

Transition to Full-Day Kindergarten in the Commonwealth of Pennsylvania

Evaluating the Implementation, Impact, and Cost

JUNE 2020

Amanda Danks | Katie Dahlke, PhD | Tina Ryznar, PhD
So Jung Park, PhD | Chad Henry | Ashley Sunde
Karen Manship | Ryan Williams, PhD | Michael Little, PhD

MAKING RESEARCH RELEVANT

Transition to Full-Day Kindergarten in the Commonwealth of Pennsylvania

Evaluating the Implementation, Impact, and Cost

JUNE 2020

Amanda Danks | Katie Dahlke, PhD | Tina Ryznar, PhD
So Jung Park, PhD | Chad Henry | Ashley Sunde
Karen Manship | Ryan Williams, PhD | Michael Little, PhD



AMERICAN INSTITUTES FOR RESEARCH®

1000 Thomas Jefferson Street NW
Washington, DC 20007-3835
202.403.5000

www.air.org

Notice of Trademark: "American Institutes for Research" and "AIR" are registered trademarks. All other brand, product, or company names are trademarks or registered trademarks of their respective owners.

Copyright © 2020 American Institutes for Research®. All rights reserved. No part of this publication may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, website display, or other electronic or mechanical methods, without the prior written permission of the American Institutes for Research. For permission requests, please use the Contact Us form on www.air.org.

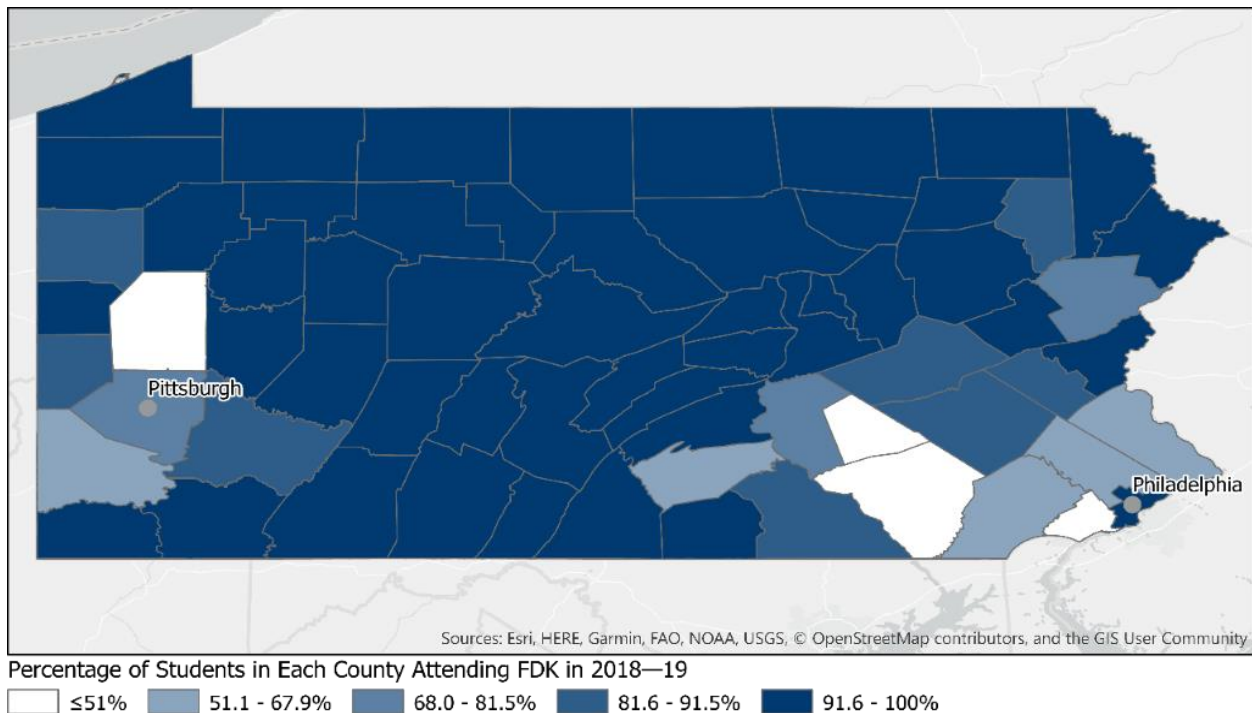
Contents

	Page
Executive Summary.....	iii
Study Overview	iv
Key Findings	iv
Implications and Future Directions.....	vi
Introduction	1
Current Status of Full-Day Kindergarten in Pennsylvania.....	1
Study Overview	2
Organization of the Report	4
Implementation Findings	5
Research Question 1. Why were districts motivated to implement FDK?	5
Research Question 2. How did districts implement FDK?	7
Research Question 3. How did kindergarten stakeholders react during the transition from PDK to FDK?.....	11
Research Question 4. How do kindergarten stakeholders describe the impact of FDK on student educational outcomes?	13
Research Question 5. What unanticipated outcomes did districts experience after implementing FDK?.....	13
Impact Findings	14
Research Question 6. How do the behavioral and academic outcomes of students who attend FDK compare to those of students who attend PDK? And, how do the impacts of FDK on student educational outcomes vary based on students' demographics?.....	14
Cost Findings	17
Research Question 7. What are the one-time, start-up costs to transition a district from PDK to FDK?.....	18
Research Question 8. What are the differences in the ongoing annual costs per student between PDK and FDK?	23
Research Question 9. How cost effective is transitioning to FDK?.....	28
Study Implications.....	29
Identifying Outcomes of Full-Day Kindergarten	29
Considerations for Implementing Full-Day Kindergarten.....	30
References	33
Appendix A. Detailed Methodology.....	34
Appendix B. Supplementary Tables	53

Executive Summary

Full-day kindergarten (FDK) has become increasingly common in the United States in recent years (Education Commission of the States, 2018). Within the Commonwealth of Pennsylvania, where the decision to offer FDK is locally determined, FDK public school student enrollment increased from 68% in 2009–10 to 81% in 2018–19.¹ As shown in Figure 1, in most Pennsylvania counties, nearly all students (91.6% to 100%) are enrolled in FDK. Many of these counties with near 100% enrollment in FDK are in rural areas but include Philadelphia, whereas those counties with less than near 100% enrollment are located in the western and eastern parts of the state and cluster around Pittsburgh and Philadelphia. Given evidence from other states on the benefits of FDK (Cooper, Allen, Patall, & Dent, 2010; DeCicca, 2007; Lee, Burkam, Ready, Honigman, & Meisels, 2006), the Pennsylvania Department of Education (PDE) sought to better understand what was needed to expand FDK to more schools across the state and to investigate the effects of FDK for students in Pennsylvania. Specifically, PDE was interested in understanding the implementation, impact, and costs of FDK to inform future decision making related to expanding FDK.

Figure 1. Percentage of Students Enrolled in Full-Day Public Kindergarten, by County, 2018–19



¹ Statistics based on authors' analyses of data from the Pennsylvania Department of Education.

Study Overview

The Pennsylvania Department of Education (PDE) contracted with the American Institutes for Research (AIR) to conduct a study of the implementation, impacts, and costs associated with FDK in the Commonwealth of Pennsylvania. The **implementation component** included qualitative data from interviews with a sample of district and building administrators to better understand district motivations for transitioning to FDK and about the processes districts engaged in to support the transition. The implementation component also highlighted stakeholder perceptions about the benefits of FDK for students. The **impact component** used a quasi-experimental, comparative interrupted time series design with existing data provided by PDE to examine the impact of FDK (relative to part-day kindergarten [PDK]) on students' attendance in kindergarten, disciplinary incidents in kindergarten, and English language arts and mathematics achievement in Grade 3. The **cost component** used an ingredients approach with data from iterative district and building administrator interviews to identify resources needed to implement FDK. Once the necessary resources were identified, AIR calculated costs using publicly available pricing data. Together, the three study components led to the following key findings.

Key Findings

1. **District and building administrators reported that creating a diverse planning team and engaging that team in a full year of planning were essential steps in preparing for implementation of FDK.** According to administrators, the team was often composed of principals; superintendents; assistant superintendents; the administrators of various departments, such as facilities, curriculum, and transportation; kindergarten teachers; art and music teachers; school counselors; and parents. In general, planning teams undertook five types of tasks during the planning year, including engaging stakeholders, planning logistics, planning staffing changes, conducting professional development, and investigating curricular and instructional needs and options.
2. **Administrators described the importance of engaging stakeholders in continuous improvement after implementation.** Administrators obtained feedback from parents and community members through multiple modes, including anonymous surveys, email, classroom communication applications (i.e., ClassDojo), phone calls, open houses, parent meetings, and PTA meetings. Teachers shared feedback and concerns in weekly meetings with principals. In all cases, feedback was used to inform and shift implementation of FDK as needed. Administrators also made it a point to share with stakeholders how their feedback was incorporated.
3. **According to administrators, teachers and parents were generally supportive of the transition from PDK to FDK.** Administrators reported that kindergarten teachers were

excited to have more quality instructional time with their students and more time to get to know their students and support their social and emotional development. Administrators indicated that parents were eager for their children to have increased opportunities to learn and prepare for coming grades and for their children to become a more active part of the school community. Parents, particularly those with work or training obligations, were also relieved to avoid childcare expenses associated with PDK and eliminate the challenges (e.g., lost time, the need to schedule wraparound childcare) associated with midday transportation to or from school. Some administrators mentioned that a small number of parents were less enthusiastic about the transition to FDK, who largely felt that kindergartners were too young to attend school for a full day. For example, some parents were worried about the stamina needed for a full day and wondered about a nap time for young children. Other parents were concerned about how struggling students would be supported in FDK.

4. **According to administrators, students who attended FDK were generally happier, more confident, and better prepared for later grades than were students who attended their PDK program in prior years.** For example, many administrators reported that children who attended FDK were better prepared for first grade both academically and socially. They indicated that students from FDK programs appeared to be happier and more confident learners who transitioned to first grade more easily than PDK students. Some administrators believed that the additional foundational instruction time and increased time for intervention led to earlier identification of learning challenges.
5. **The quasi-experimental impact analyses did not find effects of FDK on Grade 3 student achievement in English language arts and mathematics for students overall; however, exploratory analyses suggest that there may be positive effects on these outcomes for students with particular student characteristics.** Among students eligible for free and reduced-price meals (FRPM), there was a substantively large effect on average Grade 3 mathematics achievement (effect size of 0.31) for students in FDK schools compared to students in a matched sample of PDK schools. Among students with an individualized education program (IEP), there was a substantively large effect on average Grade 3 mathematics achievement (effect size of 0.42) for students in FDK schools compared to students in a matched sample of PDK schools. Though substantial in size, the effects were not statistically significant. The numbers of students and schools eligible to be included in the analyses were not large enough to measure the effect with precision.
6. **Districts incurred additional costs when transitioning to FDK, including costs related to materials and equipment and more staff to accommodate students for the entire day.** PDK classrooms served two classes of students each day (morning and afternoon classes), allowing some materials and equipment to be shared across the two classrooms. However,

FDK classrooms served one class of students each day. As a result, the transition to FDK required additional equipment to serve the same number of students. Similarly, the number of students an individual kindergarten teacher served was reduced by half once the school transitioned to FDK, thereby requiring more kindergarten teachers to serve the same number of students. Although some districts may incur costs associated with accommodating additional facility space for kindergarten classrooms, this need was not an explicit challenge among FDK districts in this sample.

Implications and Future Directions

Although the quasi-experimental impact analyses in this study did not find statistically significant impacts associated with the implementation of FDK, qualitative data point to positive outcomes. Teachers, administrators, and district personnel reported that students demonstrated increased readiness in first grade as a result of FDK and appeared to be more confident, happy, and capable during the early elementary years. Exploratory impact analyses showed that students eligible for FRPM and students with an IEP may be positively impacted by FDK; however, the small sample size in this study limits the ability to detect statistically significant effects.

In order to effectively implement FDK, administrators pointed to the importance of planning time to allow teachers to prepare for a longer instructional day and to make schoolwide scheduling and other logistical changes. District leaders also decided to use the additional instructional time to expand their curricular options, including writing programs and imaginative play to support children's social and emotional development.

Although some districts required time to achieve stakeholder consensus, most districts indicated that parents, families, teachers, and administrators were enthusiastic about the transition to an FDK program. Teachers generally appreciated additional instructional time to cover the required standards, while most parents reportedly appreciated that transportation and childcare issues associated with a part-day schedule were no longer a struggle.

Funding for FDK was not reported as an issue for recently transitioned districts; however, PDK districts considering a transition to FDK were concerned about funding the program. The basic education funding formula in Pennsylvania uses a 3-year average of average daily membership (ADM) data (in most cases) and weights each PDK student as 0.5 and each FDK student as 1.0. This funding formula did not appear to cause issues for any districts in the cost sample. However, districts in the implementation sample could not isolate funding issues to understand any funding-related impacts. This basic education funding formula should be a consideration for PDE as it contemplates expanding FDK.

Districts likely would benefit from technical assistance from PDE when planning to transition from PDK to FDK as they are managing multiple decision points and changes. Districts varied in regard to how ready they were to implement FDK. PDE should consider universal guidance across districts, as well as individualized technical assistance, to facilitate the transition from PDK to FDK. The study identified several key issues that the state should address in its technical assistance to districts, including identifying and developing plans for classroom space to accommodate more kindergarten students and addressing the need for teachers and materials to provide quality instruction to all students. Moreover, the state should consider how to help districts build community support for FDK and help facilitate the process with the community served. Finally, the state should consider how to leverage the lessons learned from districts that have transitioned to FDK and potentially provide peer-to-peer support or mentoring across districts.

Introduction

Publicly funded kindergarten is nearly universal across the United States (Education Commission of the States, 2018), but variation exists between the states in their offering of either FDK or PDK. Currently, 13 states plus the District of Columbia require full-day kindergarten (FDK; Education Commission of the States, 2016). In other states, FDK is not required, but districts and schools within the state may adopt FDK, which is the case in Pennsylvania. Each of the 499 districts in Pennsylvania is able to determine whether it offers FDK or PDK.

Although local decision makers are responsible for determining whether to offer part-day kindergarten (PDK) or FDK, state leaders are concerned about the equity of program types across the state. PDE is interested in understanding the implementation, impact, and costs of FDK to inform decisions about expanding its implementation across the state. Existing research shows positive impacts of FDK (Cooper et al., 2010), yet information about the Pennsylvania context will support an informed discussion at state and local levels concerning the provision of FDK for all students. The consideration of an expansion of FDK requires contextual analysis, including understanding implementation considerations, the associated costs, and the observable impacts associated with providing FDK.

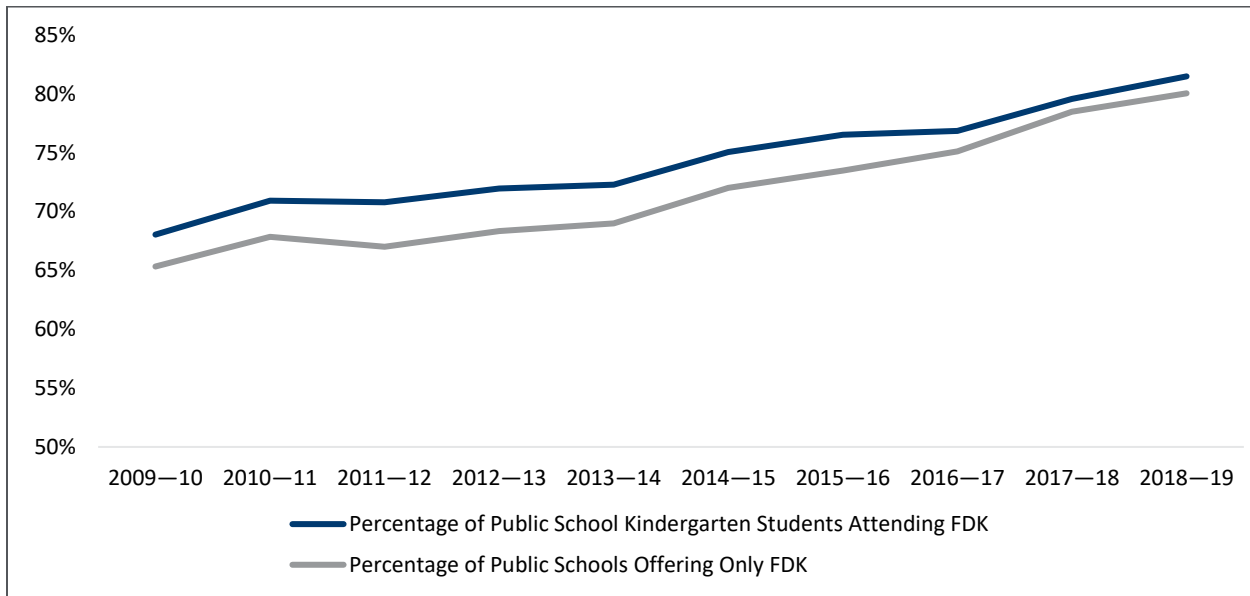
The existing research on the effectiveness of FDK relative to PDK indicates clear benefits for students' academic outcomes in early elementary school (Cooper et al., 2010). Available research also provides suggestive evidence of benefits on attendance, students' self-confidence, and the ability to work and play with others (Cooper et al., 2010; DeCicca, 2007; Lee et al., 2006). However, despite the promising findings of the benefits of FDK in the short term, research also indicates that these benefits often fade away by third grade (Cooper et al., 2010; Votruba-Drzal, Li-Grining, & Maldonado-Carreño, 2008). The evidence on the effectiveness of FDK varies by setting, suggesting that local context and implementation matter (Cooper et al., 2010). Moreover, there is evidence that states vary in how they structure and implement kindergarten (Miller, 2002). Given this variation, it is necessary for PDE to study FDK programs to best understand the effectiveness of FDK in the state's specific context.

