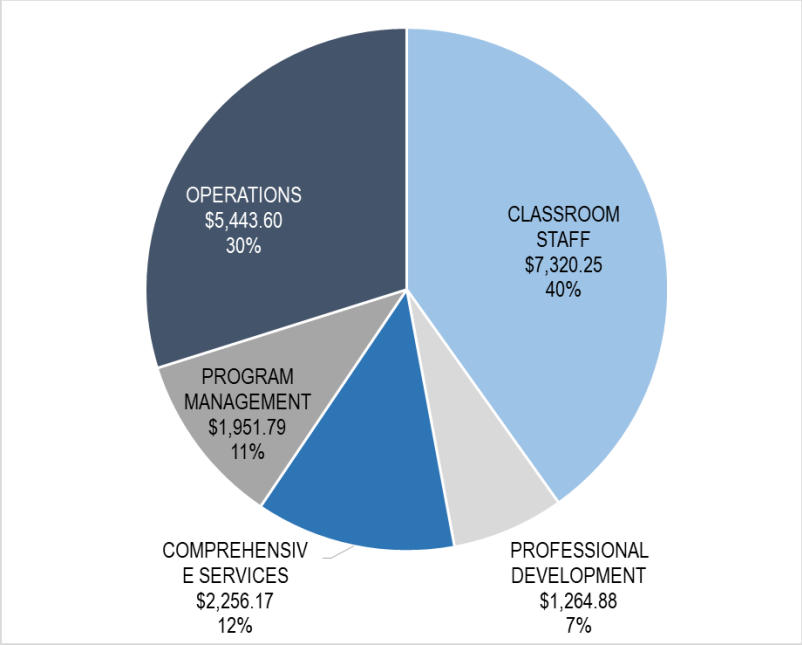
[18] These findings include the 33 classrooms (557 slots) in the four communities that did not braid PEG funds.

[19] State expenditures are included in the Appendix, and not factored into total per-child expenditures in the main body of this report, similar to many program cost studies that do not factor in the cost of higher administrative contributions/federal infrastructure.

[20] Per-classroom costs are presented for the statewide summary and are not adjusted for differences in numbers of children and teachers per PEG classroom.

  - 11% for program management; and
  - 30% for operational expenses.
- The per-child cost was similar across communities, and ranged from $17,034 to $20,919.
- There was between-ELP variation in total per-child cost, ranging from $15,492 to $21,775.

Exhibit 61. Average 2016-17 Per-Child PEG Cost by PEG Component (LEA + ELP Contributions)



Note. n=33 PEG classrooms

Exhibit 62 shows the average per-child PEG costs overall and by component across the 33 PEG classrooms. The bulk of expenditures were related to either staffing the classroom (40% of the average total cost) or operational costs (30% of the average total cost). The average per-classroom cost across these 33 classrooms was $307,813. The operational costs are detailed further in Exhibit 63 (and defined in Appendix C), which shows average per-child expenditures per operations subcategory and the percentage for each subcategory of the total operations cost.

Exhibit 62. Average 2016-17 PEG Expenditures by Component (LEA + ELP Contributions)

Component	Average Cost per Child (% Total Cost)	Average Cost per Classroom (% Total Cost)
Classroom Staff	$7,320.25 (40%)	$123,557.02 (40%)
Professional Development	$1,264.88 (7%)	$21,349.61 (7%)
Comprehensive Services	$2,256.17 (12%)	$38,081.44 (12%)
Program Management	$1,951.79 (11%)	$32,943.84 (11%)
Operations	$5,443.60 (30%)	$91,881.29 (30%)
Total	**$18,236.69**	**$307,813.19**

Note. n=33 PEG classrooms, 557 child slots

The largest expenditure subcategories in Operations were facilities costs and indirect costs (Exhibit 63).

Exhibit 63. Average PEG Year 2 Expenditures by Operations Subcategory (LEA + ELP Contributions)

Operations Subcategory	Average Cost per Child (% Operations Cost)	Average Cost per Classroom (% Operations Cost)
Executive Staff	$323.36 (4%)	$5,457.97 (6%)
Office Staff	$640.97 (9%)	$10,818.77 (12%)
Facilities	$1,708.8 0 (23%)	$28,842.46 (31%)
Equipment and Supplies	$1,025.96 (14%)	$17,316.90 (19%)
Special Events	$70.33 (1%)	$1,187.13 (1%)
Student Transportation	$179.35 (2%)	$3,027.14 (3%)
Indirect Costs	$1,417.02 (19%)	$23,917.58 (26%)
Miscellaneous	$77.81 (1%)	$1,313.34 (1%)
Total	**$5,443.60**	**$91,881.29**

Note. n=33 PEG classrooms, 557 child slots

9 Conclusions

The PEG program established 48 classrooms in five communities, and the model was characterized by (1) inclusion of key programmatic supports for educators and families that are recognized by the field as supporting high-quality settings; (2) operation of classrooms within community-based organizations that partnered closely with local school districts, particularly around professional development and coaching for educators; and (3) targeting children who were at-risk due to family income and in many cases, had not spent time in a formal child care setting prior to PEG.

