Human Capital Research Collaborative Report: Indicators of Early Childhood Program Quality and Achievement Outcomes

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Introduction

Over the past fifty years, ample evidence has accumulated that participation in high-quality early childhood education (ECE) programs can support positive academic and socioemotional functioning – especially for children who are at risk for adverse outcomes due to socioeconomic disadvantage [1–5]. What precisely constitutes a high-quality ECE program, however, remains unclear. Program quality has been defined in various ways across different theoretical and policy frameworks, using features that range from the quality of instruction and teacher-child interaction to structural features like teacher education, class size, program length, and supports for parent engagement[6–8]. Although many of these program features have been individually linked to child outcomes[8–10], their relative impact remains to be examined. Indeed, some of the strongest evidence that ECE participation can support positive child functioning comes from comprehensive interventions that alter multiple aspects of the ECE environment.[11,12] This makes it difficult to disentangle which aspects of the intervention are responsible for any observed benefits.

Determining which aspects of ECE program quality contribute to program benefits is particularly critical for schools and districts seeking cost-effective ways to improve student outcomes. Although many schools might lack the resources to implement a complete overhaul of their ECE program, they could potentially make targeted changes that still have tangible benefits for their students. The current project strove to advance this goal by developing measurable indicators of program quality as defined by two different frameworks, and examining how these relate to student outcomes. Accordingly, it had two primary aims:

1) Develop a method for assessing whether or not ECE programs and classrooms meet various quality recommendations derived from two prominent frameworks – the Child-Parent Center Program framework[13] and the Gates Foundation's "Essential Elements of High-quality Pre-K"[14].
2) Examine whether attending a program or classroom that met these recommendations – both each one individually, and multiple recommendations collectively – is associated with better student outcomes at the end of preschool, as well as sustained achievement gains in 2nd and 3rd grade.

Program Quality Frameworks

This project draws on two frameworks providing different definitions of high-quality ECE. The Gates Foundation's "Essential Elements of High-quality Pre-K"[14] comprises 15 recommendations regarding the classroom settings, program practices, and leadership environment thought to support optimal learning[15]. The Child-Parent Center (CPC) framework, in turn, highlights 21 recommendations based on the six core elements of the CPC intervention[13]. These were selected from a broader set of CPC recommendations based on theoretical importance and preliminary evidence of links with student outcomes. More detailed reports on the Effective Learning Experiences, Aligned Curriculum, and Collaborative Leadership elements of the CPC program – including several program quality metrics that were ultimately dropped from analysis due to weak associations with student outcomes – have previously been completed, and are available on the University of Minnesota's Human Capital Research Collaborative website.

The Child-Parent Center Program

The CPC program provides school-based educational and family services to high-risk children and families, placing special emphasis on the quality of classroom environments, supports for parent involvement and self-improvement, and continuity of program services from preschool through third grade[13]. Across two different longitudinal projects – the Chicago Longitudinal Study, begun in the 1980s, and the more recent

Midwest CPC Expansion Project – the CPC program has shown evidence of positive effects. Children attending CPCs have shown more positive outcomes (ranging from greater school readiness to reduced juvenile arrest) than their counterparts who did not participate in the program[11,16].

Table 1 outlines the CPC and Gates Foundation frameworks, including differences and areas of overlap.

Table 1. Crosswalk of CPC and Gates Foundation frameworks for defining high-quality ECE.

CPC Elements	Gates Foundation Elements
Effective Learning Experiences (ELE) • Small class size • Full day instruction • Teacher education (B.A.) • Balance of child- and teacher-driven instruction • Task-oriented instruction	**Education and compensation:** Teachers earn a B.A. and early learning credential, and are compensated at the same level as K-3 teachers **Adult-child ratios:** Maximum class size of 22, and adult:child ratio between 2:15 and 2:22 **Two adults in the classroom** **Teacher-child interactions focused on learning:** Teachers use structured activities and play **Learning Time:** 6-6.5 hours/day, 180-205 days/year **Support for DLLs:** Bilingual teachers & specialists **Support for students with special needs:** Early intervention
Aligned Curriculum and Practices (AC) • Consistent learning experiences from preschool to 3rd grade • Curriculum covers core instructional domains • Cross-grade collaboration	**Age-appropriate learning standards:** Goals for academic & social-emotional learning align with expectations of kindergarten and beyond **Proven curriculum:** Research-based curriculum that is aligned w/ cognitive and social-emotional goals and teachers' professional development **Formative assessments:** Classroom-based assessments designed to help teachers & administrators improve outcomes **Data-driven decision making:** Program uses data to inform action and improve outcomes for children, as part of a cycle of continuous improvement
Collaborative Leadership Team (CLT) • Complete CLT at any point during year • Head Teacher provides active leadership • Principal is highly engaged in implementation of CPC P-3 program	**Strong leadership:** Educators create a culture of high expectations, public commitment, and communicate importance of quality to parents **Integrated systems:** Learning goals, curriculum, PD, formative assessments, and data are tied together and are mutually reinforcing
Continuity and stability (CS) • Guaranteed enrollment policy • Consistent leadership team across years • At least 80% retention of students	**Public commitment:** Support from elected officials, courts, policy environment to sustain public commitment to high-quality pre-K
Professional Development (PD) • In-person and online coaching • Site mentors provide regular support • Teachers complete online PD modules	**Professional development:** Ongoing coaching focused on improving teacher-child interactions
Parent Involvement and Engagement (PI) • Parent resource room in center/school • Parent resource teacher and school-community outreach worker • Ample, diverse opportunities for PI • PI opportunities address parent needs	

The Midwest CPC Expansion Project

Data for this report come from two school districts – the Chicago and Saint Paul Public Schools – participating in the Midwest CPC (MCPC) Expansion Project. As part of this federally funded study, the CPC program was implemented in four Midwestern school districts beginning in the fall of 2012. A subset of school sites in each district implemented the CPC program, with support from the Human Capital Research Collaborative at the University of Minnesota. A second group of sites – selected to have similar student demographics to the CPC sites – were designated as control sites. These sites participated in most of the same data collection efforts as the CPC program sites, but did not implement the CPC program[16].