Current Status of Full-Day Kindergarten in Pennsylvania

In Pennsylvania, there is no legislative requirement that students attend kindergarten, and districts are autonomous in choosing the type of kindergarten program to provide. Pennsylvania has 499 districts and 3,287 traditional public schools serving between 200 and 140,000 students. The decision to offer an FDK program or a PDK program is locally determined. PDE data show that 84% of districts offer FDK, 9% offer PDK, and 7% offer a hybrid of programs

(i.e., a mix of PDK and FDK classrooms). Throughout the past decade, the number of districts and schools offering FDK has increased. In 2009–10, only 65% of districts offered FDK, but by the 2018–19 school year, 84% of districts offered FDK. In addition, student enrollment in FDK has increased during the past decade, with 68% of public school kindergarten students enrolled in FDK in 2009–10 and 81% enrolled in FDK in 2018–19 (Figure 2).

Figure 2. Enrollment in Full-Day Public Kindergarten, 2009–10 to 2018–19



Study Overview

The Pennsylvania Department of Education (PDE) contracted with the American Institutes for Research (AIR) to conduct a mixed methods study to examine the implementation, impact, and cost of FDK in Pennsylvania. First, the implementation component used qualitative interview data to develop understanding about the implementation of FDK, including how districts made the transition from PDK to FDK. Second, the impact component used a quasi-experimental design with comparative interrupted time series (CITS) analyses to estimate the effect of an FDK program relative to PDK on student outcomes related to attendance and discipline in kindergarten and academic achievement in Grade 3. Last, the cost component of this work examined the overall per-student annual cost of PDK and FDK programs, along with the costs required to initially transition from PDK to FDK.

More specifically, the study examined the following nine research questions organized by the three study components:

Implementation Research Questions

1. Why were districts motivated to implement FDK?
2. How did districts implement FDK?
3. How did kindergarten stakeholders react during the transition from PDK to FDK?
4. How do kindergarten stakeholders describe the impact of FDK on student educational outcomes?
5. What unanticipated outcomes did districts experience after implementing FDK?

Impact Research Questions

6. How do the behavioral and academic outcomes of students who attend FDK compare to those of students who attend PDK? And, how do the impacts of FDK on student educational outcomes vary based on students' demographics?

Cost Research Questions

7. What are the one-time, start-up costs to transition a district from PDK to FDK?
8. What are the differences in the ongoing overall annual costs per student between PDK and FDK?
9. How cost effective is transitioning to FDK?

Study Limitations

These findings should be considered within the context of five important limitations. First, this work occurred before and during the global COVID-19 pandemic. Prior to COVID-19–related school closures, we were able to complete interviews in most sampled districts (13 out of 16) to understand the implementation and associated costs of FDK. Once schools closed, it became difficult to reach district and school administrators because they were busy preparing for a new learning environment and meeting the needs of their students and community. Our study team was able to use the collected data to produce the findings in this report. This report does not address the implications of opening schools or kindergarten programs amid COVID-19 (i.e., implementation considerations and costs associated with COVID-19 public health guidance).

Second, the study did not include parents' perspectives. Interviews with parents and primary caregivers would provide a more comprehensive understanding of the perceived benefits, and any perceived drawbacks, of FDK. During interviews, administrators often mentioned the perspective of parents as an important part of administrators' decision making as they considered transitioning to FDK. For example, midday transportation and part-day childcare arrangements were described as an additional burden for many parents in the PDK programs

that could be alleviated by FDK. The extent to which these burdens impacted the ability of parents and caregivers to work or attend school or training is an important factor not captured by this work.

A third limitation is that this study could not randomly assign students or schools to FDK and PDK. As a result, the study employed a quasi-experimental design (i.e., CITS). Therefore, there may be important differences between the schools that elect to implement FDK schoolwide and the matched PDK schools used as a comparison. Although the study design accounted for differences in observable characteristics and baseline outcomes and was robust to address time-invariant differences between the groups, there may be unobserved time-variant characteristics of schools that implement FDK that differ from those of the comparison PDK schools. For example, the FDK schools may have had increasingly more community support and buy-in for early education that helps to facilitate early educational outcomes. Or, perhaps PDK schools had a growing number of other community-based educational opportunities for young children. These and other kinds of potential time-variant unobserved differences between PDK and FDK schools and their students and families could not be accounted for in the impact study.

Fourth, the sample of schools used to estimate the impact of FDK was restricted to schools that began implementing FDK schoolwide during a 3-year time span (2012–13 to 2014–15). This restriction was necessary to include at least 3 baseline years, given the years of available outcome data. Therefore, these findings do not capture the impact of the earliest or most recent implementers and are not representative of all schools statewide. For example, the sample is less racially diverse and less economically disadvantaged than the state overall.

Finally, the study was limited to examining outcomes with existing data. Student achievement data were not available until Grade 3. Therefore, it was not possible to examine the effect of FDK on student achievement outcomes in kindergarten, first grade, or second grade. Moreover, prior literature has found positive effects of FDK on students' social and emotional well-being; however, measures of social and emotional well-being were not available (e.g., the Social Skills Rating System, which includes measures of interpersonal skills and inhibitory control). Although the study examined disciplinary incidents in kindergarten as a proxy for children's social and emotional well-being, disciplinary incidents do not perfectly measure this construct.

Organization of the Report

The body of this report summarizes findings by the three study components (implementation, impact, and cost) followed by a discussion of the implications of these findings. Detailed methodological descriptions are provided in Appendix A, and supplementary tables are presented in Appendix B.

Implementation Findings

Implementation findings from qualitative analyses of district and building administrator interviews are organized by research question within this section. The number of district and/or building administrator interview respondents for each theme and subtheme is given in parentheses. Implementation methods are provided in Appendix A.

Research Question 1. Why were districts motivated to implement FDK?

Administrators considered FDK a strategy to improve students' academic performance and readiness for future schooling (reported by 12 out of 16 respondents). Half of the administrators (8 out of 16) reported that a full day of kindergarten better supported the development of foundational skills for later grades, with two respondents focusing particularly on improving early math and literacy skills. For example, one principal reported, "Basically, student achievement was at the top of the list. We noticed our half-day kindergarten kids were not up to par with where they needed to be. So, that was probably the biggest driving force." Relatedly, four administrators reported that they perceived FDK as an opportunity to reduce academic achievement gaps and to ensure that all kindergartners were prepared for future grades. These administrators observed that students with preschool experience and those from homes with greater socioeconomic resources were more prepared for school than were students who had not attended preschool and students with fewer socioeconomic resources.

"Basically, student achievement was at the top of the list. We noticed our half-day kindergarten kids were not up to par with where they needed to be. So, that was probably the biggest driving force."

—Principal

"The more instructional time that we can have with them, it just makes more sense [A] half-day setting just wasn't enough. It wasn't enough time."

—Principal

Administrators considered FDK a strategy to increase the amount of instructional time for kindergarten students.

Many administrators (8 out of 16) reported that PDK did not provide teachers enough time to meet the academic demands of federal and state standards. Of these respondents, two spoke of increasing the length of the kindergarten school day as an important step toward offering kindergartners more special instruction opportunities, such as in art, music, and physical education. Three respondents focused particularly on the need to increase and deepen reading and math instruction efforts, stating that a strong foundation in either of these subjects was a challenge to achieve in a part-day program. For example, one principal said, "With PDK . . . we're giving up half of one [year of instruction]."

Some administrators considered FDK an opportunity to better support students' social and emotional development. Administrators (4 out of 16) reported that the instructional day in PDK programs did not afford kindergarten teachers the time needed to promote social and emotional development, such as regular periods of developmental play. One principal shared that the rigor of the Common Core and an increased emphasis on academics have limited the time available to focus meaningfully on activities that promote children's social and emotional skills. One respondent reported,

“So by having that extra time, we were able to slow down. We added developmental play, which has been a huge benefit to the students and to the teachers because it allows the students to play and to problem-solve on their own. And the teachers really try to stay out of trying to force the activities, or direct the interactions, because they really want the kids to be able to figure things out on their own, and to still be kids and to use their imaginations. And we've seen that, now our first crew of full-day kindergarten students are in the second grade right now, and we've seen that even in how they've interacted with each other. We've seen them work through a lot of those issues on their own because they learned those skills when they were in kindergarten.”

Interest in FDK from parents and the local community was a driving force for districts to implement FDK. Multiple administrators (4 out of 16) reported that community members and parents voiced a desire for FDK. Furthermore, these stakeholders often questioned why such a program had not yet been implemented, as it is in so many other parts of the state. Several administrators mentioned that for many parents, PDK brings the added pressure of identifying and scheduling both transportation and childcare for their child during half of each school day. The financial impact of PDK on parents is not captured in this study, but responses from administrators indicated that parents struggled to find and afford unique childcare solutions required to attend a PDK program.

Research Question 2. How did districts implement FDK?

Prior to formal planning, districts engaged in groundwork activities designed to develop a rationale for FDK adoption, explore implementation feasibility, build community support, and develop teacher buy-in for the transition to FDK. Administrators (9 out of 16) described the importance of these activities in order to develop a strong FDK proposal to present to their school board.

Administrators (7 out of 16) from three districts reported that they began researching FDK to develop an evidence-based rationale for transitioning to FDK prior to presenting the idea to the school board. Administrators (4 out of 16) from four districts also shared that they reviewed the feasibility of moving their districts to FDK before presenting the idea to the school board. For example, one principal reported that “at the district level they were looking at, where is the funding going to come from to make it happen? What space needs does it create?” Moreover, building and district administrators (4 out of 16) from three districts reported that their district assessed the community’s support for the adoption of FDK by soliciting parent feedback via a survey. Finally, multiple administrators (3 out of 16) from one district reported that preparing for these presentations also provided the first opportunity to achieve buy-in and support from teachers by directly engaging them in the planning process.

FDK implementation required a full year of planning after receiving school board approval, led by a diverse team (reported by 15 out of 16 respondents). According to administrators, planning teams included principals, superintendents, assistant superintendents, the administrators of various departments (such as facilities, curriculum, and transportation), kindergarten teachers, art and music teachers, school counselors, and parents. For example, a district administrator described the composition of this planning team as follows:

“Initially the planning team started with just the elementary administrative team and that was the three building principals of our larger

“We put together a districtwide committee of our current kindergarten teachers, our counselors, I believe we probably had a school psychologist, our three elementary principals, and really brainstormed what we needed to do. All different areas of what the program would look like. What would the curriculum look like? What would the staffing look like? What would the spacing look like? What kind of report card are we going to develop? So we . . . worked a year ahead to plan for the following fall.”

—Principal

“We also had to plan parent meetings to share with parents our plans and get them on board and to understand what we were doing.”

—Principal

schools and myself as the elementary supervisor. And we started with the research. We started with what is our rationale for why it's important, what data do we need to support the transition. . . . Then the team expanded to our kindergarten teachers, tearing our proposal apart and seeing what needed to be added. . . . And then it expanded to include our specialists, and it just really came together very nicely."

In some districts this team was built based on existing teaming structures. The planning team conducted much of the work through subcommittees or working groups or both.

In general, planning teams undertook five types of tasks during the planning year, including engaging stakeholders, planning logistics, planning staffing changes, conducting professional development, and investigating curricular and instructional needs and options. These tasks are described below. A common feature across most of these tasks is that they involved the planning team in collaborative problem solving and planning.

Planning Year Task 1: Engaging Stakeholders. Administrators (6 out of 16) from six different districts stated that engaging key stakeholders, such as teachers, parents, and local childcare providers, was an important first step in FDK planning. Districts varied in regard to their level of engagement with parents and school staff, from sending parents informational letters (one district) to hosting in-person parent meetings (two districts) to involving kindergarten teachers intensively (four districts). For example, these latter four districts sought teacher buy-in from all their kindergarten teachers by actively involving them at the beginning of the planning and decision-making process. Moreover, one district also described meeting with specialist teachers, such as art and music, to ensure that those teachers' needs were incorporated into FDK implementation plans.

Building and district administrators (2 out of 16) from one district also mentioned the importance of developing a vision, mission, and goals for the transition to FDK to guide decisions moving forward.

Planning Year Task 2: Planning Logistics. Building and district administrators (9 out of 16) from six districts reported that much of the planning in the first year was centered on logistics. This work generally was conducted within subcommittees that either were composed of kindergarten teachers or incorporated feedback from kindergarten teachers. For example, one principal said, "We had ironed out the day-to-day things in the classroom with the teachers, based on how they felt things would work best, and we troubleshooted it. We did this in advance, so there were very few issues. It was like clockwork."

Planning logistics included

- outlining in detail what the day would look like for FDK students,
- considering how the rest of the school schedule (e.g., lunch, recess) would be impacted,
- identifying and addressing facility needs, such as classrooms and bathrooms, and material needs, including tables, chairs, and developmental play items (see the Cost Analysis Findings section for additional information on resources needed to implement FDK),
- considering how to adjust the report card to incorporate all components taught in the FDK program, and
- staggering the first day of kindergarten across students to give more individualized attention to each kindergartner on the child's first full school day.

Other districts that already offered FDK served as an important resource to those districts transitioning to the full-day program (reported by 7 out of 16 respondents). These more experienced districts provided input on such issues as their general FDK implementation process, daily schedule, and classroom setup. One respondent who conducted a site visit to a district that had implemented FDK discussed the value in learning from peers who had gone through the transition process and could provide tangible strategies that could be implemented in their own district: "That was really key, I think, in making our program successful."

Planning Year Task 3: Planning Staffing Changes. Building and district administrators (9 out of 16) reported that identifying staffing needs was an important component of their planning year. Some of these respondents (3 out of 16) from two districts reported the need to hire new teachers and classroom aides to accommodate the FDK program (see the Cost Analysis Findings section for additional information on personnel needed to implement FDK). Staffing needs were determined by the number of enrolling students, class size, and the number of adults the district planned to have in each kindergarten classroom. However, not all districts needed to hire teachers or aides. Instead, six districts were able to reallocate staff within the district, given retirements, the enrollment trends, and other district needs. Administrators (3 out of 16) from two districts indicated the importance of staffing FDK with teachers who were supportive of the program and were highly effective teachers. These administrators moved teachers who were unsupportive of FDK to other grade-level teaching assignments.

"I think it was very beneficial that whole year that we spent planning and researching. We didn't just rush right into it. We took our time and what we did then is we worked out a vision."

—District Administrator

Planning Year Task 4: Conducting Professional Development. Administrators (6 out of 16) shared that the planning year was an important

period for holding professional development sessions for kindergarten teachers. Professional development topic areas ranged from purposeful play and mindfulness to developmentally appropriate writing instruction for kindergartners. A principal from one district reported that professional development also was provided through visits to kindergarten classrooms with teachers who were already implementing FDK. Training for teachers returning to the kindergarten classroom from higher grade levels was important for districts reallocating staff in this way (2 out of 16).

Professional development included dedicated planning time for staff. Other respondents (6 out of 16) explained that teacher trainings and time for shared planning were crucial for preparing teachers either new to FDK or returning to kindergarten after years in another teaching placement. For one district, the summer before FDK implementation was a critical time for teachers to engage in a day-long joint planning session to discuss logistics such as the daily schedule and lesson plans.