The evaluation demonstrated that PEG significantly affected children's early academic outcomes across literacy, math, and comprehension after one year of participation in the program. PEG did not impact the aspects of children's socio-emotional outcomes that were assessed, specifically, their executive functioning. The size of the impacts at the end of preschool are very similar to the impacts reported in other studies of high-quality prekindergarten programs, which also used the same rigorous design (regression discontinuity). The evaluation also provided evidence that in some areas of development, PEG children continued to grow at a higher-than-expected rate when they were in kindergarten and first grade. Furthermore, fewer PEG children were chronically absent in kindergarten and first grade and fewer required special education services, compared to other low-income children in their districts

Why did PEG successfully improve young children's outcomes? The evaluation showed that two key hypothesized mediators of child outcomes—classroom quality and family supports—were present in PEG, albeit with some variation. In terms of classroom quality, the PEG classrooms had moderate-to-high scores on two of three domains of the CLASS (Classroom Organization and Emotional Support). In addition, the average scores on these domains increased significantly over the four years of program implementation. On the third domain (Instructional Support), the scores for the PEG classrooms did not increase, although they remained at a moderate level across the four years and showed small positive shifts in the distribution of scores for educators receiving supports all four years. The lower score on Instructional Quality is consistent with findings of lower scores in this domain from other early childhood studies. The lack of gains in this domain despite the professional training and coaching provided to the PEG teachers is an issue for future exploration for the state and field as a whole.

In terms of family outcomes, although there were no significant changes in parents' attitudes or in the reported level of their involvement in their children's learning at home, it is notable that significant gains were reported on parent economic outcomes including father's employment, job stability of parents, and overall family income. The fact that PEG children had access to free full-day, full year programming may have helped families find better and more stable jobs. These changes, in turn, can be seen as increasing various protective factors in the lives of the PEG children.

PEG is a promising model that successfully delivered high quality early childhood education through a mixed delivery system. The PEG evaluation confirmed the effectiveness of this model, and demonstrated the feasibility of obtaining significant impacts in classrooms operated by community-based organizations as opposed to public school districts, the focus of most prior rigorous research. This is an important finding in light of the fact that in many states, expansion of state preschool slots is hindered by the lack of space in districts. The PEG model required substantial investments in supports for teachers and families and serves as a demonstration model worthy of replication.

Appendix A: Early Education Organizational Essentials Additional Details

Exhibit A1. *Early Education Organizational Essentials* Questions by Essential and Dimension

Essential	Dimension	Survey Item
Collaborative Teachers	Socialization of New Teachers	Experienced teachers invite new teachers into their rooms to observe, give feedback, etc.
Collaborative Teachers	Socialization of New Teachers	A conscious effort is made by faculty to make new teachers feel welcome here.
Collaborative Teachers	Socialization of New Teachers	How many teachers are assigned a mentor teacher when they first begin working at this center?
Collaborative Teachers	Reflective Dialogue	How often have you had conversations with colleagues this program year about...what helps children learn the best?
Collaborative Teachers	Reflective Dialogue	How often have you had conversations with colleagues this program year about...Development of curriculum and instruction?
Collaborative Teachers	Reflective Dialogue	How often have you had conversations with colleagues this program year about...the goals of this center?
Collaborative Teachers	Reflective Dialogue	How often have you had conversations with colleagues this program year about...managing classroom behavior/
Collaborative Teachers	Reflective Dialogue	How often have you had conversations with colleagues this program year about...partnering with families to promote children's learning and development.?
Collaborative Teachers	Reflective Dialogue	How often have you had conversations with colleagues this program year about...creating child-centered learning environments?
Collaborative Teachers	Teacher Collaboration	This program year, how often have you...observed another teacher's classroom to offer feedback?
Collaborative Teachers	Teacher Collaboration	This program year, how often have you...observed another teacher's classroom to get ideas for your own instruction?
Collaborative Teachers	Teacher Collaboration	This program year, how often have you...gone over children's assessment data with other teachers to make instructional decisions?
Collaborative Teachers	Teacher Collaboration	This program year, how often have you...worked with other teachers to develop materials or activities for your classroom?
Collaborative Teachers	Teacher Collaboration	This program year, how often have you...worked on instructional strategies with other teachers?
Collaborative Teachers	Collective Use of Assessment Data	I review assessment data…independently.
Collaborative Teachers	Collective Use of Assessment Data	I review assessment data…with other teachers in my classroom.
Collaborative Teachers	Collective Use of Assessment Data	I review assessment data…with teachers who teach children of the same age.
Collaborative Teachers	Collective Use of Assessment Data	I review assessment data…with teachers across age groups.
Collaborative Teachers	Collective Use of Assessment Data	I review assessment data…with my center director.
Collaborative Teachers	Collective Responsibility	How many teachers at this center…take responsibility for improving the center?
Collaborative Teachers	Collective Responsibility	How many teachers at this center…feel responsible to help each other do their best?