The group of preschoolers who attended MCPC project sites during the 2012-13 school year have since advanced through the third grade, with data collected annually on their academic progress. In Chicago, this includes students who were four years old in the fall of 2012 (and started kindergarten in the fall of 2013), as well as students who were three years old in the fall of 2012 (and started kindergarten in 2014). Consequently, the third grade test scores reported for this group come from different school years (see section on findings). Furthermore, in both districts, second and third grade test scores were unavailable for a number of students – most often because the student's family did not consent to their progress being followed, or because the student left the school district. We strove to account for this by imputing missing test scores, using a statistical method to estimate what each missing score *would* have been based on the student's demographics and any other achievement scores that were available for them.[17]

In addition to data on student achievement and other outcomes, data have also been collected annually on MCPC teachers' backgrounds and experiences, principals' backgrounds and experiences, teachers' classroom practices, and (particularly at CPC program sites) families' involvement in school activities. For more information on some of the types of data that have been collected, see Table 2.

Program Quality Indicators

To analyze which of the Gates Foundation and CPC program elements predict student outcomes, it was necessary to develop a set of program quality indicators – objective ways of determining whether or not each student in the MCPC project experienced an ECE environment that was consistent with Gates Foundation and/or CPC recommendations. A variety of data sources – surveys and measures collected by the MCPC project research team, as well as documentation regarding CPC program implementation – were used in this effort. Brief descriptions of key data sources are provided in Table 2.

The operational definitions for each program quality indicator (specific criteria used to determine whether a classroom/site met recommendations for that indicator) are outlined in Tables 3 and 4. Table 3 defines each of the indicators comprising the six CPC program elements, and Table 4 does the same for the Gates Foundation elements. Due to differences in the data sources available for CPC and control (non-CPC) sites in the MCPC project (e.g., curriculum and parent involvement plans were only completed by CPC sites; see Table 2), some of these definitions had to be adjusted for control sites. Where applicable, these differences are indicated in Tables 3 and 4. Although this inconsistency represents an important caveat to some of our findings, we believed it was important to use the best available data to define program quality for the CPC sites – even if comparable data were not necessarily available for control sites.

In the interest of examining not just the preschool experience, but also how this dovetails with subsequent kindergarten experiences, all program quality indicators were defined for both MCPC project preschoolers (using data from the 2012-13 school year) and MCPC project kindergarteners (using data from the 2013-2014 school year). Due to slight differences in the data collected across these two years, minor adjustments had to be made to some of the operational definitions. Where applicable, these differences are indicated in Tables 3 and 4.

Table 2. Summary of data sources used to operationalize Gates Foundation and CPC program quality indicators.

Measure/Data source	Description
Classroom Activity Report (CAR)	The CAR is a brief questionnaire developed for the MCPC project to document use of class time. It asks teachers to report (1) how their class time during the previous week was divided across instructional domains and (2) what percentage of time in language, math, and science was spent in child-initiated vs. teacher-directed activities. Teachers complete the CAR periodically throughout the year.
Classroom Assessment Scoring System (CLASS)[18]	The CLASS is a validated, widely used observation tool used to assess the quality of classroom interactions. It comprises three sub-scores/dimensions: emotional support, classroom organization, and instructional support.
Classroom Learning and Activity Checklist (CLAC)	The CLAC is an observational measure developed for the MCPC project to assess student task orientation and the instructional practices that support it. It consists of two subscales: responsive instruction and student engagement.
Curriculum Plan[c]	Each school year, CPC head teachers in the MCPC project were required to complete a curriculum plan. This plan outlined – among other things – the curricula used at the site, the rationale for their selection, evidence of their effectiveness, perceived gaps in curriculum alignment, and plans for improvement.
Parent Involvement Plan[c]	Each school year, each CPC site in the MCPC project was required to complete a parent involvement plan. This plan outlined – among other things – the main types of activities requested by parents/families on the needs assessment, general plans for parent involvement activities, and key barriers to parent involvement.
Parent Involvement (PI) Logs[c]	Throughout the school year, individual families' participation in school events and other parent involvement opportunities was documented using monthly logs. In preschool, logs were completed by both CPC and comparison sites. In kindergarten, they were only completed by CPC sites.
Parent Involvement Calendars[c,k]	Throughout the school year, CPC sites were expected to prepare monthly calendars for students' families, which outlined important dates, school events, and other parent involvement opportunities. A subset of these calendars were submitted to MCPC project staff as documentation.
Teacher and Principal Surveys	Teachers and principals in the MCPC project were asked to complete an annual survey. This asked about topics ranging from educational background to perceptions of the school curriculum and teaching (for teachers) or leadership (for principals) practices.
CPC Program Fidelity Ratings[c]	Each year, MCPC project staff rated the fidelity of CPC program implementation (how closely the actual implementation of the program matched its intended implementation) for each of the six program elements (see Table 1).
Erikson Program Fidelity Ratings[c]	As part of the CPC program, CPC sites in the MCPC project received additional professional development provided by the Erikson Institute. This was delivered in the form of in-person coaching and online modules. Each year, Erikson program facilitators rated the fidelity of PD implementation (how closely the actual implementation of the program matched its intended implementation).

[c] Data source only available for CPC sites. [k] Data source only available for the kindergarten year.

Table 3. Indicators used to define the six **CPC elements** for sites/classrooms in the MCPC project during the 2012-13 (preschool) and 2013-2014 (kindergarten) school years. Differences in kindergarten definitions are bolded – otherwise, the same definition was used in both years.