Planning Year Task 5: Planning for Curriculum and Instruction. Almost half of administrators (7 out of 16) reported a need to revise the kindergarten curriculum to meet the needs of a full-day program and enhance supports for children’s social and emotional development through purposeful play, for example. Other changes included adding a writing curriculum, identifying instructional resources to accommodate the increased time to address state academic standards, and revising report cards to reflect academic and developmental changes in the curriculum. To accomplish these tasks, some administrators reviewed Pennsylvania’s early learning standards and other best practices and looked to curricula used by other FDK districts.

Administrators described the first year of FDK implementation as free from significant challenges (reported by 15 out of 16 respondents). For example, one principal stated, “I thought the first year went very well. Overall, I think the time we took in front, with the planning process and visiting other districts, the time I think that we had to choose the right players, the right people on the committee, so that everything, every piece was really well thought out. So, overall, I mean I felt like it was a huge success.”

Building and district administrators mentioned a few minor challenges when implementing FDK. Four building and district administrators from three districts reported that the first month of implementation was difficult because of challenges inherent in transitioning students of all levels of maturity and skill to a full day of kindergarten. One of these administrators shared,

“And I know the first week or so of that first year of full-day kindergarten, there was a lot of learning and a lot of really tired kindergartners by lunchtime. And there were other little things that popped up. Like, the kindergartners had never gone through the lunch line. They had never bought lunch in the school. So we needed to teach them how

to do that. And so there's a lot of the little things but nothing was, there were no major obstacles that we encountered."

In addition, three administrators (from three districts) stated that it was somewhat difficult to develop a new schedule to accommodate FDK and the needs of kindergartners. Shifting classrooms and staff were issues in each elementary building, but these issues were not described as significant barriers. As described earlier, administrators emphasized the need to provide adequate professional development and planning time during the year prior to implementation.

Administrators described the importance of engaging stakeholders in continuous improvement after implementation (13 out of 16 respondents). Building and district administrators from seven different districts provided multiple avenues through which parents and teachers would share concerns and feedback about FDK. These avenues included anonymous surveys, email, classroom communication applications (i.e., ClassDojo), and phone calls. Face-to-face opportunities, such as open houses, parent meetings, and PTA meetings, also were utilized as feedback opportunities for parents and community members. Teachers were encouraged to share their concerns in weekly meetings with principals. In all cases, feedback was used to inform and adapt implementation of FDK as needed. Administrators also made it a point to share with stakeholders how their feedback was incorporated.

"We gathered [feedback], we brought it all back, we talked about it [at school] and within our committee and then we responded back to parents about what we had heard and what we were changing based on their concerns. . . . [We] let the people who gave us the feedback know what we're doing to respond."

—Principal

Administrators from two districts described the importance of convening regular reflective meetings to support continuous improvement. A district administrator said, "So I think it's about having an open ear, being present in classrooms and with teachers, and then listening and coming up with remedies and solutions and providing supports when and if those are requested or needed, whether that be for academic needs or for social and emotional needs."

Research Question 3. How did kindergarten stakeholders react during the transition from PDK to FDK?

All participating administrators reported that teachers were enthusiastic about FDK (16 out of 16 respondents). Kindergarten teachers were excited to have more quality instructional time with their students as well as opportunities to support students' social and emotional development. For example, one respondent said,

“Well, [teachers] were excited, because with a half-day program, they felt completely rushed all the time. So to have time with those students for a full day I think was the biggest plus for them. Not only could they get all of the teaching content in, you know all of the core content, but they could also then touch on some other things, like mindfulness and making sure they were socially and emotionally adjusted.”

Administrators (10 out of 16) from six districts reported that they observed some nervous apprehension among their teachers about implementation, however. Teachers expressed concerns about whether students would be able to stay engaged in learning all day, whether teachers would be able to provide enough learning activities for the full day, and how the change would affect their time to plan instruction.

Many district administrators reported that most parents in their districts were excited for their children to attend an FDK program (according to 10 out of 16 respondents). Specifically, administrators reported that parents were eager for their children to have increased opportunities to learn and prepare for coming grades (8 out of 16 administrators) and for their children to become a more active part of the school community (2 out of 16). Parents were also relieved to avoid childcare expenses associated with PDK and save time by eliminating midday transportation (6 out of 16). The financial impact of PDK on parents and families was not captured in this study, but responses from administrators indicate that parents struggled to find and afford unique childcare solutions and midday transportation required to attend a PDK program. Parents reportedly appreciated that these issues were at least partially alleviated with FDK. One administrator explained, “ [PDK] wasn’t an option for parents that work because, what would they do with their little one for the afternoon?”

Some administrators (7 out of 16) mentioned that a small number of parents were less enthusiastic about the transition to FDK and largely felt that kindergartners were too young to attend school for a full day. For example, some parents were worried about the stamina needed for a full day and wondered about a nap time for young children, while other parents worried about how struggling students would be supported in the new program. One respondent said, “I would say maybe 5% [of parents] were . . . maybe not even that much. There were a few people that were disappointed. They liked the half-day program. For some of them it was a more gradual transition, for some of the moms that stayed home with their kids. They were not quite ready for them to be away from home all day.” In response to the few reluctant families, one district reported that, during the first year of FDK, families were given the opportunity for their child to attend a PDK or an FDK program. However, families that opted for PDK quickly transitioned to FDK after hearing of the success of the program and satisfaction of other families.

Principals were satisfied with the transition to FDK. District administrators (5 out of 5 who responded to this question) reported that all principals were supportive of implementation of FDK. In fact, several district officials stated that it was the principals themselves who motivated them to move forward with FDK at the district level. Across all sample districts, only two districts could recount concerns held by principals regarding the transition to FDK—these concerns focused on students’ preparedness for FDK, including both social and emotional development and stamina, as well as teachers’ preparedness for FDK, including preparedness to shift instruction from a half-day to a full-day program. To address these concerns, district administrators met regularly with principals and encouraged open communication. In addition, districts made every effort to ensure that principals had the resources they needed to implement FDK (i.e., staff, classroom materials, training).

Research Question 4. How do kindergarten stakeholders describe the impact of FDK on student educational outcomes?

Students who attended FDK were generally happier, more confident, and better prepared for later grades than students who attended their PDK program in prior years, according to administrators. For example, many administrators (11 out of 16) reported that children who attended FDK were better prepared for first grade both academically (7 out of 16) and socially (3 out of 16). One respondent said, “We did see less of a summer slide than we did previously, and we believe that has to do with, we were able to get these kids at the benchmarks.” Some administrators (5 out of 16) believed that the additional foundational instruction time and increased time for intervention led to earlier identification of learning challenges.

“Oh, I see a difference holistically in [FDK] kids! They have the ability to move further than kids who attended PDK.”

—Principal

Students from FDK programs appeared to be happier and more confident learners (4 out of 16 administrators) who transitioned to first grade more easily than PDK students. One respondent described, “I think they become more confident learners, they are very comfortable coming into school. Sometimes we have first graders come in from part-day programs, and they’re still not so sure about coming to school. I think with the full day, they are prepared for first grade.”

“First-grade [teachers], over the summer, had to rewrite their curriculum to fulfill the needs of the [better-prepared rising kindergarten] students.”

—Principal

Research Question 5. What unanticipated outcomes did districts experience after implementing FDK?

Some administrators (2 out of 16) reported that the transition to FDK required unexpected changes to curricula and instruction in

first grade. Academic gains experienced by FDK had ongoing impacts on teachers. First-grade teachers found that they needed to adjust their curriculum to better meet the needs of students who were better prepared academically after attending FDK.

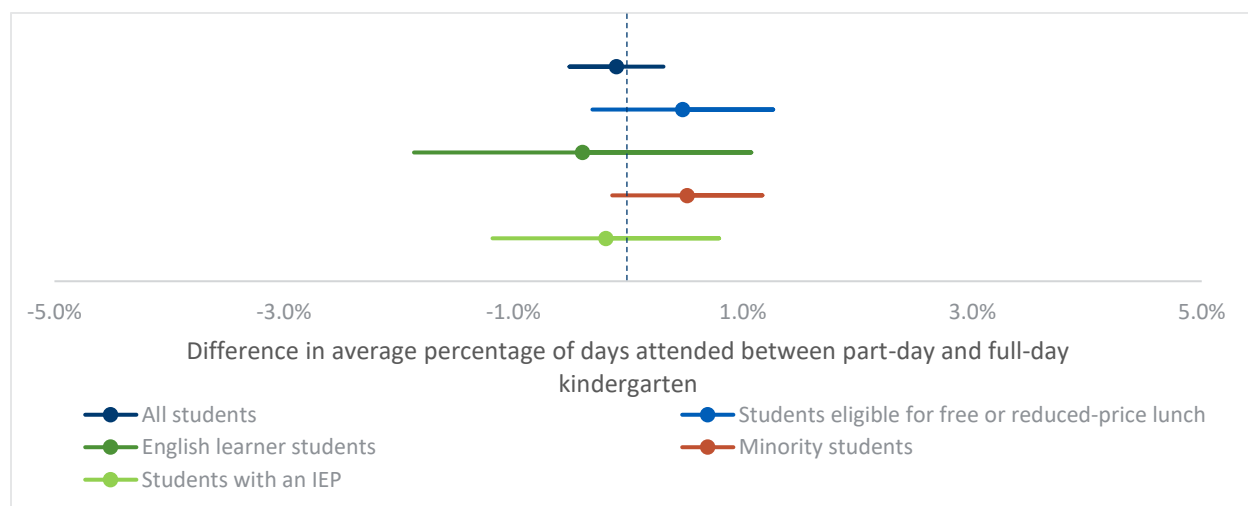
Some administrators (2 out of 16) noted that children entered FDK classrooms with lower levels of academic, learning, and social skills than they anticipated. Respondents reflected that students' skills at kindergarten entry highlighted the need to help teachers meet students where they are and connect with parents earlier about early childhood education opportunities, as well as the need to develop a high-quality prekindergarten program in their districts.

Impact Findings

This section describes findings from CITS analyses of extant data that examined the impact of FDK relative to PDK on two sets of student outcomes: Grade K outcomes (including rate of attendance in kindergarten, an indicator of chronic absenteeism in kindergarten, and an indicator of any disciplinary incidents in kindergarten); and Grade 3 student achievement (reading and mathematics achievement on the Pennsylvania System of School Assessment). Impact methods are provided in Appendix A, and supplementary results tables are presented in Appendix B.

Research Question 6. How do the behavioral and academic outcomes of students who attend FDK compare to those of students who attend PDK? And, how do the impacts of FDK on student educational outcomes vary based on students' demographics?

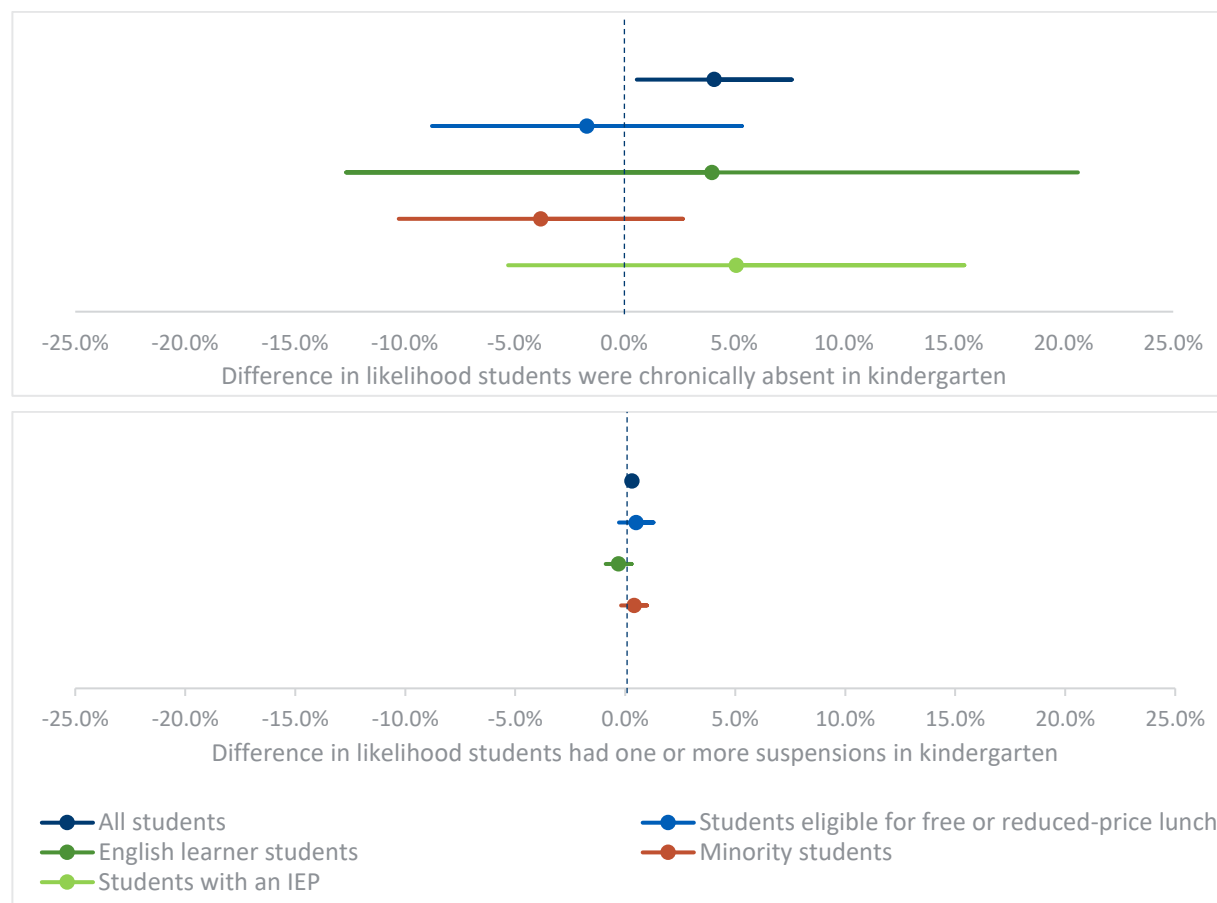
This study did not find a statistically significant effect of FDK on kindergarten attendance rates for all students. Across the first 4 years after implementation, the average percentage of days that kindergarten students attended school was slightly smaller (by approximately 0.10%) for FDK schools compared to matched PDK schools. This difference was not statistically different than zero (Figure 3 and see Table B1 in Appendix B). Examination of effects in individual post-implementation years shows a pattern in which there was an initial slight decline in attendance followed by a slight increase in attendance in Year 4 (see Table B2 in Appendix B). These individual year effects were also not statistically significant.

Figure 3. Effects of FDK on Rate of Attendance in Kindergarten

Note. The difference in the average percentage of days attended represents the pooled post-treatment effect point estimate across 4 post-implementation years from CITS analysis models.

This study found very small yet statistically significant negative effects of FDK on both chronic absenteeism in kindergarten and disciplinary incidents in kindergarten. Across the first 4 years after implementation, students in FDK schools were approximately 4% more likely to be chronically absent from kindergarten (i.e., missed more than 5% of days of school) than students in matched PDK schools, holding constant school trends in kindergarten chronic absenteeism and student characteristics prior to transitioning to FDK (Figure 4 and see Table B1 in Appendix B). In addition, students in FDK schools were less than 1% more likely to have received one or more in-school or out-of-school suspensions than students in matched PDK schools (see Figure 4).