Essential	Dimension	Survey Item
Collaborative Teachers	Collective Responsibility	How many teachers at this center…feel responsible that all children learn?
Collaborative Teachers	Collective Responsibility	How many teachers at this center…feel responsible for helping children develop self-control?
Collaborative Teachers	Collective Responsibility	How many teachers at this center…feel responsible when children in this center fail?
Collaborative Teachers	Innovation	How many teachers at this center…are really trying to improve their teaching?
Collaborative Teachers	Innovation	How many teachers at this center…are willing to take risks to make the center better?
Collaborative Teachers	Innovation	How many teachers at this center…are eager to try new ideas?
Collaborative Teachers	Innovation	All teachers in this center are encouraged to "stretch" and "grow."
Collaborative Teachers	Innovation	In this center, teachers are continually learning and seeking new ideas.
Collaborative Teachers	School Commitment	I usually look forward to each working day at this center.
Collaborative Teachers	School Commitment	I wouldn't want to work in any other center.
Collaborative Teachers	School Commitment	I feel loyal to this center.
Collaborative Teachers	School Commitment	I would recommend this center to parents seeking a place for their child.
Collaborative Teachers	Teacher-Teacher Trust	To what extent do you feel respected by other teachers at this center?
Collaborative Teachers	Teacher-Teacher Trust	Teachers in this center trust each other.
Collaborative Teachers	Teacher-Teacher Trust	It's OK in this center to discuss feelings, worries, and frustrations with other teachers.
Collaborative Teachers	Teacher-Teacher Trust	Teachers respect other teachers who take the lead in center improvement efforts.
Collaborative Teachers	Teacher-Teacher Trust	Teachers at this center respect those colleagues who are experts at their craft.
Effective Instructional Leaders	Teacher-Leader Trust	To what extent do you feel respected by your director?
Effective Instructional Leaders	Teacher-Leader Trust	The director has confidence in the expertise of the teachers.
Effective Instructional Leaders	Teacher-Leader Trust	I trust the director at his or her word.
Effective Instructional Leaders	Teacher-Leader Trust	It's OK in this center to discuss feelings, worries, and frustrations with the director.
Effective Instructional Leaders	Teacher-Leader Trust	The director takes a personal interest in the professional development of teachers.
Effective Instructional Leaders	Teacher-Leader Trust	The director looks out for the personal welfare of the staff members.
Effective Instructional Leaders	Teacher-Leader Trust	The director places the needs of children ahead of personal and political interests.
Effective Instructional Leaders	Teacher-Leader Trust	The director at this center is an effective manager who makes the school run smoothly.
Effective Instructional Leaders	Instructional Leadership	A member of the school leadership team...makes clear to the staff the leadership's expectations for meeting instructional goals.
Effective Instructional Leaders	Instructional Leadership	A member of the school leadership team...communicates a clear vision for our center.

Essential	Dimension	Survey Item
Effective Instructional Leaders	Instructional Leadership	A member of the school leadership team...presses teachers to implement what they have learned in professional development.
Effective Instructional Leaders	Instructional Leadership	A member of the school leadership team...knows what's going on in my classroom.
Effective Instructional Leaders	Instructional Leadership	A member of the school leadership team...provides me with useful feedback to improve my teaching.
Effective Instructional Leaders	Instructional Leadership	A member of the school leadership team...has provided me with the support I need to improve my teaching.
Effective Instructional Leaders	Instructional Leadership	A member of the school leadership team...sets high standards for children's learning and development.
Effective Instructional Leaders	Teacher Influence	How much influence do teachers have over center policy in...planning how discretionary center funds should be used?
Effective Instructional Leaders	Teacher Influence	How much influence do teachers have over center policy in...determining which books and other instructional materials are used in classrooms?
Effective Instructional Leaders	Teacher Influence	How much influence do teachers have over center policy in...establishing the curriculum and instructional program?
Effective Instructional Leaders	Teacher Influence	How much influence do teachers have over center policy in...determining the content of in-service programs?
Effective Instructional Leaders	Teacher Influence	How much influence do teachers have over center policy in…setting standards for student behavior?
Effective Instructional Leaders	Program Coherence	Once we start a new program in this center, we follow up to make sure that it's working.
Effective Instructional Leaders	Program Coherence	We have so many different programs in this center that I can't keep track of them all.
Effective Instructional Leaders	Program Coherence	Many special programs come and go at this center.
Effective Instructional Leaders	Program Coherence	Curriculum, instruction, and learning materials are well coordinated across the different age levels at this center.
Effective Instructional Leaders	Program Coherence	There is consistency in curriculum, instruction, and learning materials among teachers of same-aged children level at this center.
Involved Families	Teacher-Parent Trust	How many teachers at this center...Feel good about parents' support for their work?
Involved Families	Teacher-Parent Trust	How many teachers at this center...feel parents share information that is helpful to them in their teaching?
Involved Families	Teacher-Parent Trust	How many teachers at this center...support your teaching efforts?
Involved Families	Teacher-Parent Trust	How many teachers at this center...do their best to help their children learn?
Involved Families	Teacher-Parent Trust	How many teachers and parents at this center think of each other as partners in educating children?
Involved Families	Parent Involvement	How many of your children's parents...attended parent-teacher conferences when you requested them?
Involved Families	Parent Involvement	How many of your children's parents...contacted you about their child's performance?
Involved Families	Parent Involvement	How many of your children's parents...respond to your suggestions for helping their child?