Indicator	Recommendation met by CPC classrooms if…	Recommendation met by non-CPC classrooms if…
Effective Learning Experiences		
Small class size	Class size was ≤ 17 in prekindergarten or **≤25 in kindergarten**	
Full day instruction	Programming was provided for the full school-day (however this was defined by the school district)	
Teacher education	Teacher had at least a bachelor's degree	
Balance of child- and teacher-driven instruction	Teacher reported on the CAR that 35 to 65% of time was spent on child-initiated activities OR (if CAR was unavailable) spent time on both child- and teacher-directed activities (according to the CLAC) OR (if CLAC was unavailable) scored above the district mean on CLASS Emotional Support	
Task-oriented instruction	Teacher scored above the district mean on one or both CLAC sub-scales	Teacher scored above the district mean on one or both CLAC scales OR scored above the district mean on one or more dimensions of the CLASS
Aligned Curriculum		
Consistent learning experiences P to 3	Curriculum plan showed evidence of consistent curriculum, practices, or learning standards from PreK to upper grades **(in kindergarten, from K to upper grades)**	Principal reported that their school's curriculum was aligned "very well" from PreK to 3rd grade in each of six areas
Curriculum covers core domains	Teacher reported that their curriculum covered language, math, science, and socioemotional learning "very well"	
Cross-grade collaboration	Principal self-reported strong support of practices promoting cross-grade collaboration (mean score of 3+ out of 4)	
Collaborative Leadership Team (CLT)		
Complete CLT	A complete CPC-defined CLT (principal, head teacher, and PRT) was in place at any point during the school year	
Head teacher provides active leadership	Head teacher was rated as medium or high in active leadership by MCPC project staff	
Highly engaged principal	Principal's involvement in implementation of the CPC program was rated medium or high by MCPC project staff	Principal reported making decisions in collaboration with assistant principal and teachers OR their involvement was rated medium or high by MCPC project staff
Continuity and Stability		
Guaranteed enrollment policy	Students were guaranteed continuous enrollment in the same site (or affiliated elementary school)	
Consistent leadership team	Principal, head teacher, and PRT remained in their roles from one year to the next	School principal remained in their leadership role from one year to the next
At least 80% retention rate	At least 80% of students were retained in the site from one year to the next	
Professional Development (PD)		
In-person and online coaching support	Erikson PD program was implemented with "high" or "very high" fidelity (as rated by Erikson facilitators)	
Site mentors support Head Teachers	Mentor logs reported at least two mentor visit per year	School received at least one visit per semester from a dedicated PD coach
Review of online PD modules	At least two Erikson PD modules were implemented at the site (approximately 5 hours of PD, on average)	
Parent Involvement (PI)		
Parent resource room	School/site provided a dedicated parent resource room	
PRT and SCR outreach worker present	A PRT and SCR were both in place for at least six months out of the school year	
Ample, diverse opportunities for PI	PI logs provided evidence that the site facilitated at least one event per month (on average) in each of six categories	
PI opportunities address parent needs	PI logs **(or calendars, only available in kindergarten for some schools)** provided evidence of at least 9 **(7 in kindergarten)** events in each category identified in the needs assessment.	There was evidence that the site assessed family needs and provided at least 9 **(7 in kindergarten)** events in at least one CPC event category *other* than school involvement

Table 4. Operational definitions of the **Gates Foundation 15 Elements** for sites/classrooms in the MCPC project during the 2012-13 (preschool) and 2013-2014 (kindergarten) school years. Differences in kindergarten definitions are bolded – otherwise, the same definition was used in both years.

Element and Definition	Recommendation met by CPC classrooms if…	Recommendation met by non-CPC classrooms if…
Education and compensation: Teachers earn a B.A. and early learning credential, and are compensated at the same level as K-3 teachers	Teacher had at least a bachelor's degree, AND… …was licensed in a state that required training in early learning or reported other specialized training (e.g., a B.A. in early childhood education; **Note: This criterion was not applied in kindergarten**), AND … …was employed by a district or received compensation comparable to district teachers.	
Adult-child ratios: Maximum class size of 22, and adult:child ratio between 2:15 and 2:22	Class size did not exceed 22 **(25 in kindergarten)** AND adult:child ratio did not exceed 2:22 **(2:25 in kindergarten).**	
Two adults in the classroom	Two adults were consistently present in the classroom (e.g., a teacher and a full-time teaching aide)	
Teacher-child interactions focused on learning: Teachers use structured activities and play	Teacher reported on the CAR that 35 to 65% of time was spent on child-initiated activities OR (if CAR was unavailable) spent time on both child- and teacher-directed activities (based on the CLAC) OR (if CLAC was unavailable) scored above the district mean on CLASS Emotional Support	
Formative assessments: Classroom-based assessments designed to help teachers & administrators improve outcomes	Program implemented some form of systematic assessment to monitor student progress. (All sites met this recommendation by implementing the TS GOLD or IGDI/PALS in preschool, and the TRC/DIBELS or Mondo Oral Language Assessment in kindergarten.)	
Learning Time: 6-6.5 hours/day, 180-205 days/year	Programming was provided for at least 1,080 total hours during the school year (180 days x 6 hours per day).	
Support for DLLs: Bilingual teachers & specialists **Support for students with special needs:** Early intervention	Program was affiliated with a school district (which would routinely provide these services) or showed other evidence that DLL and/or special education support was provided.	
Age-appropriate learning standards: Goals for academic and social-emotional learning align w/ the expectations of kindergarten and beyond	Program learning standards were aligned with state or national learning standards and these standards addressed both academic and socioemotional domains.	
Proven curriculum: Research-based curriculum that is aligned with cognitive and social-emotional goals and teachers' professional development	For at least one primary curriculum used at the site, CPC project staff were able to find independently gathered evidence (i.e., not from the publisher) that the curriculum was linked to improved outcomes for *preschoolers* **(or, in kindergarten, improved outcomes for kindergarteners).**	
Data-driven decision making: Program uses data to inform action and improve outcomes for children, as part of a cycle of continuous improvement	Principal reported that teachers were expected – to a "moderate" or "great" extent (score of 3 or higher on a four-point scale) – to use student data to strengthen classroom practice and set goals for individual children	
Professional development: Ongoing coaching focused on improving teacher-child interactions	Teachers at the site participated in PD provided by the Erikson Institute (3-4 modules) and received individualized support from CPC mentors.	Teachers at the site participated in organized PD (organized by principal or district) and received individualized support from coaches.
Integrated systems: Learning goals, curriculum, professional development, formative assessments, and data are tied together and are mutually reinforcing	Site demonstrated excellent fidelity of CPC program implementation (indicated by a rating of at least 3.5 on a five-point scale) for the Aligned Curriculum, Professional Development, and Collaborative Leadership CPC program elements. All non-CPC sites received a rating of 0 on this element.	
Strong leadership: Educators create a culture of high expectations, public commitment, and communicate importance of quality to parents	Site's head teacher was rated medium/high in active leadership, and principal was rated medium/high on involvement in implementation of the CPC program, by MCPC project staff	Principal self-reported making decisions in collaboration with the assistant principal and teachers OR their involvement in school activities was rated medium/high by MCPC project staff
Public commitment: Support from elected officials, courts, policy environment to sustain public commitment to high-quality pre-K	Site was located in a state that provided publicly-funded PreK services and a school district that demonstrated commitment to high-quality PreK above and beyond the provision of basic services (e.g., was willing to support implementation of an experimental program like CPC).	