Figure 4. Effects of FDK on Indicators of Chronically Absent and Disciplinary Actions in Kindergarten



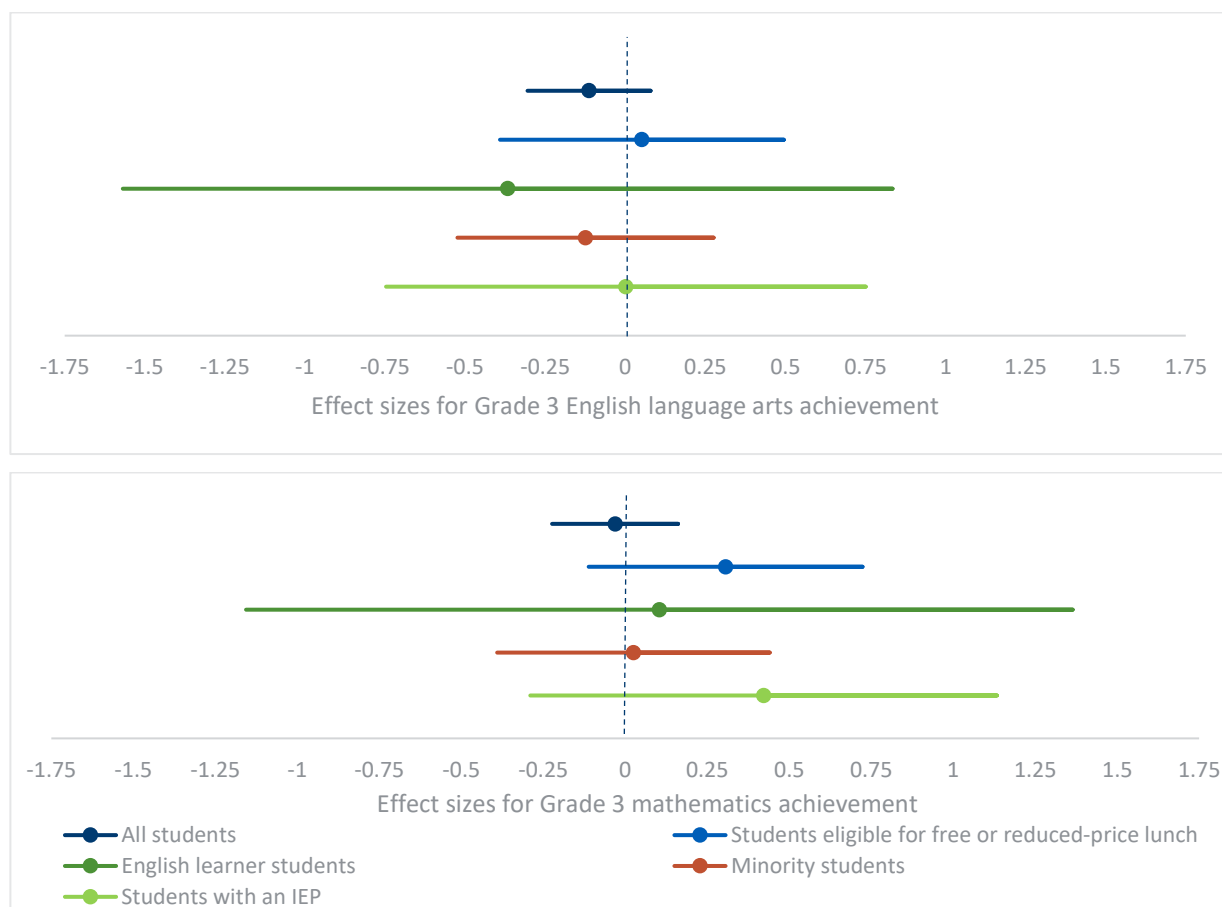
Note. The differences in the likelihood of these outcomes represent the pooled post-treatment effect point estimates across 4 post-implementation years from CITS analysis models.

This study did not find a statistically significant effect of FDK on Grade 3 English language arts or mathematics achievement for all students. Across the first 3 years after implementation, students' Grade 3 test scores were slightly lower on average for students in FDK schools compared to those for students in PDK schools. These differences were not statistically different than zero (Figure 5 and see Table B3 in Appendix B).

Exploratory analyses, which examined differential effects across students with different characteristics for a subset of the overall sample, suggested that there may be larger positive effects of FDK on mathematics achievement for students eligible for FRPM as well as for students with an individualized education program (IEP). Among students eligible for FRPM, there was a substantively large effect on average Grade 3 mathematics achievement (effect size of 0.31) for students in FDK schools compared to students in PDK schools (see Figure 5 and Table B3 in Appendix B). In addition, among students with an IEP, there was a substantively large effect on

average Grade 3 mathematics achievement (effect size of 0.42) for students in FDK schools compared to students in PDK schools. Despite these large effect sizes, the number of students and schools eligible to be included in the analyses for this study was not large enough to measure the effect with precision.² As a result, the effects on mathematics achievement for students with these characteristics were not statistically significant. In addition, this study did not find statistically significant effects on student achievement for English learner students or minority students.

Figure 5. Effects of FDK on Grade 3 English Language Arts and Mathematics Achievement



Note. The estimated effect sizes represent the pooled post-treatment effect point estimate across 3 post-implementation years from CITS analysis models.

Cost Findings

This section describes findings related to the costs of implementing FDK, including (a) the one-time, start-up costs and (b) the ongoing annual costs of additional resources needed to

² According to power analyses conducted by AIR, an analytic sample of 116 schools (58 treatment and 58 comparison) with an average of 12,212 students per wave providers would yield a minimum detectable effect size (MDES) of 0.15 in the first year of implementation and 0.30 in the fourth year of implementation.

implement FDK. In addition, this section describes the limitations of reporting the cost-effectiveness of FDK using analyses conducted with available existing student outcome measures. Findings are organized by research question and are informed by district and building administrator interview respondents as well as publicly available databases. Cost analyses methods are described in Appendix A. Supplementary cost tables with additional detail are also presented in Appendix A.

Research Question 7. What are the one-time, start-up costs to transition a district from PDK to FDK?

The average one-time, start-up costs to transition from PDK to FDK, including personnel and nonpersonnel costs, are \$478 per student. Districts incurred these costs in the year prior to implementing FDK. This estimate represents the sum of average costs associated with the resources required for a district to initially transition to an FDK program.³ In the following sections, we provide additional details about the resources required for transition, including personnel resources (i.e., staff planning time), nonpersonnel resources (i.e., classroom materials), and the variation discovered across both types of resources. Table 1 presents the average one-time costs per student to transition.⁴

Table 1. Estimated Average One-Time, per-Student Start-Up Costs Associated With Transitioning From PDK to FDK

Resource type	Average per-student cost
Personnel (e.g., teachers, principals, district leaders)	\$393
Nonpersonnel (e.g., classroom equipment, instructional materials)	\$85
One-time cost to transition	\$478

Note. The costs of facilities are not included here because those costs will vary greatly based on district-specific needs and student enrollment. Nonpersonnel costs here include the average of a single year of the amortized costs based on the functional life span of each nonpersonnel resource. Time allocation for transition did not vary by classroom size.

The Pennsylvania Basic Education Funding (BEF) formula uses prior-year data and weights PDK students at 0.5 and FDK students at 1.0, which may cause funding challenges in some districts. Discussions with the PDE Bureau of Budget and Fiscal Management revealed that the Pennsylvania BEF formula relies on the 3-year average of a districts' prior average daily

³ Details about how the per-student cost for transition was calculated can be found in Appendix A.

⁴ In interviews, districts that had recently transitioned were able to do so without any construction costs and simply reallocated existing facilities to accommodate FDK. However, PDK districts hypothesizing about a potential transition discussed in interviews a variety of solutions, including building additional classrooms or an entirely new school building to accommodate FDK. Given that individual district circumstances will dictate the extent to which any new facilities will be required for remaining districts to transition to FDK, these facility costs were not included in transition cost estimates. These costs would need to be determined individually.

membership (ADM) to calculate a portion of the BEF allocation. For example, an average of the 2016–17, 2017–18, and 2018–19 ADM data was used to determine the per-student BEF for the 2020–21 payment year. If a district transitions to FDK in 2020–21, the funding for that first year of implementation would rely on the BEF weights for PDK students (0.5) for the years when students attended PDK (2016–17, 2017–18, 2018–19). The district would not receive the BEF weights for only FDK students (1.0) until the 2024–25 payment year, which would use ADM from 2020–21, 2021–22, 2022–23.⁵ As Pennsylvania considers expanding FDK, the BEF formula is an important factor to consider because districts will not receive the full funding for FDK students in the first years of implementation.

The cost component of this work does not address how districts would support the additional costs of FDK nor does it address the consequences of the BEF formula on districts' ability to cover the additional costs. Some districts reported making the transition from PDK to FDK after a year or more of declining student enrollment, making the associated funding for all kindergartners manageable. Other districts considering the transition reported that they had steady or even increasing student enrollment trends, which could potentially lead to budget shortfalls. The current BEF formula for schools may present issues for districts attempting to make this transition and should be considered when making policies related to the mandatory implementation of FDK.

Personnel

The average per-student cost associated with staff time required during the planning year was \$393. District staff used time during the planning year to manage the logistics associated with integrating the FDK program into existing schedules (i.e., specialized content schedules, cafeteria, recess) and to determine the daily classroom schedule and content for FDK. Some districts also reported the need to build buy-in with parent groups and the school board prior to beginning the transition planning.

The time an individual allocated to transition planning varied by the position held and the district's needs and capacity. For example, one district relieved an individual PDK teacher from one class each day (i.e., half the day) to research FDK programs and to help with the planning process during the year prior to FDK implementation. Other districts leveraged the hour-long collaborative planning sessions each week to develop FDK plans. Districts often relied on mentoring from neighboring districts or similar districts in their respective Intermediary Unit (IU) to understand how to implement an FDK program. Time allocated to transition in all

⁵ This description of how the ADM is applied is specific to the BEF. The charter school weight, local effort capacity index, and sparsity/size ratio apply the ADM differently.

positions did not appear to be related to the number of students in an average kindergarten classroom. Table 2 shows the average time allocations reported across the sample districts, along with the associated costs per student.⁶

Table 2. Average One-Time Cost of Personnel Time Needed to Transition From PDK to FDK During Planning Year

Position	Time allocated to transition activities	Per-student cost of time allocation
Teachers	1,137 hours	\$327
Building administrators	128 hours	\$38
District assistant superintendent	30 hours	\$11
District superintendent	44 hours	\$17
Overall one-time personnel costs per student	—	\$393

Note. All costs are reported in 2020 dollars and include benefits for those positions that qualify. Cost-per-student estimates use the number of students in an average PDK district. More information about cost calculations can be found in Appendix A.

Materials and Equipment

The average per-student cost for materials and equipment needed for FDK implementation was \$85. PDK classrooms served two classes of students each day (morning and afternoon classes), allowing some materials and equipment to be shared across the two classrooms. However, FDK classrooms served only one class of students each day. As a result, the transition to FDK required twice as much equipment to serve the same number of students.

Materials and equipment needed for FDK included additional size-appropriate tables and chairs that supported flexible seating (i.e., small-group instruction, center-based instruction), additional area rugs to encourage developmentally appropriate play and seating for whole-group instruction, and additional classroom storage (e.g., cubbies to hold student belongings). These items were already available in the PDK classrooms, but transitioning districts needed to purchase additional materials to equip the expanded number of kindergarten classrooms. Transitioning districts also purchased equipment for classroom storage (e.g., cubbies to hold student belongings) and content area-specific curriculum kits to implement the districts' priorities for how to use the additional time during the full-day program (e.g., materials for imaginative play, writing kits).

⁶ The costs for those time allocations were derived from the hourly wage for each position, including benefits if appropriate. Information about how hourly rates were calculated can be found in Appendix A.

We used the average enrollment in PDK districts to estimate the quantities needed for each type of material and equipment.⁷ We assumed that a transitioning district would already have enough equipment for half the kindergarten students, given that they already served two classes of students per classroom and teacher. We divided that average PDK student enrollment in half to represent the number of students who would need additional materials under this assumption. Then we divided by the assumed class sizes of 18 students to determine the number of classrooms for which new materials would need to be purchased.

Classroom equipment is used for more than 1 year. Therefore, the costs are amortized across an appropriate number of years for each item. Tables, chairs, and classroom storage units are expected to last 10 years, whereas the area rugs and imaginative play sets are expected to last 5 years. The one-time, start-up costs described previously include the first year of the amortized costs. However, policymakers should note the prices of equipment because those costs likely will be actualized by districts at the time of transition. The amortized cost represents the opportunity cost for each year of ownership, while the unit price is what a district can expect to pay per unit to initially implement FDK. Both the amortized costs and unit prices are included in Table 3.

The FDK programs used additional materials to facilitate academic and social and emotional learning during the extra classroom time. Each district made curricular decisions based on student needs and school priorities. FDK administrators reported purchasing additional curriculum kits to address the need for more instructional content with students in FDK. Transitioning districts reported purchasing instructional materials related to developmentally appropriate writing instruction for kindergartners, and all FDK programs reported having similar resources. Curricular materials for social and emotional learning included dramatic play equipment (e.g., kitchen sets with pretend food, puppet show centers). Regardless of PDK or FDK program, all districts used the kindergarten extension of curriculum kits already purchased for the other elementary grades (i.e., reading, mathematics, science, and social studies). Reading and mathematics curriculum kits were purchased annually for the number of students served in each school; therefore, no additional up-front costs were associated with the reading and mathematics curriculum kits.

⁷ The classroom materials needed to transition from PDK to FDK varied according to enrollment trends and existing materials in the district. Some districts were able to reallocate classroom equipment from underused classrooms whereas other districts had to purchase all new equipment for each additional kindergarten classroom.

Table 3. Costs of Materials and Equipment Needed for Transition per Student

Classroom materials and equipment (unit price)	Amortized cost per unit	Additional units needed	One-time, per-student cost
Student table (\$302 each)	\$21	35	\$3
Student chair (\$40 each)	\$3	173	\$2
Area rug (\$274 each)	\$46	8	\$1
Imaginative play sets (\$213 each)	\$36	8	\$1
Writing curriculum kits (\$1,369 each)	\$1,369	15	\$76
Classroom storage (\$310 each)	\$22	30	\$2
Overall one-time materials and equipment costs per student	—	—	\$85

Note. All costs are reported in 2020 dollars. Calculations use average kindergarten enrollment in PDK districts to determine the number of additional classrooms of 18 students needed. Writing kits were not included in the PDK program. Therefore, they need to be purchased for all kindergarten students.

Facilities

Facilities are an important part of the transition from PDK to FDK, yet facility usage is constrained by building capacity and school grade-span structure. All districts in the sample with PDK programs served two classes of 18 to 25 students (i.e., 36 to 50 total students) each day in a single classroom. In the districts with FDK programs, a single classroom was devoted to each group of 18 to 25 students. The transition from PDK to FDK therefore required twice as many classrooms allocated to the kindergarten program.

In addition, in both PDK and FDK programs, kindergarten students traveled to the specialized content area classrooms or spaces. These specialized places included the school gymnasium, art room, music room, and library space. Students in the full-day programs had lunch in the cafeteria whereas students in the part-day program did not have lunch at school and therefore did not use the cafeteria daily. Interview respondents reported varying classroom sizes and amenities for their kindergarten students. Although not reported as a district requirement, the majority of kindergarten classrooms were reported to have an attached restroom or, at a minimum, a restroom shared between two kindergarten classrooms.

Districts addressed the need for additional building space in different ways. All FDK classrooms were reported to be part of the original school building; none were housed in modular

buildings. Some districts reported a decline in student enrollment across all grade levels during the years preceding the FDK implementation year, which they leveraged to allocate additional classrooms to kindergarten. Other districts reported moving offices for IU staff to other buildings or spaces in the district to accommodate the increased need for classrooms. One PDK district considering a shift to FDK reported the possibility of transforming multiple neighborhood elementary schools (serving Grades K–5) into elementary “centers” in which each school served a smaller grade span (e.g., Grades K–2, Grades 3–5), thus making space for an FDK program. With elementary centers, the district felt it could avoid the drastic annual changes in building occupancy observed within the neighborhood schools. Other districts considering FDK did not yet know how they would accommodate additional facility needs.

The facilities needed to transition from PDK to FDK will vary based on the unique circumstances of each district, including the space available, enrollment trends, district zoning structure, and community preferences. These circumstances vary greatly across individual districts that may transition to FDK and change yearly depending on enrollment at all grades and available space. As a result, this study does not include facility costs in the estimates provided. However, districts will need to consider facility changes and plan for those costs if they decide to offer FDK.

Research Question 8. What are the differences in the ongoing annual costs per student between PDK and FDK?

This section summarizes the additional estimated *ongoing annual costs* per student required to implement FDK compared to the costs associated with PDK. These findings were informed by district and building administrator interview respondents and cost estimates described in Appendix A.

After the initial start-up costs, the implementation of FDK costs up to approximately \$3,321 more per student each year than implementation of PDK. Table 4 shows the average overall annual per-student cost for PDK and FDK programs for personnel and nonpersonnel resource categories.⁸ According to district and building administrators, implementation of FDK required additional personnel, classroom space, and materials and equipment beyond those required for implementation of PDK. Additional details for each of the ongoing annual resources needed to implement FDK are subsequently described.