Essential	Dimension	Survey Item
Involved Families	Teacher Outreach/Collaboration with Parents	Is your teaching influenced by what parents share with you about their child's learning style?
Involved Families	Teacher Outreach/Collaboration with Parents	Do you collaborate with parents to set goals for their child(ren)'s learning and development?
Involved Families	Teacher Outreach/Collaboration with Parents	Do you solicit parents' observations of their child(ren) at home to supplement your understanding of their child(ren)'s development?
Involved Families	Teacher Outreach/Collaboration with Parents	Do you design your instruction based on specific information parents provide about their child?
Involved Families	Teacher Outreach/Collaboration with Parents	This program year, how frequently have you...suggested ways parents can reinforce at home what their child is learning in the classroom?
Involved Families	Teacher Outreach/Collaboration with Parents	This program year, how frequently have you...provided parents with information about their child's progression towards learning and development goals?
Involved Families	Teacher Outreach/Collaboration with Parents	This program year, how frequently have you...organized opportunities in your classroom for all parents to participate with their child in learning activities?
Involved Families	Parent Influence	To what extent does this center...involve parents/guardians in the development of programs aimed at improving students' academic outcomes?
Involved Families	Parent Influence	To what extent does this center...involve parents/guardians in commenting on curricula?
Involved Families	Parent Influence	To what extent does this center...Include parent leaders from all backgrounds in center improvement efforts?
Involved Families	Parent Influence	To what extent does this center...develop formal networks to link all families with each other (for example: sharing parent directories, providing a website for parents/guardians to connect with one another, etc)?
Involved Families	Parent Influence	To what extent does this center...encourage more involved parents/guardians to reach out to less involved parents/guardians?

Appendix B: Impact Study Technical Details

Global Regression Results: Main Effects

Model Parameters

All main effects models included the following parameters:

Treatment indicator: In RDD models, there is one key variable that measures the effect of the treatment, which is age eligibility (an indicator for age of at least 4 at the cutoff). Together with other age variables (either linear or quadratic terms on each side of the cutoff), that indicator for age eligibility models the effect of the treatment in the context of this type of design. For example, in a linear model, indicators were included for participation (measuring the jump at cutoff), distance from cutoff in age (measured in days away from the cutoff), and the interaction of the jump at cutoff and the distance from the cutoff (which measures the differences in slopes).

Key child-level demographics: A key assumption in an RDD is that children in the treatment and control group, particularly very close to the cutoff, are similar to one another in all measured and unmeasured ways except for age and exposure to treatment. Under this assumption, it is unnecessary to adjust for covariates, but adjusting for covariates can improve precision. Therefore, all three child covariates were included to account for any variation not controlled for by the design. Analyses routinely checked for bias in the impact estimate related to the inclusion of child-level covariates and did not find evidence of meaningful bias.

Classroom-level nesting: Classroom-level fixed effects were included for each of the 48 classrooms. These do not address bias in RDD models, but serve to increase precision, to the extent that mean achievement differs systematically across classrooms. Further, this classroom-level nesting accounts for ELP- and LEA-level differences even without including terms for those levels which would only introduce collinearity issues into the models.

Results of the Main Effects Model

The results shown below use a global regression model, meaning the full analytic sample. Under each estimate, the exhibit shows the parameter estimate for the test that that the coefficient is zero, robust to clustering at the classroom level. In each model, the coefficient on linear time (age) is positive, indicating the natural growth in test scores with age, which is exactly why one would not want to compare raw test scores in the treatment group (who are uniformly older) to the control group (younger) without controlling for age. Exhibit B.1 also shows the standard error of the treatment estimate. The associated t-statistic can be obtained as the ratio of the coefficient on the treatment to the standard error, where the resulting t-statistic is greater than 2.0 means that the null hypothesis that the coefficient is zero should be rejected. In the models in Exhibit A.1, in addition to each parameter shown in the table, the model also controlled for the fixed effects of classroom with a series of dummy codes. Also of note is the interaction of time and the treatment indicator, which often has a negative but statistically insignificant estimate. This interaction captures the regression to the mean of effects at the cutoff, though the interpretation of this coefficient does not have the sharp causal interpretation supported by comparisons at the cutoff in an RD design.

Exhibit B.1. Results of Main Effects Models (Parameter Estimate, Standard Error, and Indication of Significance)

Parameter	Early Literacy	Early Math	Vocabulary	Executive Function (Mixed Trials)	Executive Function (Congruent Trials)	Executive Function (Incongruent Trials)
Treatment	**24.54*** (3.83)**	**11.33*** (2.47)**	**4.93* (2.21)**	**.01 (.03)**	**.00 (.02)**	**-.04 (.04)**
Age (Distance from Cut-off)	.05*** (.01)	.07*** (.01)	.07*** (.01)	.00*** (.00)	.00*** (.00)	.00*** (.00)
Treatment by Age Interaction	-.02 (.02)	-.03* (.01)	-.01 (.01)	.00 (.00)	-.00** (.00)	-.00 (.00)
Female	1.87 (1.39)	4.65** (1.53)	4.86** (1.40)	-.00 (.01)	.04* (.02)	.03 (.02)
English as Home Language	3.73* (1.51)	9.98*** (2.03)	16.52*** (1.66)	.01 (.01)	.00 (.02)	-.00 (.02)
Prior Childcare Exposure	7.18** (2.63)	5.64* (2.51)	5.14* (2.50)	-.01 (.02)	-.02 (.02)	-.06* (.03)
Constant	315.00*** (2.06)	386.00*** (2.30)	48.21*** (1.76)	.60*** (.02)	.82*** (.02)	.67*** (.03)

*p<.05, **p<.01, ***p<.001

Notes. Models were global regression models with linear functional form and included a set of dummy codes for classroom. Statistics are rounded to two decimal places.