How are MCPC project sites doing?

Table 5 shows the percentage of MCPC project students whose site/classroom met each of the CPC recommendations in preschool (Year 1 of the project; 2012-13) and kindergarten (Year 2; 2013-14). Table 6 shows the same for the fifteen Gates Foundation elements. These percentages are broken down by school district (Chicago or St. Paul) and whether or not the student attended a CPC program.

Rates of meeting each program quality recommendation varied substantially, with some recommendations met by every site/classroom and some met rarely or never. Unsurprisingly, CPC sites/classrooms were generally more likely to meet program quality recommendations than non-CPC sites/classrooms. However, this was not universally true. In a few cases (e.g., for student retention in the Chicago school district), non-CPC sites/classrooms were somewhat more likely to provide what we had defined as a "high-quality" ECE experience.

It is also important to note that some of the recommendations – including a complete collaborative leadership team, active head teacher leadership, review of online PD modules, presence of a parent room, and integrated school systems – mapped almost perfectly onto the CPC/control program distinction. In other words, CPC-implementing sites/classrooms virtually always met recommendations for these indicators, as we had defined them, but control sites/classrooms never did. As highlighted later in the discussion of our findings, this made it difficult to analyze the potential effect of these indicators on student outcomes. Any observed association between the indicators and student performance could be explained either by the specific indicator *or* by students' participation in the overall CPC program, and these explanations were impossible to disentangle.

Student Outcomes

To assess whether students' ECE experiences (specifically, whether or not their site/classroom met recommendations for each of the Gates and/or CPC quality indicators) are associated with their subsequent academic achievement, we examined MCPC students' scores on standard district-wide assessments. For the Chicago Public Schools, these comprised the Teaching Strategies GOLD[19] in preschool; the NWEA's MAP assessments[20] in the 2016-17 school year (when MCPC project students were in the second or third grade, depending on their age at the start of the project); and the PARCC assessments[21] in the third grade. For the Saint Paul Public Schools, these comprised the Individual Growth and Development Indicators (IGDIs)[22] and Phonological Awareness Literacy Screening (PALS)[23] in preschool; the Mondo language and literacy assessment[24] in the second grade; and the Minnesota Comprehensive Assessments[25] in the third grade.

Table 5. Percentage of preschool and kindergarten students in the MCPC project whose site met each of 21 CPC program recommendations. The number of students comprising each group is indicated in parentheses.

	Year 1 (Preschool)		Year 2 (Kindergarten)		Year 1 (Preschool)		Year 2 (Kindergarten)	
Effective Learning Experiences	Chicago CPC (1724)	Chicago Control (906)	Chicago CPC (1,010)	Chicago Control (220)	St Paul CPC (317)	St Paul Control (209)	St Paul CPC (699)	St Paul Control (590)
Small Class Size	64.6	20.8	64.4	25.0	40.4	0.0	84.7	57.8
Full-Day Instruction	23.7	0.0	100.0	100.0	0.0	0.0	100.0	100.0
Teacher Education	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Balance of Instruction	76.3	65.9	60.2	29.5	100.0	20.1	79.5	57.8
Task-orientation	68.5	58.2	79.6	42.7	82.3	39.2	45.4	57.6
Aligned Curriculum								
Consistent Learning Experiences	64.2	33.3	100.0	100.0	100.0	39.2	100.0	100.0
Curriculum covers core domains	29.2	41.7	14.7	5.9	38.5	20.6	47.1	44.2
Cross-Grade Collaboration	39.7	70.1	80.4	72.7	22.7	20.1	79.0	21.4
Collaborative Leadership Team								
Complete CLT	94.8	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Active Head Teacher	94.8	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Engaged Principal	95.1	46.9	72.8	51.8	100.0	0.0	100.0	21.4
Continuity and Stability								
Guaranteed Enrollment Policy	88.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Consistent Leadership Team	37.5	90.8	47.1	93.6	57.1	100.0	37.8	57.8
80% retention rate	47.5	55.9	51.1	64.5	10.7	0.0	0.0	0.0
Professional Development								
In-person and online coaching support	36.4	0.0	66.4	0.0	80.1	0.0	73.0	0.0
Site Mentors	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0
Review of online PD modules	100.0	0.0	96.1	0.0	100.0	0.0	100.0	0.0
Parent Involvement								
Parent Resource Room	100.0	0.0	100.0	0.0	76.7	0.0	100.0	0.0
PRT & SCR	94.8	0.0	86.7	0.0	100.0	0.0	84.8	0.0
Ample, Diverse PI	64.6	0.0	81.5	26.8	19.9	0.0	0.0	0.0
PI addresses parent needs	74.7	23.6	81.5	0.0	10.7	0.0	0.0	0.0

Table 6. Percentage of preschool and kindergarten students in the MCPC project whose site met each of 15 Gates Foundation recommendations. The number of students comprising each group is indicated in parentheses.