⁸ See Appendix A for the range of the ongoing annual costs per student.

Table 4. Summary of Average Annual per-Student Costs Associated With PDK and FDK

Resource	PDK per-student cost	FDK per-student cost	Difference in per-student cost
Personnel	\$4,613	\$7,848	\$3,235
Nonpersonnel	\$94	\$180	\$86
Overall program cost	\$4,707	\$8,028	\$3,321

Note. Personnel costs include benefits for those positions that qualify. All costs are reported in 2020 dollars and assume a maximum class size of 18 students (see Appendix A for lower-bound estimates using 25 students per class as the alternative assumption).

Personnel

The average per-student cost for personnel resources was \$4,613 for PDK programs and \$7,848 for FDK programs. The number of students served per teacher was the main driver of the difference in cost for teachers because PDK teachers provided instruction to approximately twice as many students as did FDK teachers. For example, most districts reported a maximum class size of 18 students. In those cases, one FDK teacher would serve 18 students a day, whereas one PDK teacher would serve 36 students a day. For school and district personnel, including content area specialists and bus drivers, time allocation is reported as time spent supporting the kindergarten program overall. The cost per student was determined using the average kindergarten enrollment in PDK or FDK districts, respectively, which causes some positions with the same time allocation to vary in the dollar-per-student cost associated with that time allocation. Table 5 summarizes the costs associated with the average time allocation of each position type for PDK and FDK. Differences in the positions between PDK and FDK programs are subsequently described.

Table 5. Annual per-Student Personnel Costs Associated With PDK and FDK Programs

Position	PDK		FDK	
	Average annual time allocated to kindergarten	Average per-student cost estimate	Average annual time allocated to kindergarten	Average per-student cost estimate
Teacher	655 hours (per class)	\$2,810	1,309 hours (per class)	\$5,620
Instructional assistant	315 hours (per class)	\$370	630 hours (per class)	\$740
Volunteer	—	—	270 hours (per class)	\$317
Content area specialists	180 hours (per class)	\$813	180 hours (per class)	\$813

Position	PDK		FDK	
	Average annual time allocated to kindergarten	Average per-student cost estimate	Average annual time allocated to kindergarten	Average per-student cost estimate
Building administrator	267 hours (per school)	\$241	139 hours (per school)	\$175
District assistant superintendent	21 hours (per district)	\$8	21 hours (per district)	\$11
District superintendent	21 hours (per district)	\$8	21 hours (per district)	\$12
Bus driver	1,309 hours (per bus route)	\$363	900 hours (per bus route)	\$160
Overall per-student cost	–	\$4,613	–	\$7,848

Note. Personnel costs include benefits for those positions that qualify. All costs are reported in 2020 dollars and assume a maximum class size of 18 students (see Appendix A for estimates using 25 students per class as the alternative assumption). See Appendix A for cost calculation methods.

Twice as many kindergarten classroom teachers, and therefore twice as many kindergarten classroom teacher hours, were needed for FDK than for PDK. Teachers were an essential human resource in the production of both FDK and PDK. Personnel who provided services to kindergarten students included classroom teachers, teaching assistants, content area specialists (i.e., physical education, art, music, computer science), special educators, and interventionists. District administrators and principals reported that kindergarten classroom teachers spent 100% of their time focused on the kindergarten program, both directly (i.e., daily instruction) and indirectly (i.e., collaborative planning). FDK teachers served between 18 and 25 students each day whereas PDK teachers served two groups of 18 to 25 students, totaling 36 to 50 students each day. District administrators and principals reported that teaching assistants spent between 1 and 6 hours a day focused on kindergarten students, regardless of program type. Table A9 in Appendix A presents the differences in annual time allocations for each teaching position between PDK and FDK as reported by district and building administrators who participated in cost interviews.

Regular volunteer programs were described by some FDK programs, but volunteers in PDK programs were more sporadic. Districts that offered FDK in our sample reported having regular volunteers to assist with classroom activities, writing instruction, or small reading groups. It was reported that the length of day allowed time for these types of volunteer programs. In the PDK programs, it was reported that volunteers were more sporadically present in the classrooms and mainly helped with things like special programs or events for just a few hours a year. Although volunteers may come at no cost to the district, the value of their time is important

when considering replication of the program at scale. By providing a value for volunteer time, policymakers can understand what the time may cost in the case where volunteers may not be available. In this work, it was assumed that a district likely would hire additional instructional assistants to support teachers in the classroom in the absence of any volunteers. Therefore, volunteer time uses the same compensation rates as the instructional assistants.

Time allocation for content area specialists (i.e., music, art, physical education) varied across PDK and FDK districts in our sample; however, that variation appeared to be related to district choices and available content area specialists rather than to the program type.

Content area specialists generally spent approximately 45 minutes (plus 15 minutes for planning) with kindergarten students each day, regardless of the program type. Districts across both program types reported varying structures for content area specialists. For example, in some districts, a single art teacher served multiple elementary schools. In other districts, there were enough students to warrant content area specialists in each elementary school. In each district, regardless of program type, kindergarten students attended one content area special class per day. Throughout a single week, depending on the availability of content area specialists in the district, a kindergarten class may see the same specialist more than one time in a week. For example, some districts did not have a computer teacher, so kindergartners went to library/media two times each week.

Administrators reported allocating a greater amount of time to supporting PDK programs relative to FDK programs at the beginning of each school year. At the start of each school year, principals spent additional time with each kindergarten class to support students' transitions to and from the school. In PDK programs, this time was doubled because of students arriving and leaving at two points each day (i.e., morning and afternoon). Interview respondents reported that building-level administrators (i.e., principals and assistant principals) spent approximately 1 to 5 hours per week working with kindergarten teachers and students in both program types. This work could be in the form of direct student support, weekly professional learning community meetings, or annual observation cycles. Principals also reported that they spent about 2 full days each summer to support the kindergarten screening processes. District administrators (i.e., superintendent, assistant superintendent of curriculum and instruction) spent approximately 1 to 2 hours per month focused on the kindergarten program.⁹

In districts that provided transportation, bus drivers had daily contact with kindergarten students of both program types. In FDK districts that provided transportation, part-time bus drivers (without benefits) were employed and were assumed to work 5 hours each school day, whereas, in the districts implementing PDK, they were assumed to be full-time employees (with

⁹ Time allocation for leadership at both the school and district levels changed during the planning year that preceded transitioning to FDK; those details are described under Research Question 7.

benefits) and work 1,309 hours each school year. The difference in hours was attributed to the midday transportation run described by some PDK districts. Transportation estimates do not include other types of transportation (e.g., field trips, special events). Some PDK districts provided midday transportation whereas other PDK districts relied on parents, family members, or childcare facilities. Parents were not interviewed as a part of this study; therefore, transportation costs borne by families were not estimated in this work. According to building administrators, the midday transportation burden can be quite significant for some families and was a major factor in the decision to implement FDK.

The time that some staff spent supporting kindergarten varied across schools depending on the conditions within the district and schools, including individual student needs, but did not vary systematically by PDK or FDK schedule. For example, the time spent by special educators and interventionists toward kindergarten students was determined by student need and changed from year to year, and even week to week, as students made progress or experienced challenges. Interviewees did not report differences in time allocation for these staff between PDK and FDK districts. Given the specialized nature of the services provided by special educators and interventionists, their time allocation was reported to be solely a function of student need and not related to the program type (i.e., PDK or FDK).

Materials and Equipment

As described previously, districts transitioning to FDK purchased additional materials and equipment to accommodate students for the entire day. Although these materials were purchased in the year prior to implementation, they would be used over multiple years. As a result, we present amortized costs across the assumed life span of each item. The amortized costs represent the opportunity cost to the district of the original purchase.

The average annual per-student cost of materials and equipment for PDK programs was \$94 compared to \$180 for FDK programs. There was some variation in costs for materials and equipment driven by programmatic decisions related to how FDK programs utilized the extended instructional day. For example, some FDK districts decided to incorporate imaginative play in their curriculum to attend to the social and emotional needs of their kindergarten students. Other districts leveraged the extended instructional day to incorporate a developmentally appropriate writing program for young students. Table 6 shows the materials and equipment that were typically used in each program type along with the average estimated costs per student (based on the amortized costs in Table 3). Differences in the materials and equipment needed between PDK and FDK programs are previously described under Research Question 7.

Table 6. Summary of Annual per-Student Costs for Materials and Equipment in PDK and FDK Programs

Materials/Equipment (unit price)	PDK annual per-student cost	FDK annual per-student cost
Student table (\$302)	\$3	\$5
Student chair (\$40)	\$2	\$4
Area rug (\$274)	\$1	\$3
Reading curriculum kits (\$1,346)	\$74	\$74
Math curriculum kits (\$261)	\$14	\$14
Writing curriculum kits (\$1,369)	–	\$76
Imaginative play sets (\$213)	–	\$2
Classroom storage (\$310)	–	\$2
Overall per-student cost	\$94	\$180

Note. All costs are reported in 2020 dollars and assume a maximum class size of 18 students. Tables and chairs were assumed to have a 10-year life span. Rugs and imaginative play sets were assumed to have a 5-year life span. Curriculum kits were assumed to be an annual purchase.

Staff Training

Ongoing training for staff was a resource reported across all programs, and there were no reported differences between FDK and PDK programs. Each district reported using the allotted annual professional development days, which ranged from 4 to 10 annually depending on the district, to support teachers in providing high-quality instruction for students across all content areas. There were no reports of professional development solely for kindergarten teachers that fell outside the required teacher workdays. Districts also reported relying on the Intermediary Units (IUs) to help structure professional development opportunities for all staff, including kindergarten teachers. All ongoing professional development focused solely on serving kindergarten students occurred within the required teacher workdays and has already been included in the kindergarten teacher time allocated toward kindergarten. There were no incremental costs to report related to ongoing training. (One-time training costs required to transition to FDK are described under Research Question 7.)

Research Question 9. How cost effective is transitioning to FDK?

As described earlier in this report, this study did not find statistically significant positive effects of FDK, relative to PDK, on the available student outcome measures for students overall. When positive impacts cannot be causally linked to the program of interest, there is said to be no observed effect of the program that can be linked to the program costs. Therefore, cost-effectiveness analyses are not relevant (Bowden & Belfield, 2015; Levin, McEwan, Belfield, Bowden, & Shand, 2018).

Study Implications

This study investigated the benefits of FDK for students in the Commonwealth of Pennsylvania. Given evidence of the effectiveness of FDK on students' academic and social and emotional outcomes from other states (Cooper et al., 2010; DeCicca, 2007; Lee et al., 2006), FDK was expected to influence students' academic and social and emotional outcomes in kindergarten. The extent to which the benefits would be observed into Grade 3 (when student achievement data were available) was uncertain given other research that shows the benefits often fade away (Cooper et al., 2010; Votruba-Drzal et al., 2008). Ideally, this study would have examined impacts using validated, existing measures of children's academic and social and emotional skills in kindergarten. However, in the absence of these measures, this study examined kindergarten attendance and disciplinary incidents in kindergarten (i.e., proxies for engagement). The combination of these two variables allowed us to operationalize emotional skills in the available data. In addition, in the absence of measures of children's academic knowledge and skills at the end of kindergarten, the study examined student achievement in Grade 3, which was the first available collection point.

This study also investigated how districts and schools transitioned to and implemented FDK in order to outline considerations and opportunities for state guidance to support additional schools as they transitioned to implementing FDK.

Identifying Outcomes of Full-Day Kindergarten

Although the quasi-experimental impact analyses in this study did not find statistically significant positive effects of FDK, relative to PDK, on the available student outcome measures (i.e., kindergarten attendance, disciplinary incidents in kindergarten, and Grade 3 English language arts and mathematics achievement) for students overall, exploratory impact analyses and qualitative data signal the possibility of positive outcomes. For example, when examining effects of FDK on kindergarten attendance by individual post-implementation years, we observed an initial slight decline in attendance, followed by a slight increase in attendance in Year 4. Lagged effects may be attributed to some initial implementation challenges during the first few years of implementation, which could have been resolved over time with the experience of implementation. In addition, district administrator interviews revealed that increases in district funding to support FDK students, specifically per-student basic education funding calculated from 3 years of ADM data, also could explain why positive effects on kindergarten attendance were not observed until Year 4.

Exploratory analyses among students eligible for FRPM also signaled potential positive effects that this study could not observe reliably because of the smaller number of students in this subgroup within the study schools. This study identified substantively large (though not

statistically significant) positive effects of FDK on kindergarten students' later mathematics achievement in Grade 3 for students eligible for FRPM. It is possible that with a larger sample of schools this effect may be observed with greater precision. These differential effects by the socioeconomic status of students' households may be attributed to differences in PDK students' out-of-school time experiences by socioeconomic status. Families with more economic resources may be able to afford other enrichment opportunities for their children.

In addition, qualitative interview data from this study suggested potential positive impacts of FDK on other outcomes for which data were unavailable for this study. For example, district and building administrators reported that they perceived that, in general, students who attended FDK were happier, more confident, and better prepared for later grades in terms of their academic and social and emotional skills than were students who attended their PDK program in prior years. Administrators attributed these perceived outcomes to additional instructional time as well as additional time spent building relationships with students and supporting their social and emotional development. Administrators reported that teachers appreciated the additional time with students to provide instruction in all content areas and build school-readiness. Administrators also reported that parents supported the transition to FDK for academic, social, and childcare reasons.

Considerations for Implementing Full-Day Kindergarten

The implementation and cost interviews identified important considerations for districts when transitioning from PDK to FDK, including processes and resources needed and their costs.

Pre-Implementation Planning

Districts reported needing approximately 1 year to plan for the transition from PDK to FDK with the support of a diverse group of staff and indicated that maintaining this planning group throughout the first year of implementation is important. During the planning year, building-level administrators were able to make class placement and scheduling plans to accommodate the increased school day for all kindergarten students. The districts needed time to manage transportation, hire additional teachers, and prepare families and local childcare facilities for the program change. Interviewees from recently transitioned districts talked about needing to build consensus among families and local school board members. If PDE seeks to promote the expansion of FDK to more districts, PDE should consider intentionally engaging district superintendents, local school boards, and educators in building support for the new program in all regions.

District leaders emphasized the importance of staff training to support effective implementation of FDK. In addition, districts that already had FDK provided invaluable support to those districts transitioning to an FDK program. Their mentorship provided districts with

concrete plans for implementation and ideas for what to expect during and after implementation occurred.

Common Technical Assistance Needs Among Districts

Interviews with district and school leaders helped identify three areas on which Pennsylvania may need to focus its technical assistance efforts: (a) identifying and developing plans for space to support FDK within the school campus, (b) expanding the curriculum to accommodate a full day of instruction, and (c) developing schedules and plans for incorporating FDK into the larger school and district context.

Finding adequate space for FDK was posed as a potential challenge for some districts considering a shift to FDK. Districts may require support to understand the options available to them for making space for an FDK program as well as procedures to follow when moving IU offices out of district buildings. In tandem with district-specific support, Pennsylvania may want to consider collecting facilities usage data for the entire state. This effort would provide critical insight into school capacity, available classroom space, available land for school expansion, and other important factors.

Second, a major focus for districts transitioning to FDK was expanding the curriculum, particularly in regard to promoting children's social and emotional development and, as in most of the study districts, fostering children's writing skills. Schools and districts could benefit from guidance from PED, IUs, and other FDK districts for identifying curricula and materials for FDK programs.

Last, the support of the IUs can be leveraged to understand how to manage the logistics associated with incorporating the FDK program into the day-to-day district activities. This support can include information about handling transportation, school schedules, and report cards. Although neighboring districts also may have helpful approaches to these issues, the IUs are uniquely positioned to understand the varying circumstances within each region and may be a source of rich information to shape decision making.

Stakeholder Approval

Buy-in was generally not a challenge for districts interviewed for this study. The majority of parents and all teachers were reported to welcome the transition to FDK. Teachers recognized the benefits for children and for educators' ability to do their job effectively, given a longer instructional day. Parents reportedly recognized the benefits for children's school readiness and saw FDK as an opportunity to lighten the burdens associated with PDK (i.e., securing childcare for half the day, providing transportation). It should be noted, however, that respondents indicated a small variation in parental buy-in. For example, administrators reported that for

parents who could provide full time care for their students in their homes, they were less likely to support the transition to FDK. However, parents who did not support FDK reportedly represented a small percentage of the population and were most prevalent in high-income areas. Regardless, the need to build consensus among parents for FDK was clear and recognized by all the districts in the study.