Design Details

Children were eligible to enroll in PEG in a given year if they turned four years old by September 1 of that year. The RDD takes advantage of this age cut-off to compare outcomes from children at the end of one year of PEG to children who have just begun participating in PEG preschool in the next year. Any observed differences between children who fall on opposite sides of the age cut-off are interpreted as estimates of the causal impact of PEG participation.

The fact that four of the five PEG communities primarily targeted children who have never before been enrolled in formal early education of any kind meant that the majority of students who enroll in PEG were not exposed to a formal program in the year prior to their preschool year. This requirement improved the precision of the treatment-control contrast in the RDD study. However, the fifth PEG community used different eligibility requirements for their PEG families, which meant that children could enroll in PEG whether or not they had previously been in other types of formal early childhood education. In the other four PEG communities, the eligibility requirements also relaxed in the 2016-17 school year when programs were not able to fully enroll by a certain date. Because the prior care experience of children is important in determining the impact of PEG, analyses were conducted that interacted previous care experience with treatment to determine if the PEG impact varied as a function of care experiences prior to PEG.

Sample Eligibility Rules

The necessity of the assessment window in typical age-cutoff RDD studies, where children in both groups are assessed at the beginning of the prekindergarten year for the control group, poses certain difficulties in defining the sample. It is imperative that identical sample eligibility rules are used for both groups to define participants eligible for the analytic sample. Thus, a series of eligibility rules in the PEG evaluation

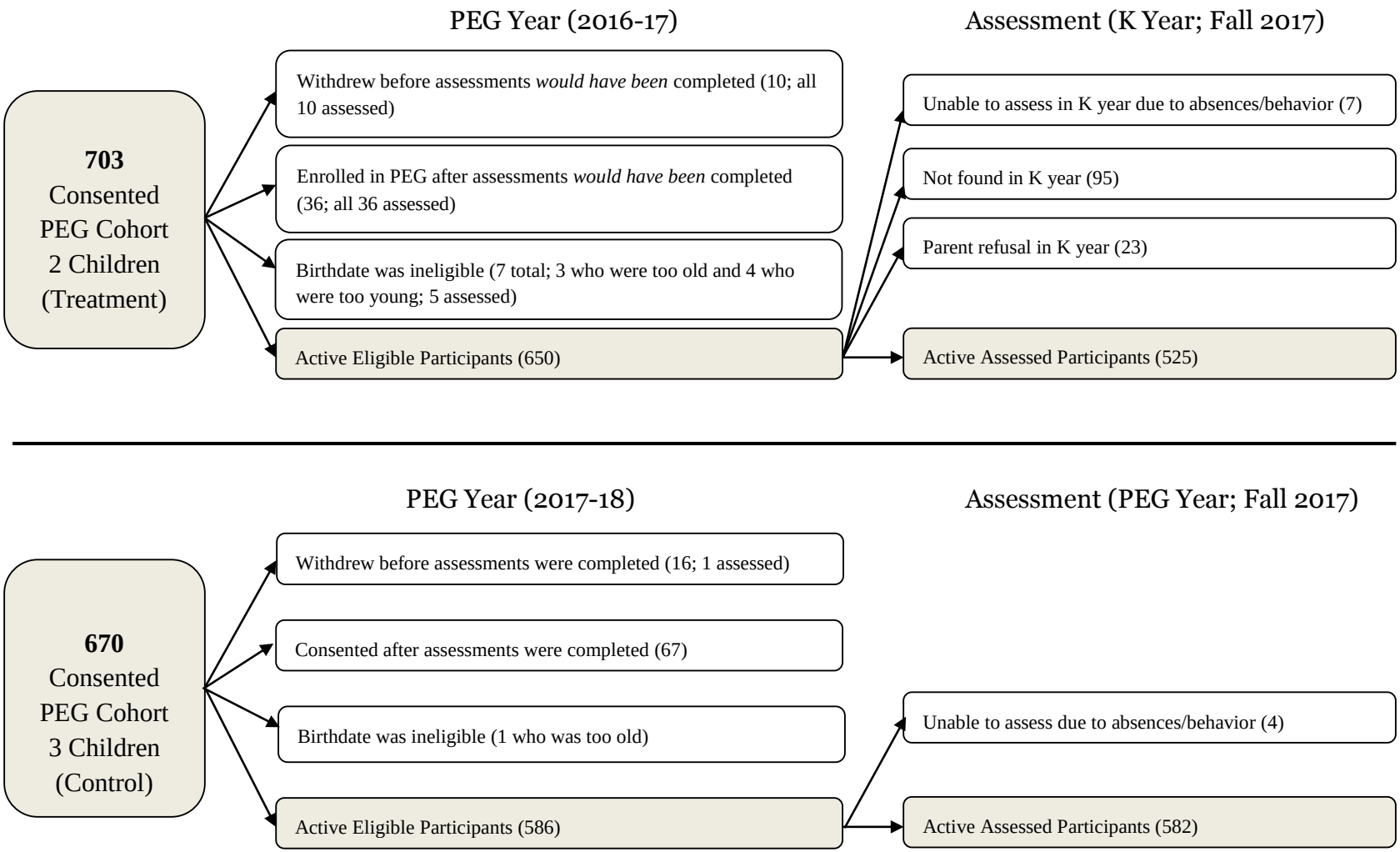
were imposed in order to meet this imperative. Eligibility requirements for inclusion in the analysis sample were:

- PEG Enrollment Date Before November of the PEG Year
  - In the PEG programs, while most children were enrolled within the first weeks of the school year, if classrooms are not filled early in the year or children leave and there are open slots, some children could enroll at another time during the year. Because parental consent for the treatment group was collected at the beginning of the 2016-17 PEG year, enrollment eligibility requirements were applied to both groups in order to include children who enrolled in their PEG year during the same window. To be eligible for the sample for the RD, a child must have been enrolled in the PEG classroom early in the school year, which, for the purposes of the study, was defined as prior to or during the PEG fall assessment window (August 18 – November 10)[21].
- PEG Withdrawal Date Later than November of the PEG Year
  - Children must not have withdrawn from the PEG program prior to the end of the fall assessment window of their PEG year. Kindergarteners who had withdrawn from their PEG program very early in the year would potentially not have been present for assessments had the team conducted assessments in the PEG year. Consequently, the same PEG enrollment period end date criteria was applied to both the treatment and control groups.
- Age Eligible for PEG Program (Turned 4 years of age by September 1 of the PEG year)
  - Children must have birthdates within the range that defines their cohort. For the treatment group, all birthdates were between (and including) September 2, 2011 and September 1, 2012. For the control group, all birthdates were between (and including) September 2, 2012 and September 1, 2013.
- Located in Any Setting in the Kindergarten Year
  - All efforts were made to locate and assess children in the treatment group who did not enroll in the local school district in the year following their PEG exposure. These children were *not* excluded from the sample, provided they could be located and assessed.

The flow of sample participants through the stages from consented to analysis sample is illustrated in the CONSORT chart in Exhibit B.2. There were only a small number of children who were assessed but were not ineligible for PEG based on age, and only 4 out of 703 were too young (the relevant margin for an RDD study). Furthermore, as reflected in the CONSORT chart, the large majority of sample losses were because individuals could not be located for assessment, not for technical reasons or refusal of consent.

[21] Occasionally, a student was assessed after November 10, which was typically due to an earlier partial assessment or multiple absences. The eligibility period was not expanded because of these additional assessments. Thirty-five children in the treatment group were assessed by team members from the Expanding Children's Early Learning Network (ExCEL) project, a separate study conducted by MDRC and partners (University of Michigan, Harvard, Boston Public Schools, and Stanford) that overlaps with some of the PEG classrooms, and occasionally those assessments extended beyond the PEG fall assessment window, as well.

Exhibit B.2. PEG Impact Study Sample Consort Chart



Analysis Sample Numbers by Classroom

This analysis includes assessments from 1,107 children total (582 children in the control group and 525 in the treatment group). Exhibit B.3 shows this total by community, classroom, and condition.

Exhibit B.3. Analysis Sample Numbers by Classroom and Condition

Community/ Classroom	Control	Treatment
Boston	***186***	***138***
116	5	6
117	14	9
118	18	8
119	10	9
120	16	12
121	16	10
122	10	10
123	12	15
124	11	8
125	12	10
126	16	8
127	9	6
128	12	9
129	14	6
130	11	12
Holyoke	***65***	***53***
305	20	9
306	17	10
307	12	17
308	16	17
Lawrence	***127***	***120***
211	14	15
212	17	12
213	8	8
214	7	9
215	8	9
216	8	9
217	19	18
218	10	9
219	18	18
220	18	13

Community/ Classroom	Control	Treatment
Lowell	***99***	***111***
409	13	16
410	14	13
411	12	11
412	10	12
413	15	16
414	11	11
415	14	15
416	10	17
Springfield	***105***	***103***
512	3	5
513	13	11
514	7	7
515	12	13
516	14	11
517	8	6
518	16	10
519	9	12
520	4	7
521	9	8
522	10	13

Unadjusted Outcome Scores

Exhibit B.4 shows the average unadjusted standard scores or percent correct (for executive function) for the treatment and control groups for the full sample and for a limited-bandwidth sample.

Exhibit B.4. Unadjusted Average Outcome Scores by Condition and Bandwidth Selection

Bandwidth Selection/ Outcome	Control Group	Treatment Group
Full Sample	(n=582)	(n=524-525)
Early Literacy	92.85	97.59
Early Math	93.92	97.57
Vocabulary	85.64	94.09
Executive Function (Mixed Trials)	49.97%	63.45%
Limited Bandwidth Sample (30 days)	(n=42)	(n=52)
Early Literacy	93.93	104.44
Early Math	95.00	100.65
Vocabulary	89.81	91.87
Executive Function (Mixed Trials)	59.52%	59.50%

Notes. Scores are not adjusted for anything other than age at time of test.