	Year 1 (Preschool)		Year 2 (Kindergarten)		Year 1 (Preschool)		Year 2 (Kindergarten)	
	Chicago CPC (1724)	Chicago Control (906)	Chicago CPC (1,010)	Chicago Control (220)	St Paul CPC (317)	St Paul Control (209)	St Paul CPC (699)	St Paul Control (590)
Education and compensation	100.0	100.0	100.0	100.0	90.9	100.0	100.0	100
Adult-child ratios	100.0	86.4	11.3	0.9	100.0	100.0	84.7	57.8
Two adults in the classroom	100.0	100.0	19.7	0.0	100.0	100.0	100.0	99.2
Teacher-child interactions focused on learning	76.3	65.9	60.2	29.5	100.0	20.1	79.5	57.8
Formative assessments	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Learning Time	23.7	0.0	100.0	100.0	0.0	0.0	100.0	100.0
Support for DLLs	100.0	100.0	100.0	100.0	90.9	100.0	100.0	100.0
Support for students with special needs	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Age-appropriate learning standards	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Proven curriculum	38.7	83.0	76.9	50.5	0.0	0.0	100.0	100.0
Data-driven decision making	39.9	76.0	97.8	60.9	100.0	0.0	58.9	0.0
Professional development	100.0	100.0	96.1	100.0	100.0	100.0	0.0	100.0
Integrated systems	10.7	0.0	54.5	0.0	100.0	0.0	84.8	0.0
Strong leadership	90.0	46.9	72.8	51.8	100.0	0.0	100.0	21.4
Public commitment	100	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Findings: Do preschool quality indicators predict student achievement?

To assess whether the program quality recommendations made by the Gates Foundation and CPC frameworks are actually associated with improved student achievement, we examined associations between preschool quality indicators (as defined in Tables 3 and 4) and students' achievement test scores. Because the aim of this report is to provide an overall look at the quality indicators proposed by each framework, we focus primarily on whether (a) meeting recommendations for each individual indicator in preschool, and (b) the total number of recommendations met in preschool, were associated with later achievement.

More nuanced analyses of the Effective Learning Experiences, Aligned Curriculum, and Collaborative Leadership Team elements of the CPC program (and their constituent indicators) have been described in previous reports, which can be found on the HCRC website. Importantly, while these reports complement the current report, their methods and time frames differ in key ways. For instance, the Effective Learning Experiences report primarily examined classroom experiences across CPC sites and focused on students'

school readiness at the end of preschool, while the current report examines classroom experiences across all MCPC sites and emphasizes long-term (third grade) academic outcomes. Thus, although there may be some apparent inconsistencies in the results reported her and elsewhere, these are due to differences in the analytic methods used and the sample(s) and/or outcome(s) examined.

Individual Quality Indicators

Tables 7.1 and 7.2 show associations between individual CPC indicators and students' academic outcomes at the end of preschool, as well as sustained achievement gains in second and third grade. Tables 8.1 and 8.2 show the same for the Gates indicators. To assess whether the core elements of each framework predict school readiness and sustained gains, each indicator was analyzed in a separate regression model controlling for key student characteristics: CPC program attendance in preschool, gender, race/ethnicity, achievement score in the fall of preschool, free/reduced lunch status, special education status, dual language learner status, mother's employment and education, single parent status, and the overall achievement level of the student's preschool site. For both frameworks, only indicators that showed variation across sites/classrooms (some sites/classrooms met the recommendation and some did not) were analyzed.[1]

In both sets of tables, a plus (+) indicates a significant positive association between the corresponding indicator and outcome (students whose preschool site/classroom met that recommendation had significantly higher achievement scores than students whose site/classroom did not). A minus (-) indicates a significant negative association; a blank square indicates no statistically meaningful association; and N/A indicates that there was no variation in meeting the corresponding indicator (everyone met it, or everyone did not) and so it was not analyzed. The associations are shown separately for each sub-test of the district assessments, and the third-grade findings are further broken down to show associations separately for CPC students (those who attended a CPC site in preschool) and non-CPC students.

It is important to note that although these findings identify *associations* between preschool experiences and academic performance – and thereby provide insight into which program features might have the greatest impact on achievement – they do not decisively show that preschool experiences *caused* academic performance to change. Fully understanding why the observed academic gains occurred will require (a) examining the broader school ecology in which program features are implemented, and (b) corroborating evidence from other studies linking ECE quality to achievement. This is especially important to keep in mind in cases where we found negative associations between program quality indicators and student achievement. Because these inverse links lack a strong theoretical rationale, care should be taken to avoid treating them as evidence that program features negatively impact performance. For example, although we found that broad curriculum coverage was associated with reduced achievement, this does not necessarily suggest that narrowing the curriculum focus would benefit students. Perhaps MCPC project teachers who reported broad coverage also tended to use a curriculum that was less-than-ideal in other respects, or perhaps this pattern emerged in our study due to random variation.