Funding

Funding for FDK may be a concern for districts. The Pennsylvania BEF formula uses an average of the 3 previous years of ADM data (in most cases) to determine the amount of basic education funding a district receives. PDK students are weighted at 0.5, whereas FDK students are weighted at 1.0. The calculation of the BEF may create a stumbling block for some districts seeking to implement the longer school day because districts will not receive the full weighted BEF amount for FDK students until the fifth year of implementation. In addition to the increase in annual costs of FDK compared to PDK, there are the initial costs required to implement the program (i.e., one-time transition costs). Although some districts were able to make the transition with little additional spending, some districts may experience financial shortfalls when making the transition. District-specific support regarding transitioning should include consideration of enrollment trends and the BEF formula.

Many districts in this sample were able to pivot to an FDK program during years of declining enrollment, thus avoiding the financial crunch the transition can cause due to the current BEF formula. This circumstance will not be the case for all current PDK districts. Specific funding guidance may be helpful during the initial planning and implementation years, or a shift in the BEF formula may support districts with stable or growing enrollment.

Several districts described scenarios in which students attended a non-public kindergarten program, then returned to the public schools in first grade. Interview participants described this move as being primarily due to parents' preferences for FDK in districts where only PDK was offered. It is also possible, however, that some students' families choose not to attend *any* kindergarten program because of the lack of mandatory kindergarten attendance for all age-eligible students. This possibility may mean that some districts with existing FDK programs also may require more resources if kindergarten were made mandatory across the commonwealth. According to historical enrollment data, there are districts with large differences between kindergarten and first-grade enrollment over the past 10 years, with the highest differences occurring in Philadelphia. These differences could signal the need for additional resources to understand how to accommodate mandatory kindergarten. Further investigation is recommended to help PDE policymakers understand the causes of these historical kindergarten and first-grade enrollment differences.

References

- Bowden, A. B., & Belfield, C. (2015). Evaluating the talent search TRIO program: A benefit-cost analysis and cost-effectiveness analysis. *Journal of Benefit-Cost Analysis*, 6(3), 572–602.
- Cooper, H., Allen, A. B., Patall, E. A., & Dent, A. L. (2010). Effects of full-day kindergarten on academic achievement and social development. *Review of Educational Research*, 80(1), 34–70.
- DeCicca, P. (2007). Does full-day kindergarten matter? Evidence from the first two years of schooling. *Economics of Education Review*, 26(1), 67–82.
- Education Commission of the States. (2016). *Full-day kindergarten: A look across the states*. Retrieved from <https://www.ecs.org/wp-content/uploads/Full-Day-Kindergarten-A-look-across-the-states.pdf>
- Education Commission of the States. (2018). *State kindergarten-through-third-grade policies*. Retrieved from <http://ecs.force.com/mbdata/MBQuest2RTanw?rep=KK3Q1805>
- Lee, V. E., Burkam, D. T., Ready, D. D., Honigman, J., & Meisels, S. J. (2006). Full-day versus half-day kindergarten: In which program do children learn more? *American Journal of Education*, 112(2), 163–208.
- Levin, H., McEwan, P., Belfield, C., Bowden, B., & Shand, R. (2018). *Economic evaluation in education: Cost-effectiveness and benefit-cost analysis*. New York, NY: SAGE Publications.
- Miller, A. (2002). *Frequently requested information: Full-day kindergarten*. Champaign, IL: ERIC Clearinghouse on Elementary and Early Childhood Education.
- Votruba-Drzal, E., Li-Grining, C. P., & Maldonado-Carreño, C. (2008). A developmental perspective on full- versus part-day kindergarten and children's academic trajectories through fifth grade. *Child Development*, 79(4), 957–978.
- What Works Clearinghouse. (2020a). *WWC procedures handbook* (Version 4.1). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, What Works Clearinghouse.
- What Works Clearinghouse. (2020b). *WWC standards handbook* (Version 4.1). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, What Works Clearinghouse.

Appendix A. Detailed Methodology

This appendix describes the methodology used for each of the three study components: implementation, impact, and cost.

Implementation Methods

The implementation study component aimed to understand the practical implications of expanding full-day kindergarten (FDK) from the perspectives of district and building administrators who have made the transition from part-day kindergarten (PDK) to FDK. A comprehensive understanding of these experiences was expected to provide policymakers with the tools they need to support districts transitioning from PDK to FDK. More specifically, this study sought to answer the following five implementation research questions:

Research Question 1. Why were districts motivated to implement FDK?

Research Question 2. How did districts implement FDK?

Research Question 3. How did kindergarten stakeholders react during the transition from PDK to FDK?

Research Question 4. How do kindergarten stakeholders describe the impact of FDK on student educational outcomes?

Research Question 5. What unanticipated outcomes did districts experience after implementing FDK?

Data Sources and Measures

District and building administrators participated in semi-structured 45- to 60-minute telephone interviews. Interview questions examined how districts approached the transition to FDK, challenges they encountered, and solutions they found. Interviews were audio-recorded. A professional transcription service was used to transcribe the interview audio files. Brief analytic memos were collected during the interview process, and a reflection journal was used following each interview to capture immediate analytic reflections.

Sampling and Recruitment

Using extant data provided by the Pennsylvania Department of Education (PDE), the American Institutes for Research (AIR) identified the population of districts that transitioned to FDK in the past 5 years—20 districts met that criterion. Next, AIR examined the distribution of those 20 districts across the following strata: geographic locale type (i.e., large city, midsize city, rural) and region (i.e., eastern, central, western). In consultation with PDE, AIR purposefully selected 10 districts to maximize variation across the two district characteristics strata.

Once the districts were selected, PDE sent an email to the district superintendents to invite the district to participate in the study. Once PDE confirmed a district's agreement to participate, AIR contacted the district to discuss next steps for participation. Of the 14 selected districts, 10 agreed to participate. Those districts that agreed to participate were asked to provide AIR with contact information for up to three district administrators who were knowledgeable about the kindergarten program and up to three elementary school principals to invite them to participate in telephone interviews.

Due to school closures associated with the COVID-19 pandemic, many scheduled interviews were canceled, and other interviews could not be scheduled at all. Within the 10 participating districts, interviews were collected from a total of seven districts. AIR conducted six interviews with district administrators and 10 interviews with elementary school principals. Table A1 shows the sample distribution by participating district. In an effort to incorporate information from more districts, interview notes from the cost study interviews were used as a supplemental data source to the implementation interviews. As shown in Table A1, there were three districts for which cost interview notes were repurposed for implementation analyses.

Table A1. Summary of District Sample for Implementation Analysis

District name	Locale	Region	District administrator interview	Principal interview	Cost interview notes
District A	Midsize city	Western		1	
District B	Large city	Western	2		
District C	Midsize city	Eastern	1	2	
District D	Large city	Eastern		2	
District E	Rural	Eastern	1	3	
District F	Large city	Western			1
District G	Rural	Western		2	1
District H	Rural	Eastern	2		1
Total			6	10	3

Implementation Analyses

AIR analyzed interview transcriptions and notes using the qualitative coding software NVivo 12. Analyses were organized around an a priori coding structure based on the overarching themes present in the implementation research questions. A hierarchical coding strategy was then used. This strategy yielded initial primary, secondary, and tertiary codes that expanded on and provided a more detailed picture for the a priori themes. After initial codes were established, these codes, and their sub-codes, then were refined and reviewed for interconnectedness. Finally, core themes were reviewed for the purposes of outlining a detailed narrative of FDK

implementation in Pennsylvania. That narrative development included again reviewing sub-codes within each major theme and quantifying each theme and sub-code.

Impact Methods

The impact study component aimed to understand the impact of FDK, relative to PDK, on students' behavioral and academic outcomes. More specifically, this study sought to answer the following impact research questions:

Research Question 6. How do the behavioral and academic outcomes of students who attend FDK compare to those of students who attend PDK? And, how do the impacts of FDK on student educational outcomes vary based on students' demographics?

In the absence of an experiment, in which random assignment of students into two groups of treatment (i.e., students enrolled in FDK) and control (i.e., students enrolled in PDK) occurs, we must use alternative methods for assessing possible program impacts. For this study, we used a quasi-experimental design called comparative interrupted time series (CITS), which examines program impacts by examining whether the treatment group (i.e., students enrolled in schools with FDK) deviates from its baseline level by a greater amount than the comparison group (i.e., students enrolled in schools with PDK). In this case, baseline refers to the outcomes of a school prior to implementing FDK. To do this, the approach compares the outcomes of students in schools before and after the introduction of FDK to those of students in schools that only have PDK across the entire time series. Because the available Pennsylvania Information Management System (PIMS) data include multiple cohorts of students attending FDK and PDK over time, the CITS model is an appropriate quasi-experimental approach.

Data Sources

The impact study component included two data sources: (a) PIMS data provided by PDE and (b) Common Core of Data (CCD).

PIMS. Data obtained from PDE included student-level school enrollment for the 2009–10 through 2018–19 school years used to associate students with schools and grades in particular years. Data from PDE also included the following variables used as outcome measures:

- student attendance in kindergarten (i.e., number of days in attendance divided by the number of days enrolled),
- disciplinary infractions in kindergarten (i.e., number of in-school or out-of-school suspensions during the school year),
- Grade 3 Pennsylvania System of School Assessment score for English Language Arts, and

- Grade 3 Pennsylvania System of School Assessment score for Mathematics.

Data from PDE also included the following student-level characteristics that served as covariates in analytic models: race/ethnicity, eligibility for free and reduced price meals (FRPM), indicator of English learner student, indicator of an individualized education program (IEP).

CCD. AIR also used student-level administrative data for the 2009–10 through 2018–19 school years regarding school and student characteristics from the Common Core of Data (CCD). These variables included total enrollment, percentage of female students, percentage of students eligible for FRPM, percentage of African American students, percentage of Asian students, percentage of Hispanic students, and percentage of White students. These variables were used for baseline equivalence and covariates in analytic models.

Data were merged to create a panel of data with the type of kindergarten program (i.e., PDK or FDK) each student experienced along with each student’s measurable outcomes. AIR transformed student attendance into two binary outcome variables. Attendance rates of less than 95% were coded as *chronically absent*; attendance rates of less than 100% were coded as *ever absent*. Disciplinary infraction data were transformed into a single outcome variable, *ever disciplined*, indicating students with one or more infractions.

Treatment School Sample Identification

For each set of outcomes—that is, the kindergarten outcomes (e.g., attendance and discipline) and the Grade 3 outcomes (e.g., English language arts and mathematics test scores)—AIR identified a separate sample of treatment schools on the basis of two inclusion criteria:¹⁰

1. The CITS model requires at least 3 years of pre-FDK data to establish trends as well as at least 1 year of post-FDK data (we restricted to up to 4 years of post-FDK data from prior experience) to produce a reliable estimate of the effect of FDK over multiple years.
2. Schools were considered FDK if no more than five (or 10% of the total count of kindergarten students at the school) student records were identified as enrolled in PDK from the PIMS data. For example, a school with 100 kindergartners where 97 students were marked as FDK and 3 were marked as PDK was designated an “FDK school.”¹¹

In order to establish a clear delineation between treatment and comparison schools, schools that offered both PDK and FDK during the time series were excluded from both the treatment

¹⁰ No charter schools met the criteria to be included in the analytic sample for this work.

¹¹ As a sensitivity check, we also expanded the threshold of inclusion criteria of the treatment schools. Specifically, we subsequently defined treatment schools if 25% of kindergarten students at the school enrolled in FDK and ran the same set of analyses. The numbers of FDK schools for these sensitivity analyses were 89 for kindergarten outcomes and 37 for Grade 3 outcomes.

and comparison groups. We also excluded schools that had FDK during the entirety of the time series because there was no variation between PDK and FDK within them.

Kindergarten Outcomes. There were 58 treatment schools across six waves that met the inclusion criteria, as shown in Table A2. The kindergarten outcomes data were available starting in 2009–10 through 2018–19. As a result, the first wave of FDK kindergarten schools included in the study was the kindergarten class of 2012–13. Treatment schools included schools that transitioned from offering PDK to FDK during the observation period (2012–13 to 2018–19), and comparison schools included schools that implemented only PDK in all years of the observation period.

Grade 3 Outcomes. There were 15 treatment schools across two waves that met the inclusion criteria, as shown in Table A3. The Grade 3 outcomes data were available starting in 2012–13 through 2017–18. To examine the effect of FDK on Grade 3 outcomes, the treatment indicator is lagged by 3 years. As a result, the 2015–16 cohort of Grade 3 students is the first cohort of students within schools that transitioned to FDK during the 2012–13 school year. Treatment schools included schools that transitioned from offering PDK to FDK in during the observation period (2012–13 to 2014–15), and comparison schools included schools that implemented only PDK in all years of the observation period.

The matching procedures used to identify the comparison schools are described in the Comparison School Sample Identification section.

Table A2. Kindergarten Behavior Outcomes Treatment Schools Sample by Wave

Wave	Kindergarten school year									
	09–10	10–11	11–12	12–13	13–14	14–15	15–16	16–17	17–18	18–19
Wave 1 (6 schools)	Baseline years			First FDK cohort	Second FDK cohort	Third FDK cohort	Fourth FDK cohort			
Wave 2 (0 schools)	(No schools transition to FDK in 2013–14)									
Wave 3 (10 schools)			Baseline years			First FDK cohort	Second FDK cohort	Third FDK cohort	Fourth FDK cohort	
Wave 4 (12 schools)				Baseline years			First FDK cohort	Second FDK cohort	Third FDK cohort	Fourth FDK cohort
Wave 5 (8 schools)					Baseline years			First FDK cohort	Second FDK cohort	Third FDK cohort
Wave 6 (14 schools)						Baseline years			First FDK cohort	Second FDK cohort
Wave 7 (8 schools)							Baseline years			First FDK cohort

Table A3. Grade 3 Achievement Outcomes Treatment Schools Sample by Wave

Wave	Third-grade school year									
	09–10	10–11	11–12	12–13	13–14	14–15	15–16	16–17	17–18	18–19
Wave 1 (5 schools)				Baseline years			First FDK cohort	Second FDK cohort	Third FDK cohort	Grade 3 test score data not available
Wave 2 (0 schools)	(No schools transition to FDK in 2013–14)									
Wave 3 (10 schools)						Baseline years		First FDK cohort		

Comparison School Sample Identification

AIR selected comparison schools through propensity score matching.¹² The matching process identified comparison schools that are similar to the FDK schools in terms of prior outcomes and school characteristics. A single comparison school was matched to each FDK school using a propensity score estimated with the baseline year outcomes and school characteristics.¹³ The matching process resulted in one comparison school for every FDK school included in an analysis (i.e., a one-to-one match without replacement), so that the total sample size for a specific analysis is twice the number of FDK schools included in the analysis.

To test whether the matching process improved comparability of the FDK and the PDK schools, we compared the observed characteristics of the two groups. A general rule of thumb for determining whether the two groups are similar is if the standardized mean difference (SMD) on measurable characteristics is less than 0.25 standard deviations (What Works Clearinghouse™, 2020a, 2020b).¹⁴ Tables A4 and A5 provide information about how similar, on average, the FDK schools were to the matched comparison group for each set of outcome measures. For the four baseline outcome measures, the two groups have similar baseline outcomes (i.e., behavior outcomes or achievement) before the introduction of FDK, which is an important condition for making valid comparisons between the two groups.

¹² A propensity score is the predicted probability that a school had access to FDK based on observed characteristics of the schools. Schools with similar propensity scores have similar characteristics, and matching classes based on their estimated propensity score is an efficient way to match schools across multiple characteristics.

¹³ To determine a final set of matching indicators for each analytic sample, we tested several different models using different combinations of the baseline year outcomes and school-level characteristics. Then, we reviewed the standardized group differences between FDK and matched comparison schools on each indicator and selected the model that had the smallest standardized group differences.

¹⁴ To calculate the SMD, we used Hedge's *g* for continuous measures and the Cox index for dichotomous measures.