Regression Results for Child Subgroups

Exhibits in this section show the results of global linear and quadratic regressions estimated for various subsets of the sample, or where models include interactions of treatment with subgroup indicators (which is equivalent to estimating models in each subgroup and then combining the results to test for differences in treatment impact across subgroups). Because there are many coefficients tested in these models, and no correction is made for multiple hypothesis testing, the reader is cautioned to interpret results with care.

Analyses examined the interaction of treatment and child covariate (gender, home language, and prior care) in separate models, providing global and limited-bandwidth model (rectangular kernel with 190-day bandwidth) results (see Exhibits B.5-B.7).

Though there is not sufficient power to detect whether these patterns are due to chance or systematic variation, the most robust suggestive pattern is that treatment effects tend to be smaller for children with prior care than for children who have not had prior exposure to formal childcare.

Exhibit B.5. Impacts Results by Child Gender

Parameter	Early Literacy		Early Math		Vocabulary	
	Linear Global Model	Limited Bandwidth Model (190 days)	Linear Global Model	Limited Bandwidth Model (190 days)	Linear Global Model	Limited Bandwidth Model (190 days)
Treatment	27.57***	27.60**	14.80***	14.31*	5.92	4.85
Age (Distance from Cut-off, Linear)	.04**	.07	.07***	.10	.06***	.12*
Treatment by Age Interaction	-.01	-.08	-.04	-.10	-.02	-.11*
Gender	5.97	12.06	7.15	5.37	4.35	1.08
Female by Treatment Interaction	-6.31	-9.75	-7.30	-5.37	-2.12	6.63
Female by Age Interaction	.01	.11	.00	.00	-.00	-.03
Female by Treatment by Age Interaction	-.01	-.12	.01	.02	.02	.12
English as Home Language	3.72*	2.00	10.03***	7.72**	16.58***	16.24***
Prior Childcare Exposure	6.97*	14.08***	5.32*	12.27***	5.04	12.11**
Constant	312.80***	322.10***	384.6***	388.80***	48.31***	51.40***

*p<.05, **p<.01, ***p<.001

Notes. Models also included a set of dummy codes for classroom. Limited bandwidth models used rectangular kernels and linear functional form. Statistics are rounded to two decimal places.

Exhibit B.6. Impact Results by Child Home Language

Parameter	Early Literacy		Early Math		Vocabulary	
	Linear Global Model	Limited Bandwidth Model (190 days)	Linear Global Model	Limited Bandwidth Model (190 days)	Linear Global Model	Limited Bandwidth Model (190 days)
Treatment	31.73***	28.71**	19.26***	18.37*	9.86*	5.43
Age (Distance from Cut-off, Linear)	.04*	.12	.08***	.06	.06**	.10
Treatment by Age Interaction	-.03	-.13	-.04	.00	-.01	-.05
English as Home language	9.02*	9.50	15.43**	21.83*	19.84***	18.82*
English as Home language by Treatment Interaction	-12.76	-11.71	-14.19**	-13.95	-8.65	-5.49
English as Home language by Age Interaction	0.01	.01	-.00	.09	.02	-.00
English as Home language by Treatment by Age Interaction	0.01	-.03	.02	-.16	.01	-.00
Female	1.93	1.47	4.76**	3.65*	4.87**	4.37*
Prior Childcare Exposure	6.85*	13.11**	5.28*	11.73***	4.91	11.86**
Constant	312.30***	324.20***	383.80***	383.10***	46.10***	49.03***

*p<.05, **p<.01, ***p<.001

Notes. Models also included a set of dummy codes for classroom. Limited bandwidth models used rectangular kernels and linear functional form. Statistics are rounded to two decimal places.

Exhibit B.7. Impacts Results for Child Subgroup: Children with Prior Child Care

Parameter	Early Literacy		Early Math		Vocabulary	
	Linear Global Model	Limited Bandwidth Model (190 days)	Linear Global Model	Limited Bandwidth Model (190 days)	Linear Global Model	Limited Bandwidth Model (190 days)
Treatment	29.34***	25.36***	17.19***	17.62***	9.49**	4.77
Age (Distance from Cut-off, Linear)	.04***	.12**	.05***	.07	.05***	.09*
Treatment by Age Interaction	-.02	-.14*	-.01	-.05	.01	-.03
Prior Childcare Exposure	13.30**	17.88*	20.01***	27.44***	16.20***	17.71*
Prior Childcare Exposure by Treatment Interaction	-18.40*	-9.13	-18.88***	-20.13**	-14.73*	-7.69
Prior Childcare Exposure by Age Interaction	.01	-.01	.06*	.11	.05**	.02
Prior Childcare Exposure by Treatment by Age Interaction	.02	-.01	-.07*	-.12	-.05	-.05
English as Home Language	3.59*	7.05	9.76***	7.14**	16.34***	15.69***
Female	1.66	1.09	4.58***	3.47*	4.80***	4.16*
Constant	312.90***	326.30***	381.00***	385.3***	44.34***	48.65***

*p<.05, **p<.01, ***p<.001

Notes. Models also included a set of dummy codes for classroom. Limited bandwidth models used rectangular kernels and linear functional form. Statistics are rounded to two decimal places.