[1] Note that these analyses do not account for the fact that indicators might be associated (e.g., a site that provides one aspect of parent involvement infrastructure might be especially likely to also provide the others). To address this, six regression models (one for each CPC element) were run assessing the extent to which meeting each CPC recommendation was associated with third-grade test scores *after accounting for other recommendations within the same CPC element.* The results are summarized in Appendix tables A-1 and A2. Despite some differences, the key results from our analysis of individual indicators (summarized in the section on "Individual Quality Indicators: Key Findings") held up when other indicators were controlled.

Table 7-1. Associations between experiencing a pre-K environment consistent with each CPC recommendation and students' academic outcomes in the **Chicago** school district..

	TS GOLD: Preschool				NWEA: 2nd/3rd Grade[i]						PARCC: 3rd Grade					
					All students		2nd graders		3rd graders		All students		CPC students		Control students	
	Literacy	Math	SEM	Total	Reading	Math	Reading	Math	Reading	Math	English	Math	English	Math	English	Math
Class size ≤ 17	-	-		-	-	-	-		-	-						-
Full day instruction	+	+	+	+	+	+			+	+			-		N/A	N/A
Balanced instruction		+									-	-	-	-	+	+
Task-oriented instruction																
Consistent experiences	+		+													
Curriculum coverage	-				-	-	-	-	-	-	-	-	-		-	-
Collaboration	+	+	-		+	+	+	+		+		+				
Active head teacher	-	-											N/A	N/A	N/A	N/A
Involved principal	+	+	+	+									N/A	N/A	-	-
Complete CLT	-	+											N/A	N/A	N/A	N/A
Team continuity	-	-	-	-	+	+	+		+	+		+		+		
80% retention	-				+	+				+	+	+	+	+		
Parent room	+	+	+	+		+		+			+	+	N/A	N/A	N/A	N/A
PRT & SCR	-	-													N/A	N/A
Ample PI activities			+		-	-	-	-		-					N/A	N/A
PI activities match needs			+			+		+		+	+	+	+	+	N/A	N/A
PD coaching, support	+							+							N/A	N/A
2+ PD modules	+	+	+	+		+		+			+	+	N/A	N/A	N/A	N/A

[i]NWEA scores come from the 2016-17 school year, when some MCPC project students were in 2nd and others in 3rd grade (depending on their age at the start of the project). Results are shown for all students and separately by age group. Each column represents separate analyses for different subject matter.

Table 7-2. Associations between experiencing a preschool environment consistent with each CPC recommendation and students' academic outcomes in the **St. Paul** school district..

	IGDI/PALS: Preschool		Mondo: 2nd Grade				MCA: 3rd Grade					
							All students		CPC students		Control students	
	IGDI comp	PALS comp	Reading Stage	Oral Lang	Text Level	Fluency	English	Math	English	Math	English	Math
Class size ≤ 17											N/A	N/A
Balanced instruction	-	-	+	+	-	-	-		N/A	N/A		
Task-oriented instruction	-		-	-	-	+	+	+	+	+		
Consistent experiences	-	-	+	+	-	-	-		N/A	N/A		
Curriculum coverage				+							N/A	N/A
Collaboration	-	-		-	+	-	+	+	+	+		
Active head teacher	+	+	+	+	+	+	-		N/A	N/A	N/A	N/A
Involved principal	+	+	+	+	+	+	-		N/A	N/A	N/A	N/A
Complete CLT	+	+	+	+	+	+	-		N/A	N/A	N/A	N/A
Team continuity	-	-		+	-	+	-	-		-	N/A	N/A
80% retention	+		+				+	+	+		N/A	N/A
Parent room	+	+		+	+	-	+	+		+	N/A	N/A
PRT & SCR	+	+	+	+	+	+	-		N/A	N/A	N/A	N/A
Ample PI activities	+						+	+	+		N/A	N/A
PI activities match needs	+						+	+	+		N/A	N/A
PD coaching, support	-						-	-	-		N/A	N/A
Site mentors	-	-	-	-	-	-	+		N/A	N/A	N/A	N/A
2+ PD modules	+	+	+	+	+	+	-		N/A	N/A	N/A	N/A

Each column represents separate analyses for different subject matter.

Table 8-1. Associations between experiencing a preschool environment consistent with each Gates Foundation recommendation and students' academic outcomes in the **Chicago** school district..

	TS GOLD: Preschool				NWEA: 2nd/3rd Grade						PARCC: 3rd Grade					
					All students		2nd grade		3rd grade		All students		CPC		Control	
	Literacy	Math	SEM	Total	Reading	Math	Reading	Math	Reading	Math	English	Math	English	Math	English	Math
Class Size/Ratio	-		-	-					-	-			N/A	N/A		
Learning Time	+	+	+	+	+	+			+	+			-			
Proven Curriculum			+			+						+			+	+
Data Driven Decisions			-									-		-	-	-
Integrated Systems	+	+	-		+	+	+	+	+	+					N/A	N/A
Strong Leadership			+	+											-	-
Teacher-Child interaction		+									-	-	-	-	+	+

[i]NWEA scores come from the 2016-17 school year, when some MCPC project students were in 2nd and others in 3rd grade (depending on their age at the start of the project). Results are shown for all students and separately by age group. Each column represents separate analyses for different subject matter.

Table 8-2. Associations between experiencing a preschool environment consistent with each Gates Foundation recommendation and students' academic outcomes in the **St. Paul** school district..

	IGDI/PALS: Preschool		Mondo: 2nd Grade				MCA: 3rd grade					
							All students		CPC		Control	
	IGDI comp	PALS comp	Reading Stage	Oral Lang	Text Level	Fluency	English	Math	English	Math	English	Math
Teacher-child interaction	-	-	+	+	-	-	-		N/A	N/A		
Data Driven Decisions	-	-		-	+	-	+	+	+	+	N/A	N/A
Integrated Systems	+	+	+	+	+	+	-		N/A	N/A	N/A	N/A
Strong Leadership	+	+	+	+	+	+	-		N/A	N/A	N/A	N/A

Each column represents separate analyses for different subject matter.