Table A4. Kindergarten Outcomes Sample—Baseline School Characteristics for FDK and Matched Comparison Schools

School characteristic	Mean (Standard deviation)		Standardized mean difference
	Treatment (<i>n</i> = 58 schools)	Comparison (<i>n</i> = 58 schools)	
Percentage of African American students	0.06 (0.07)	0.04 (0.06)	0.215
Percentage of Hispanic students	0.08 (0.09)	0.06 (0.06)	0.379
Percentage of White students	0.76 (0.15)	0.80 (0.17)	0.239
Percentage of Asian students	0.05 (0.06)	0.06 (0.07)	0.077
Percentage of students eligible for FRPM	0.29 (0.18)	0.24 (0.16)	0.289
Percentage of female students	0.48 (0.03)	0.48 (0.03)	0.06
Total students	409.91 (154.98)	399.60 (135.42)	0.071
Suburban	41 (70.7)	45 (77.6)	0.158
Rural	17 (29.3)	13 (22.4)	0.158
Region: Western	14 (24.1)	14 (24.1)	< 0.001
Region: Eastern	38 (65.5)	25 (43.1)	0.462
Region: Central	6 (10.3)	19 (32.8)	0.567
Attendance rate	95.66 (1.08)	95.89 (1.01)	0.22
Ever absent	0.93 (0.10)	0.93 (0.13)	0.014
Chronically absent	0.31 (0.10)	0.29 (0.11)	0.206
Ever disciplined	0.00 (0.00)	0.00 (0.00)	0.021

Table A5. Grade 3 Outcomes Sample—Baseline School Characteristics for FDK and Matched Comparison Schools

School characteristic	Mean (Standard deviation)		Standardized mean difference
	Treatment (<i>n</i> = 15 schools)	Comparison (<i>n</i> = 15 schools)	
Percentage of African American students	0.09 (0.09)	0.07 (0.11)	0.127
Percentage of Hispanic students	0.04 (0.02)	0.06 (0.07)	0.501
Percentage of White students	0.73 (0.13)	0.76 (0.23)	0.123
Percentage of Asian students	0.09 (0.07)	0.06 (0.05)	0.445
Percentage of students eligible for FRPM	0.24 (0.17)	0.22 (0.16)	0.135
Percentage of female students	0.48 (0.03)	0.47 (0.03)	0.368
Total students	444.27 (157.67)	443.93 (109.39)	0.002
Suburban	13 (86.7)	13 (86.7)	< 0.001
Rural	2 (13.3)	2 (13.3)	< 0.001
Region: Western	4 (26.7)	5 (33.3)	0.146
Region: Eastern	10 (66.7)	5 (33.3)	0.707
Region: Central	1 (6.7)	5 (33.3)	0.707
Grade 3 English language arts scores (3 years prior)	0.06 (1.04)	-0.27 (1.08)	0.317
Grade 3 Mathematics scores (3 years prior)	-0.02 (1.22)	-0.16 (1.20)	0.122
Grade 3 English language arts scores (2 years prior)	-0.18 (1.26)	-0.57 (0.99)	0.341
Grade 3 Mathematics scores (2 years prior)	-0.37 (1.05)	-0.42 (1.11)	0.05
Grade 3 English language arts scores (1 year prior)	-0.39 (1.28)	-0.39 (0.99)	0.004
Grade 3 Mathematics scores (1 year prior)	-0.51 (1.19)	-0.54 (0.84)	0.034

Impact Analyses

We employed a multiple baseline multilevel CITS model to evaluate the impact of FDK on kindergarten outcomes (i.e., attendance and disciplinary incidents) and Grade 3 achievement outcomes (i.e., English language arts and mathematics). These models account for the multiple cohorts included in the analysis and the clustering of students within schools. Conceptually, we examined the change in student outcomes when their schools implement FDK relative to the change in student outcomes for a similar set of comparison schools selected using the matching procedures described earlier. All models controlled for confounding factors and any changes in the given indicator over time not due to the intervention itself. We also accounted for the nesting of students within cohorts (i.e., a particular school in a given year) within each school. In addition, to bolster the basic CITS model, we included a set of student-level and school-level

characteristics as control variables covariates to further account for any differences that exist after matching. These control variables help to reduce bias by accounting for time variant demographic factors that may be related to FDK treatment and student outcomes.

The model we used for the CITS analysis can be written as follows:

$$\begin{aligned}
 Y_{ijk} &= \beta_0 + \beta_1 FDK_k + \beta_2 Time_{jk} + \beta_3 FDK_k Time_{jk} + \beta_4 PY1_{jk} + \beta_5 PY2_{jk} + \beta_6 PY3_{jk} \\
 &+ \beta_7 PY4_{jk} + \beta_8 FDK_k PY1_{jk} + \beta_9 FDK_k PY2_{jk} + \beta_{10} FDK_k PY3_{jk} + \beta_{11} FDK_k PY4_{jk} \\
 &+ B_{12} X_{ijk} + B_{13} Z_k + \varepsilon_{ijk} + \mu_{jk} \\
 &+ \omega_j
 \end{aligned} \tag{1}$$

where Y_{ijk} is the outcome measure (i.e., standardized test scores, attendance, chronic absenteeism, disciplinary actions) for a student i at time j in school k ; FDK_k is an indicator for an FDK school k ; and $Time_{jk}$ is a counter for time centered at the last baseline year. $FDK_k Time_{jk}$ is an interaction between FDK and $Time$, allowing for different preintervention trends between FDK and PDK schools. $PY1_{jk}$, $PY2_{jk}$, $PY3_{jk}$, and $PY4_{jk}$ are indicators for the 1st, 2nd, 3rd, and 4th posttreatment years, respectively. $FDK_k PY1_{jk}$, $FDK_k PY2_{jk}$, $FDK_k PY3_{jk}$, and $FDK_k PY4_{jk}$ are interactions between FDK and $PY1$, $PY2$, $PY3$, and $PY4$. These are indicators where school k had received FDK intervention during the 1st, 2nd, 3rd, and 4th years posttreatment, respectively. The vector X includes student characteristics (i.e., gender, FRPM, EL, special education status, and race/ethnicity dummies). The vector Z includes school characteristics (i.e., proportion of male students, proportion of students on FRPM, proportion of Black, proportion of Hispanic, and proportion of Asian). Random effects were included to account for student, school, and cohort effects by adding a random error term for each student (ε_{ijk}), cohort (μ_{jk}), and school (ω_j).

β_0 is an overall intercept term. β_1 compares the mean outcome score between students in FDK schools and comparison schools at time = 0. β_2 represents baseline slope for the comparison schools. β_3 is the difference in the outcome trend between comparison and FDK schools during pretreatment years. β_4 , β_5 , β_6 , and β_7 are the differences in mean outcome for comparison schools for the 1st, 2nd, 3rd, and 4th posttreatment years, respectively, compared to the pretreatment year trends. β_8 , β_9 , β_{10} , and β_{11} are the coefficients of interest for the posttreatment differences in outcome trend between comparison and FDK schools for the 1st, 2nd, 3rd, and 4th posttreatment years. B_{12} is a vector of student-level predictors. B_{13} is a vector of school-level predictors.

In order to examine whether the program was effective for each subgroup (i.e., racial minority, FRPM, EL, and special education status) and wave, we estimated Equation 1 separately by subgroups and waves.

Sensitivity Analyses

Given that some schools provided a combination of both FDK and PDK classrooms, AIR also conducted sensitivity analyses to examine the impact of offering FDK as an option for parents (and students), relative to matched schools that only offered PDK. For these analyses, we defined FDK schools as those that transitioned from only enrolling students in PDK to later enrolling at least 25% of kindergarten students in FDK within the time series.

Results from these sensitivity analyses were similar to those from the primary analyses. First, the sensitivity analyses did not find statistically significant effects of FDK on any of the outcomes examined (i.e., kindergarten attendance, chronic absenteeism in kindergarten, disciplinary incidents in kindergarten, Grade 3 English language arts achievement, or Grade 3 mathematics achievement for all students). Overall effects on chronic absenteeism and Grade 3 English language arts achievement approached statistical significance. Across the first 4 years after implementation, students in schools with FDK were approximately 2.5% more likely to be chronically absent from kindergarten (i.e., missed more than 5% of days of school) than were students in matched schools with PDK, holding constant school trends in kindergarten chronic absenteeism and student characteristics prior to transitioning to FDK. In addition, across the first 3 years after implementation, students' Grade 3 test scores were slightly higher on average for students in schools that transitioned to FDK compared to students in schools that only ever implemented PDK. In addition, there was a larger (though not statistically significant) effect of FDK on students' Grade 3 test scores among students eligible for FRPM and among students with an IEP.

Cost Methods

The cost study component aimed to understand the additional resources required to implement FDK (including both one-time, start-up resources and ongoing annual resources), the costs of those resources, and the cost-effectiveness of implementing FDK. AIR used rigorous cost analysis methods to answer the following three cost study research questions:

Research Question 7. What are the one-time, start-up costs to transition a district from PDK to FDK?

Research Question 8. What are the differences in the ongoing overall annual costs per student between PDK and FDK?

Research Question 9. How cost effective is transitioning to FDK?

To address these questions, we used the ingredients approach (Levin et al., 2018). This approach is grounded in the theory of opportunity cost. Essentially, once a resource is allocated to one program, it is no longer available for use in another program. This is true for personnel and nonpersonnel resources. The monetary value of the one-time, start-up resources needed

to transition from PDK to FDK as well as the monetary value of the ongoing resources to implement FDK each year give districts and the Commonwealth of Pennsylvania information about the potential implications of a policy shift to require FDK statewide. Expenditure data tell what was spent, and budgeting information shows what is intended to be spent; however, those data do not accurately capture all the resources used daily to provide the kindergarten program or transition from one program type to another. The ingredients approach uses stakeholder interview responses (in this case, from district and building administrators) to record information about resources used in an educational program and assign prices to calculate the total cost.

At the core of the ingredients approach is to first understand and quantify all resources, or ingredients, used in the production of the treatment. In this case, this process entails determining what resources are required for both the PDK and FDK programs and understanding the differences. Using an iterative interview protocol, the study team spoke with district and school administrators with the goal of understanding what resources were used in both kindergarten program types, as well as what was required to transition from PDK to FDK. As information about resources was gathered, ingredients were logged into resource categories (i.e., annual personnel and nonpersonnel resources, personnel and nonpersonnel transition resources) to ensure that all resources were considered and none were double counted. Information about resources used, including the types and quantities needed, were recorded in the AIR Resource Cost Model (RCM) to calculate ingredients costs and sum overall costs. Next, publicly available data were leveraged to determine the per-unit cost of each resource. These data sources included online shopping platforms and publicly available salary and benefit information. Once all resources had assigned prices, cost calculations were completed, including pricing adjustments (e.g., inflation). Finally, the overall per-student cost of each program type (PDK and FDK) was calculated. Costs associated with the transition from PDK to FDK were estimated separately so that we could report the expected one-time costs that typically accompany a district shift from PDK to FDK.

Sample

The goal of the cost analysis component is to understand the costs of both the PDK and FDK programs, the difference between the two, and the costs associated with transitioning from PDK to FDK. To understand these three important conditions, we used three groups of districts for this work. The FDK districts were those that had offered an FDK program for more than 5 years. The PDK districts were those that currently have a PDK program. Recently transitioned districts were those that had offered a PDK program and moved to an FDK program within the past 5 years. Districts were selected across varying sizes, locales, and regions to be as representative as possible, given the natural distribution of the three conditions. Table A6 shows the distribution of participating districts. There were some districts that met these

criteria but elected not to participate. For those districts, a replacement district was selected that mirrored their program category, size, and locale as much as possible.

Table A6. Summary of District Sample for Cost Analysis

District name	Type of district	Locale	Geographic region
District F	Recently switched to FDK	Large city	Western
District G	Recently switched to FDK	Large city	Central
District H	Recently switched to FDK	Rural	Eastern
District I	Historical FDK	Midsize city	Central
District J	Historical FDK	Municipality	Central
District K	Historical FDK	Large city	Eastern
District L	PDK	Rural	Western
District M	PDK	Large city	Central
District N	PDK	Large city	Eastern

Data

The study team reached out to each district in the sample requesting a 45-minute phone interview with at least one elementary school principal and one person at the district level with extensive knowledge about the kindergarten program. A \$25 electronic gift card was offered to each participant as a token of gratitude for their time. The interview protocol for all districts aimed to identify the resources used in the district's kindergarten program, while those districts that recently transitioned were also asked about the resources required to shift from PDK to FDK. As interview data were gathered for each kindergarten program type (i.e., PDK, FDK, recently transitioned), resources were entered into the RCM.

Specifications about each resource were also gathered during the interview process. Resource specifications included the quantities of types of resources. For example, principals in FDK and PDK programs varied in the amount of time they spent supporting the kindergarten program. Principals in FDK programs described how they needed to spend extra time with kindergarten students and teachers at the beginning of the year as students became acclimated to being at school. FDK principals said that this time allocation was higher during the first two weeks of school, then tapered off as students, parents, and teachers all adjusted to the school day. Principals in PDK schools described a similar use of their time; however, they spent additional time for *each class* of entering kindergartners (i.e., morning and afternoon sessions), doubling their time allocation for the first two weeks of school. This type of variation was collected in the RCM for PDK and FDK districts separately to support accurate cost calculations.

Details about resources then were used to assign accurate prices to each resource implicated in the kindergarten programs. Nonpersonnel resources (e.g., materials) were found in national

online market databases, and their prices were calculated as 2020 dollars. To calculate an annual cost of each of these nonpersonnel items, a 3.5% discount rate was used, and assumptions were made about the life span of each item. For example, classroom tables and chairs were assumed to last 10 years whereas academic play kits were expected to last 5 years. Table A7 shows all resources that were mentioned in interviews along with the pricing source, average cost, and annual cost given a 3.5% discount rate over the life of the item.

Table A7. Nonpersonnel Resources, Pricing Sources, Average Price, and Annual Cost

Resource	Pricing source	Average price	Amortized cost
Activity table	Worthington Direct; Jonti-Craft	\$302	\$21
Child's chair	Worthington Direct; School Outlet	\$40	\$3
Area rug	Worthington Direct; Today's Classroom	\$274	\$46
Backpack cubby storage unit	Worthington Direct; Today's Classroom	\$310	\$22
Academic play set and assorted parts	School Specialty; Mansion Schools; Overstock	\$213	\$36
Wonders: Comprehensive classroom package	McGraw Hill	\$869	\$869
Foundations Classroom Set Level K	Wilson Language	\$1,369	\$1,369
Reading Horizon's Discovery, Kindergarten Kit	Reading Horizons; Backbone Communications	\$1,799	\$1,799
Ready Math, Grade K set	Curriculum Associates	\$467	\$467
Everyday Math: Core Classroom Materials Grade K	McGraw Hill	\$55	\$55

Personnel costs were taken from the PDE compensation data and local district collective bargaining agreements.¹⁵ The average annual salaries for all positions mentioned in the production of kindergarten were calculated using the salary information from the Professional Personnel Individual Staff files in the Data and Reporting section.¹⁶ For example, to understand the annual salaries of specialized content area teachers, such as an elementary physical education teacher, the average of all elementary physical education teachers in the state was used. For positions that are paid hourly or those not included in the statewide salary database,

¹⁵ Collective bargaining agreements were used to understand the compensation for hourly paid employees.

¹⁶ Salaries and hourly compensation for personnel were taken from <https://www.education.pa.gov/DataAndReporting/ProfSupPers/Pages/ProfPersIndStaff.aspx>.

sample districts' collective bargaining agreements, as available online, were searched to understand the relevant salary information.

The most recent salary information available from PDE is for the 2018–19 school year. There were some positions paid hourly and therefore not eligible for benefits, such as teaching assistants and bus drivers. There were also some positions paid by the day across the 180 mandatory school days in Pennsylvania (i.e., bus drivers). All compensation data, regardless of type, were adjusted to 2019–20 school year dollars using the Consumer Price Index (CPI) from the U.S. Bureau of Labor Statistics. This procedure allowed all personnel-related cost figures to be represented in the same year as the nonpersonnel resources. Then a 49.7% benefit rate, from the Bureau of Labor Statistics,¹⁷ was applied for those positions eligible for benefits.

Kindergarten teachers were assumed to spend 100% of their annual time devoted to instruction for kindergarten students. All other positions were reported to devote only a portion of their time to the kindergarten program. Therefore, the hourly compensation rate, including benefits if appropriate, was needed to value the time of positions devoting less than 100% of their annual time. This hourly compensation rate for all employees was used in our per-student cost calculations to represent the value of the time devoted toward the kindergarten program.