Appendix C: Cost Study Additional Details

Process of Categorizing Expenditure Report Line Items

Sources

The general approach to this cost analysis was a top-down costing estimation. All data were from 2016-17. Three sources were used to calculate the per-classroom cost: LEA expenditures, ELP expenditures, and follow-up telephone and email interviews with LEA and ELP staff responsible for fiscal oversight. Additional contributions from the Massachusetts Department of Early Education and Care (EEC) expenditure report were also considered.

Calculation Process

To begin this process, the study team collected all necessary expenditure reports. Then, each line item of each LEA, ELP, and EEC expenditure report was categorized by the study team according to components of the PEG model (classroom staff, professional development, comprehensive services and engagement for children and families, and program management) and a component that was not specific to PEG implementation but was necessary for running the program (i.e., operations costs). A general description of the types of line items grouped into each category is provided below. Italicized subheadings represent those overall categories from the state-provided budget/expenditure shell.

- **Classroom Staff**
  - *Personnel & Fringe:* Lead and assistant teachers and paraprofessionals/floaters that serve as third/fourth teachers in the classroom
- **Professional Development**
  - *Personnel & Fringe:* Coaches; substitute teachers assumed to cover staff leave for training purposes; Classroom Developers
  - *Travel:* Staff reimbursement for travel to conferences/supervision meetings
  - *Supplies*: Coaching resource materials
  - *Contractual*: Subcontracts for coaches and mentors; staff training; Continuing education courses
  - *Training Stipends:* Training stipends; Tuition reimbursement for approved courses
  - *Other:* Conference/workshop/staff training costs
- **Comprehensive Services and Engagement for Children and Families**
  - *Personnel & Fringe:* Case managers; enrollment/engagement specialists; volunteer coordinators; nurses; nutrition coordinators; cooks; meal deliverers, family coaches; family advocates; intervention teams; community managers; music therapists; special education therapists; priority population specialists
  - *Travel:* transportation costs for families to attend events/obtain services; travel costs for home visits
  - *Supplies:* outreach and recruitment supplies; training resources for working with families; parent resources; therapeutic supplies
  - *Contractual:* Mental health consultants; music specialists; child health contractors; special education contractors; translation services; swimming lessons; family YMCA memberships
  - *Other:* food for parents and children; advertising costs; family engagement events; kindergarten backpacks for children

- **Program Management**
  - *Personnel and Fringe:* EG Program Managers and Project Coordinators; Site Directors
- **Operations** (**described** in the next step).

Any in-kind costs listed in expenditure reports or discussed in interviews with PEG staff were not included in the above component categories. In Boston, some of these costs were included in an additional 'Funds from Other Sources' category, but in the other four communities, lack of documentation prohibited including specific expenditure amounts in this category.

Once all line items were categorized, the study team then further categorized the expenditures in the rather large and various operations category according to their purpose. A general description of the types of line items grouped into each sub-category is provided below.

- *Executive Staff:* Executive Directors; Directors and Assistant Directors of Early Childhood Education and Program Development.
- *Office Staff:* Management staff; financial officers; human resources staff; IT technicians; custodial staff; office managers; accountants; data managers.
- *Facilities:* rent; storage costs; utilities; trash and landscaping fees; insurance; telephones; licenses/permits/fees; legal and audit fees; pest control; internet access costs.
- *Equipment and Supplies:* cellular phones; computer software, hardware, and licenses; technology repair and maintenance; furniture; instructional materials; office supplies; screening/assessment supplies; playground equipment; medical supplies; uniforms.
- *Special Events:* Special student trips and events for curriculum enrichment.
- *Student Transportation:* student transportation costs (not applicable in all communities).
- *Indirect Costs:* any reported indirect costs charged to the PEG grant.
- *Other:* any other reported administrator travel costs and gas expenses; data processing and professional fees; hiring materials.

Individual line item amounts were collapsed across reporting periods and summed within category for each ELP. Category sums for each individual ELP were summed with the LEA amounts from those same categories. Finally, the per-ELP sums in each category were divided by the number of PEG slots to yield an average *per child* expenditure for each ELP.

EEC invested resources toward staffing and the state evaluation at the state level and distributed additional funds to each PEG community to help support the evaluation. Those expenditures are not included in the per-child costs described in the main body of this report. Exhibit C.1 shows the breakdown of the EEC costs per expenditure component.

Exhibit C.1. Average 2016-17 Cost per PEG Child by Component from EEC Contributions

Component	Average Cost per Child (% Total Cost)
Classroom Staff	$0 --
Professional Development	$74.70 (13%)
Comprehensive Services	$0 --
Program Management	$391.78 (68%)
Operations	$109.48 (19%)
Indirect Costs	$96.60
Miscellaneous	$12.88
Total	**$575.96**

Note. n=48 PEG classrooms, 837 child slots