Individual Quality Indicators: Key Findings

The analyses summarized in the preceding tables yield two key observations:

1) The two preschool program quality indicators that robustly predicted higher 3rd grade test scores in both districts were **80%+ student retention** from preschool to kindergarten, and implementation of activities to support parent involvement (chiefly **provision of involvement activities that match families' needs**). Strong principal support for cross-grade teacher collaboration also predicted higher 3rd grade scores across districts, though this finding was less consistent across test domains and sub-groups of students. Interestingly, these indicators align with two core principles of the CPC program that distinguish it from many other preschool quality frameworks: (1) maximizing the continuity and alignment of students' experiences across the transition from preschool to later grades; and (2) working to build school-family links and provide support for families/parents as well as their children.

   Although these findings do not necessarily signify that retention and parent involvement *caused* achievement to improve, they do suggest that these features deserve particular attention in discussions of preschool program quality. Retention is especially interesting to consider, as higher retention may be the product of a better overall school climate. In prior analyses, we have found that other CPC program quality elements (including curriculum alignment and coverage) are associated with a greater likelihood of students remaining in their preschool site for the subsequent year.[26] Thus, it is possible that retention (and the continuity it facilitates in children's educational experiences) is a mechanism whereby other program quality features promote student achievement.

2) Associations between specific preschool experiences and student achievement varied across school districts. This finding highlights the importance of understanding the broader school and district ecology in which program quality elements are implemented. Each MCPC project district had a different leadership and policy climate, and served a sociodemographically distinct population of students and families. As such, it seems likely that the different patterns of findings reflect the varied needs of different student/family populations, or that the various program features cohered differently in different environments (e.g., perhaps the leadership environment affected the extent to which school practices mutually reinforced one another).

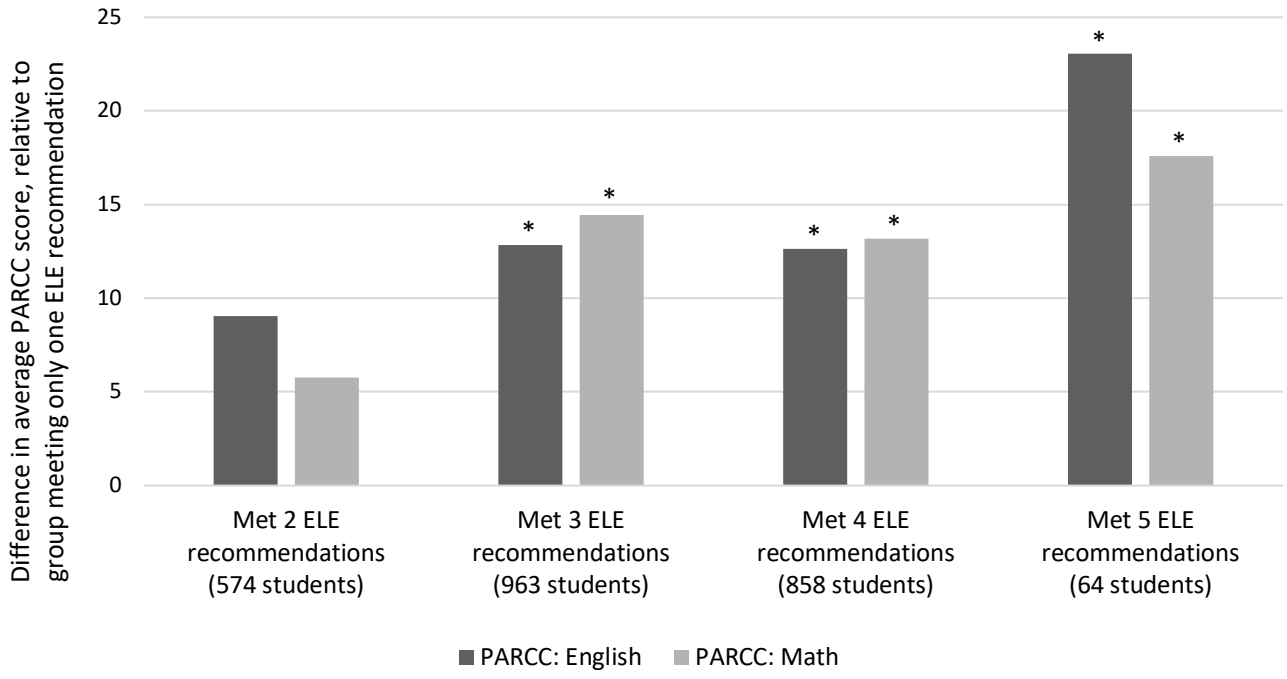
Two caveats are important to note here. First, for several indicators, different data sources were used to define the indicator in CPC vs. control sites (see Table 2). As a result, associations between these indicators and student achievement should be viewed with caution; differences in data may have produced artificial associations or failed to reveal true associations. Second, a number of indicators mapped very closely onto the CPC/control distinction – CPC sites/classrooms virtually always implemented them, while control sites/classrooms virtually never did. Consequently, it is impossible to determine whether associations with these indicators are a product of the individual indicators or of students' participation in the overall CPC program. Importantly, however, the two key findings highlighted above – positive associations of high student retention and parent involvement activities with 3rd grade achievement – hold up despite these caveats. In both cases associations were found *within* the CPC sample, suggesting that they do not simply reflect differences in data availability or a broader CPC program effect.