Given the district autonomy afforded in Pennsylvania, several assumptions were made to calculate the total number of hours each position type worked in a school year. For administrators at both the district and school levels, it was assumed that a 40-hour workweek for 52 weeks a year, including paid time off, was the norm (i.e., 2,080 hours per year). State policy requires that students receive 900 hours of instruction over 180 days, which results in 5 hours a day of instruction. It was assumed that teachers have an additional 2 hours each day of required duties (i.e., collaborative planning time, required meetings, paid lunch). This assumption would bring the teacher total to 1,260 hours per year. Districts in this sample described between 4 and 10 required teacher workdays each year according to local collective bargaining agreements. Our calculations used an average of seven 7-hour days in addition to the instructional days for teachers, making 1,309 the assumed total annual hours for teachers. Teaching assistants were assumed to work 7 hours during each instructional day (i.e., 1,260 hours per year). Part-time bus drivers (paid by the day) were assumed to work 5 hours during only the 180 required instructional days, whereas full-time bus drivers (only reported in PDK programs) were assumed to receive benefits and work a total of 1,309 hours per year.

¹⁷ The benefit rate for school employees was calculated using information from <https://www.bls.gov/news.release/eccec.t03.htm>.

Table A8 shows the average annual compensation (including benefits if applicable), the total annual hours worked, and the average hourly rate for each position discussed during interviews for this study.

Table A8. Annual and Hourly Compensation, by Position Type

Position	Total annual compensation	Annual hour total	Average hourly rate
Teacher	\$101,154	1,309 hours	\$77
Instructional assistant	\$3,805–\$22,831	180–1,080 hours	\$21
Library teacher	\$110,142	1,309 hours	\$84
Computer teacher	\$109,124	1,309 hours	\$83
P.E. teacher	\$108,188	1,309 hours	\$83
Art teacher	\$99,802	1,309 hours	\$76
Music teacher	\$104,533	1,309 hours	\$80
Building administrator	\$168,351	2,080 hours	\$81
District assistant superintendent	\$212,441	2,080 hours	\$102
District superintendent	\$224,772	2,080 hours	\$108
Part-time bus driver	\$11,553	900 hours	\$13
Full-time bus driver	\$52,337	1,309 hours	\$40

Note. Annual compensation includes benefits, if applicable, and is reported in 2020 dollars.

District and school leaders described varying amounts of time they spent supporting the kindergarten program. The average amount of time reported across all sample districts was used in the per-student cost calculations; however, the variation in time allocation may be helpful for policymakers to understand the cost impact of varying time allocation structures. Tables A9 and A10 show the variation in time allocation as described by interviewees and the corresponding costs in PDK, FDK, and during the transition for 18- and 25-student classrooms. All ranges include benefits, if an employee receives them, and are reported in 2020 dollars.

Table A9. Ranges of Time Allocation and per-Student Costs for PDK and FDK With 18 Students per Class and the Transition

Position	PDK		FDK		Transition	
	Time range	Cost range	Time range	Cost range	Time range	Cost range
Teacher	655 hours (per class)	\$2,810	1,309 hours (per class)	\$5,620	655–1,619 hours (overall)	\$188–\$465
Instructional assistant	90–540 hours (per class)	\$106–\$634	180–1,080 hours (per class)	\$211–\$1,268	NA	–
Volunteer	NA	–	180–360 hours (per class)	\$211–\$423	NA	–
Library teacher	27–36 hours (per class)	\$126–\$168	27–36 hours (per class)	\$126–\$168	NA	–
Computer teacher	27–36 hours (per class)	\$125–\$167	27–36 hours (per class)	\$125–\$167	NA	–
P.E. teacher	27–36 hours (per class)	\$124–\$165	27–36 hours (per class)	\$124–\$165	NA	–
Art teacher	27–36 hours (per class)	\$114–\$152	27–36 hours (per class)	\$114–\$152	NA	–
Music teacher	27–36 hours (per class)	\$120–\$160	27–36 hours (per class)	\$120–\$160	NA	–
Building administrator	119–414 hours (per school)	\$107–\$374	63–214 hours (per school)	\$80–\$271	30–55 hours (overall)	\$27–\$50
District assistant superintendent	16–25 hours (per district)	\$6–\$9	16–25 hours (per district)	\$9–\$13	20–40 hours (overall)	\$8–\$15
District superintendent	16–25 hours (per district)	\$6–\$10	16–25 hours (per district)	\$9–\$14	32–55 hours (overall)	\$13–\$22
Bus driver	1,309 hours (per district)	\$363	900 hours (per district)	\$160	NA	–
Overall per-student costs	–	\$4,007–\$5,012	–	\$6,909–\$8,581	–	\$236–\$552

Table A10. Ranges of Time Allocation and per-Student Costs for PDK and FDK With 25 Students per Class and the Transition

Position	PDK		FDK		Transition	
	Time range	Cost range	Time range	Cost range	Time range	Cost range
Teacher	655 hours (per class)	\$2,203	1,309 hours (per class)	\$4,046	655–1,619 hours (overall)	\$188–\$465
Instructional assistant	90–540 hours (per class)	\$76–\$457	180–1,080 hours (per class)	\$152–\$913	NA	–
Volunteer	NA	–	180–360 hours (per class)	\$152–\$304	NA	–
Library teacher	27–36 hours (per class)	\$91–\$121	27–36 hours (per class)	\$91–\$121	NA	–
Computer teacher	27–36 hours (per class)	\$90–\$120	27–36 hours (per class)	\$90–\$120	NA	–
P.E. teacher	27–36 hours (per class)	\$89–\$119	27–36 hours (per class)	\$89–\$119	NA	–
Art teacher	27–36 hours (per class)	\$82–\$110	27–36 hours (per class)	\$82–\$110	NA	–
Music teacher	27–36 hours (per class)	\$86–\$115	27–36 hours (per class)	\$86–\$115	NA	–
Building administrator	119–414 hours (per school)	\$107–\$374	63–214 hour (per school)	\$27–\$90	30–55 hours (overall)	\$27–\$50
District assistant superintendent	16–25 hours (per district)	\$6–\$9	16–25 hours (per district)	\$9–\$13	20–40 hours (overall)	\$8–\$15
District superintendent	16–25 hours (per district)	\$6–\$10	16–25 hours (per district)	\$9–\$14	32–55 hours (overall)	\$13–\$22
Bus driver	1,309 (per district)	\$363	900 hours (per district)	\$160	NA	–
Overall per-student costs	–	\$3,019–\$3,821	–	\$4,993–\$6,125	–	\$236–\$552

Class size is an important factor when determining the cost per student. In the body of the report we assume 18 students per class as that was the modal classroom size in the cost interviews; however, some districts reported having up to 25 kindergarten students in each class. This range in number of students per class impacts the overall cost per student in different ways. For example, some resources, such as a classroom chair or an individual student curriculum kit, have a clear incremental impact on the cost per student (i.e., one additional item). For other resources, such as a kindergarten teacher or building administrator, that impact is less clear, because a teacher or administrator is legally able to serve more than 18 kindergarten students per class. Table A11 shows how the cost per student will vary as a function of the number of students in a class.

Table A11. Average per-Student Annual Costs Associated With Classroom Size Variation

Resource	18 students per class		25 students per class	
	PDK	FDK	PDK	FDK
Personnel	\$4,613	\$7,848	\$3,494	\$5,750
Nonpersonnel	\$94	\$180	\$69	\$132
Overall per-student cost	\$4,707	\$8,028	\$3,563	\$5,882

Note. Annual compensation includes benefits, if applicable. All costs are reported in 2020 dollars.

Appendix B. Supplementary Tables

Kindergarten Outcomes Tables

Table B1. CITS Estimates of Impact of FDK on Kindergarten Outcomes, Pooled Across 4 Years

	Kindergarten attendance					Chronically absent in kindergarten					Kindergarten ever disciplinary action				
	All students	FRPM	Minority students	EL	IEP	All students	FRPM	Minority students	EL	IEP	All students	FRPM	Minority students	EL	IEP
Average treatment effect	-0.101	0.477	0.516	-0.396	-0.194	0.041*	-0.017	-0.038	0.040	0.051	0.003**	0.005	0.004	-0.003	n/a
Robust standard error	0.209	0.402	0.334	0.750	0.504	0.018	0.036	0.033	0.085	0.053	0.001	0.004	0.003	0.003	n/a
Interpretation	No impact	No impact	No impact	No impact	No impact	0.041*	No impact	No impact	No impact	No impact	0.003**	No impact	No impact	No impact	n/a
Number of waves	7	7	7	7	7	7	7	7	7	7	7	7	7	7	n/a
Number of schools	116	116	116	116	116	116	116	116	116	116	116	116	116	116	n/a
Number of students	69,346	12,225	14,887	2,429	4,183	69,346	12,225	14,887	66,917	4,183	69,346	12,225	14,887	2,429	n/a

Note. Effects represents point estimates from multiple baseline multilevel CITS models that examine the impact of FDK on each outcome. Each model includes multiple cohorts and accounts for the nesting of students within cohorts (i.e., a particular school in a given year) within each school. In addition, to bolster the basic CITS model, we included a set of student-level and school-level characteristics as control variables covariates to further account for any time variant differences. The following acronyms are used in this table: Students qualifying for free and reduced price meals (FRPM), Students with an IEP (IEP), English learners (EL). Data on disciplinary incidents in kindergarten were not available (n/a) for students with an IEP.

*** $p < 0.001$ ** $p < 0.01$. * $p < 0.05$. + $p < 0.1$.

Table B2. CITS Estimates of Impact of FDK on Kindergarten Outcomes, by Year

	Kindergarten attendance					Chronically absent in kindergarten					Kindergarten ever disciplinary action				
	All students	FRPM	Minority students	EL	IEP	All students	FRPM	Minority students	EL	IEP	All students	FRPM	Minority students	EL	IEP
Year 1: Average treatment effect	-0.050	0.492	0.573	-0.300	-0.358	0.033	-0.020	-0.049	0.020	0.060	0.001	0.003	0.002	-0.003	n/a
Robust standard error	.240	0.446	0.374	0.852	0.586	0.021	0.040	0.037	0.097	0.061	0.001	0.004	0.003	0.003	n/a
Year 2: Average treatment effect	-0.192	0.397	0.402	-0.655	0.105	0.058*	-0.007	-0.010	0.088	0.036	0.005***	0.005	0.006 ⁺	-0.003	n/a
Robust standard error	0.269	0.499	0.416	0.927	0.639	0.024	0.045	0.041	0.105	0.066	0.001	0.005	0.004	0.004	n/a
Year 3: Average treatment effect	-0.148	0.670	0.583	-0.227	-0.348	0.035	-0.021	-0.067	0.005	0.044	0.005**	0.015**	0.007 ⁺	-0.003	n/a
Robust standard error	0.316	0.583	0.481	1.097	0.759	0.028	0.053	0.048	0.125	0.079	0.001	0.005	0.004	0.004	n/a
Year 4: Average treatment effect	-0.192	1.032	0.978 ⁺	-1.934	-0.157	0.029	-0.004	-0.054	0.227	0.091	0.006***	0.011 ⁺	0.011*	-0.004	n/a
Robust standard error	0.360	0.680	0.559	1.302	0.876	0.031	0.061	0.055	0.149	0.091	0.002	0.006	0.005	0.005	n/a
Number of waves	7	7	7	7	7	7	7	7	7	7	7	7	7	7	n/a
Number of schools	116	116	116	116	116	116	116	116	116	116	116	116	116	116	n/a
Number of students	69,346	12,225	14,887	2,429	4,183	69,346	12,225	14,887	2,429	4,183	69,346	12,225	14,887	2,429	n/a

Note. Effects represents point estimates from multiple baseline multilevel CITS models that examine the impact of FDK on each outcome. Each model includes multiple cohorts and accounts for the nesting of students within cohorts (i.e., a particular school in a given year) within each school. In addition, to bolster the basic CITS model, we included a set of student-level and school-level characteristics as control variables/covariates to further account for any time variant differences. The following acronyms are used in this table: Students qualifying for free and reduced price meals (FRPM), Students with an IEP (IEP), English learners (EL). Data on disciplinary incidents in kindergarten were not available (n/a) for students with an IEP.

*** $p < 0.001$. ** $p < 0.01$. * $p < 0.05$. ⁺ $p < 0.1$.

Grade 3 Outcomes Tables

Table B3. CITS Estimates of Impact of FDK on Grade 3 Achievement Outcomes, Pooled Across 3 Years

	English language arts achievement					Mathematics achievement				
	All students	FRPM	Minority students	EL	IEP	All students	FRPM	Minority students	EL	IEP
Average treatment effect	-0.113	0.052	-0.124	-0.367	0.002	-0.031	0.306	0.025	0.104	0.422
Robust standard error	(0.098)	(0.226)	(0.204)	(0.613)	(0.382)	(0.098)	(0.213)	(0.212)	(0.643)	(0.363)
Interpretation	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact
Number of waves	3	3	3	3	3	3	3	3	3	3
Number of schools	30	30	30	30	30	30	30	30	30	30
Number of students	8,528	1,045	1,655	190	349	8,528	1,045	1,655	190	349

Note. Effects represents point estimates from multiple baseline multilevel CITS models that examine the impact of FDK on each outcome. Each model includes multiple cohorts and accounts for the nesting of students within cohorts (i.e., a particular school in a given year) within each school. In addition, to bolster the basic CITS model, we included a set of student-level and school-level characteristics as control variables covariates to further account for any time variant differences. The following acronyms are used in this table: Students qualifying for free and reduced price meals (FRPM), Students with an IEP (IEP), English learners (EL).

*** $p < 0.001$ ** $p < 0.01$. * $p < 0.05$. + $p < 0.1$.

Table B4. CITS Estimates of Impact of FDK on Grade 3 Achievement Outcomes, by Year

	English language arts achievement					Mathematics achievement				
	All students	FRPM	Minority students	EL	IEP	All students	FRPM	Minority students	EL	IEP
Year 1: Average treatment effect	-0.074	0.110	-0.090	-0.118	-0.125	-0.019	0.303	0.039	0.369	0.252
Robust standard error	(0.102)	(0.235)	(0.215)	(0.643)	(0.395)	(0.103)	(0.228)	(0.224)	(0.677)	(0.376)
Year 2: Average treatment effect	-0.324*	-0.150	-0.263	-1.252	0.258	-0.105	0.358	-0.029	-0.705	0.923
Robust standard error	(0.154)	(0.308)	(.0.294)	(0.874)	(0.652)	(0.157)	(0.298)	(0.307)	(0.919)	(0.613)
Year 3: Average treatment effect	-0.035	0.311	-0.035	-2.825 ⁺	0.074	0.026	0.573	-0.079	-1.794	0.078
Robust standard error	(0.173)	(0.368)	(0.334)	(1.448)	(0.670)	(0.176)	(0.357)	0.349	(1.531)	(0.634)
Number of waves	3	3	3	3	3	3	3	3	3	3
Number of schools	30	30	30	30	30	30	30	30	30	30
Number of students	8,528	1,045	1,655	190	349	8,528	1,045	1,655	190	349

Note. Effects represents point estimates from multiple baseline multilevel CITS models that examine the impact of FDK on each outcome. Each model includes multiple cohorts and accounts for the nesting of students within cohorts (i.e., a particular school in a given year) within each school. In addition, to bolster the basic CITS model, we included a set of student-level and school-level characteristics as control variables covariates to further account for any time variant differences. The following acronyms are used in this table: Students qualifying for free and reduced price meals (FRPM), Students with an IEP (IEP), English learners (EL).

*** $p < 0.001$ ** $p < 0.01$. * $p < 0.05$. ⁺ $p < 0.1$.



Established in 1946, with headquarters in Washington, D.C., the American Institutes for Research® (AIR®) is a nonpartisan, not-for-profit organization that conducts behavioral and social science research and delivers technical assistance, both domestically and internationally, in the areas of education, health, and the workforce. For more information, visit www.air.org.

MAKING RESEARCH RELEVANT

AMERICAN INSTITUTES FOR RESEARCH
1000 Thomas Jefferson Street NW
Washington, DC 20007-3835 | 202.403.5000
www.air.org

LOCATIONS

Domestic: Washington, DC (HQ) | Sacramento, and San Mateo, CA | Atlanta, GA | Chicago and Naperville, IL | Indianapolis, IN | Waltham, MA
Frederick and Rockville, MD | Chapel Hill, NC | New York, NY | Cayce, SC | Austin, TX | Arlington, VA | Seattle, WA

International: Ethiopia | Germany (A.I.R. Europe) | Haiti