Spotlight on Effective Learning Experiences

To complement our prior report on the CPC element of Effective Learning Experiences and its associations with school readiness[27], we examined whether the number of core ELE recommendations met by a preschool site/classroom was associated with third-grade achievement. In the Chicago school district, students whose site/classroom met three or more ELE recommendations had significantly higher third-grade achievement scores than students whose site/classroom only met one ELE recommendation (see Figure 1).[2] In the St. Paul district, there was no consistent, statistically reliable association between the number of ELE recommendations met and third-grade achievement – possibly due to limited variation in the number of ELE recommendations met by different sites/classrooms.

Follow-up analyses statistically controlling for students' preschool achievement scores (to provide a more robust test of the relation between ELEs and achievement) showed a similar pattern of results (see Appendix).

Figure 1. Association between number of preschool ELE recommendations met and third-grade achievement in the Chicago school district



*Denotes a statistically significant difference relative to the group of 171 students whose class only met one recommendation

[2] Note that, because CPC sites generally met more ELE recommendations than control sites, this may be partly explained by the overall effect of participating in the CPC program.

Overall Program Quality

One advantage of the program quality indicators we have developed (Tables 3 and 4) is that they can be summed to provide an index of overall program quality. This allowed us to examine whether overall preschool program quality – as defined by the CPC and Gates Foundation frameworks – was associated with later student achievement, and whether there seemed to be a minimum number of quality recommendations that a site/classroom needed to meet in order to see sustained achievement gains.

Figures 1-4 show the third-grade academic performance of MCPC students whose preschool sites/classrooms met different numbers of Gates Foundation and CPC recommendations. These graphs are purely descriptive, and do not statistically account for student demographics, baseline academic performance, or CPC program participation. As such, they should be viewed as preliminary and not interpreted as evidence that the number of recommendations met *influences* academic performance. However, they do show several patterns that suggest interesting directions for future research:

1) There may be a "threshold" number of recommendations at which sustained gains are more likely. For instance, in the Chicago sample, there appears to be a "jump" in performance among sites/classrooms meeting eight or more CPC recommendations, and possibly another "jump" at 16 recommendations. These patterns, however, are preliminary and require more rigorous statistical examination to determine their validity.

2) Patterns of achievement differ across school districts – sometimes in counterintuitive ways. In the Saint Paul sample, for instance, there appears to be a subset of relatively high-performing sites/classrooms that met relatively few Gates Foundation and CPC recommendations. This raises questions about (a) whether our indicators, as we have defined them, assess the same program characteristics across school districts and (b) whether certain important elements of ECE program quality might be missing from these frameworks and/or not fully captured by our indicators.

Figure 1. Association between numbers of Gates Foundation recommendations met in preschool and student scores on the third-grade PARCC assessment in the Chicago school district.

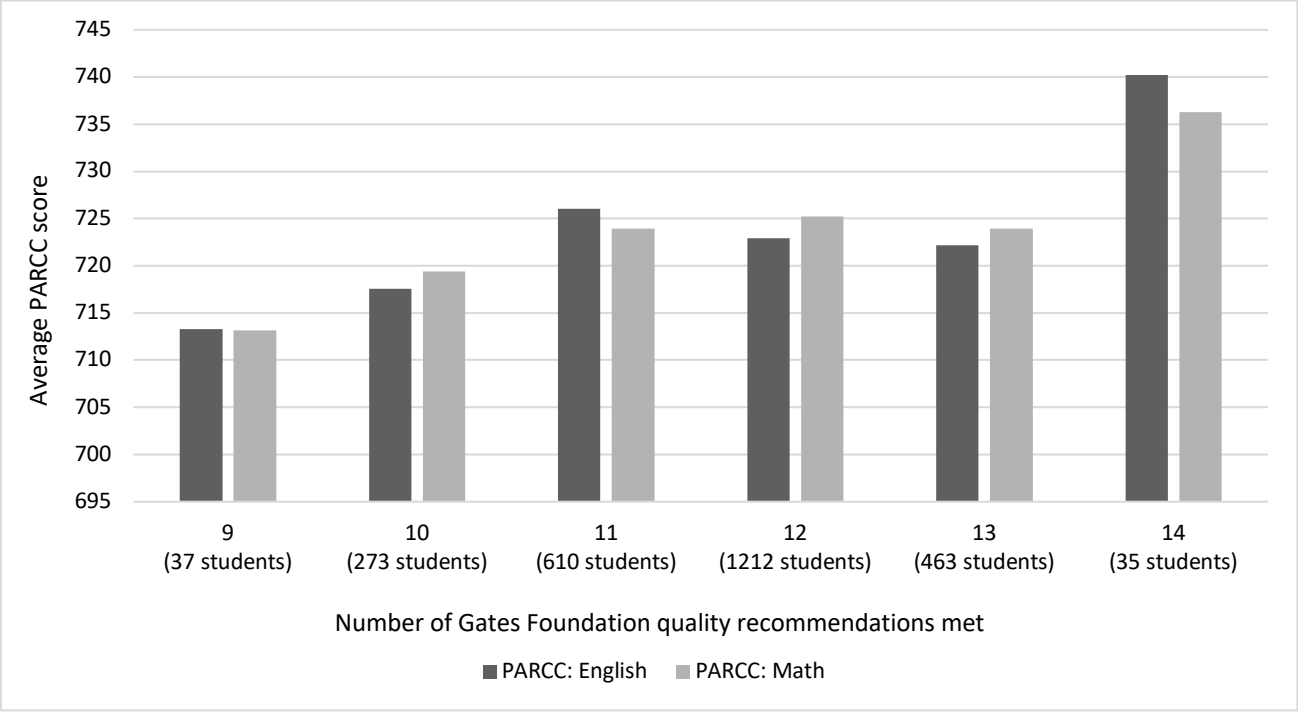


Figure 2. Association between numbers of CPC recommendations met in preschool and student scores on the third-grade PARCC assessment in the Chicago school district.

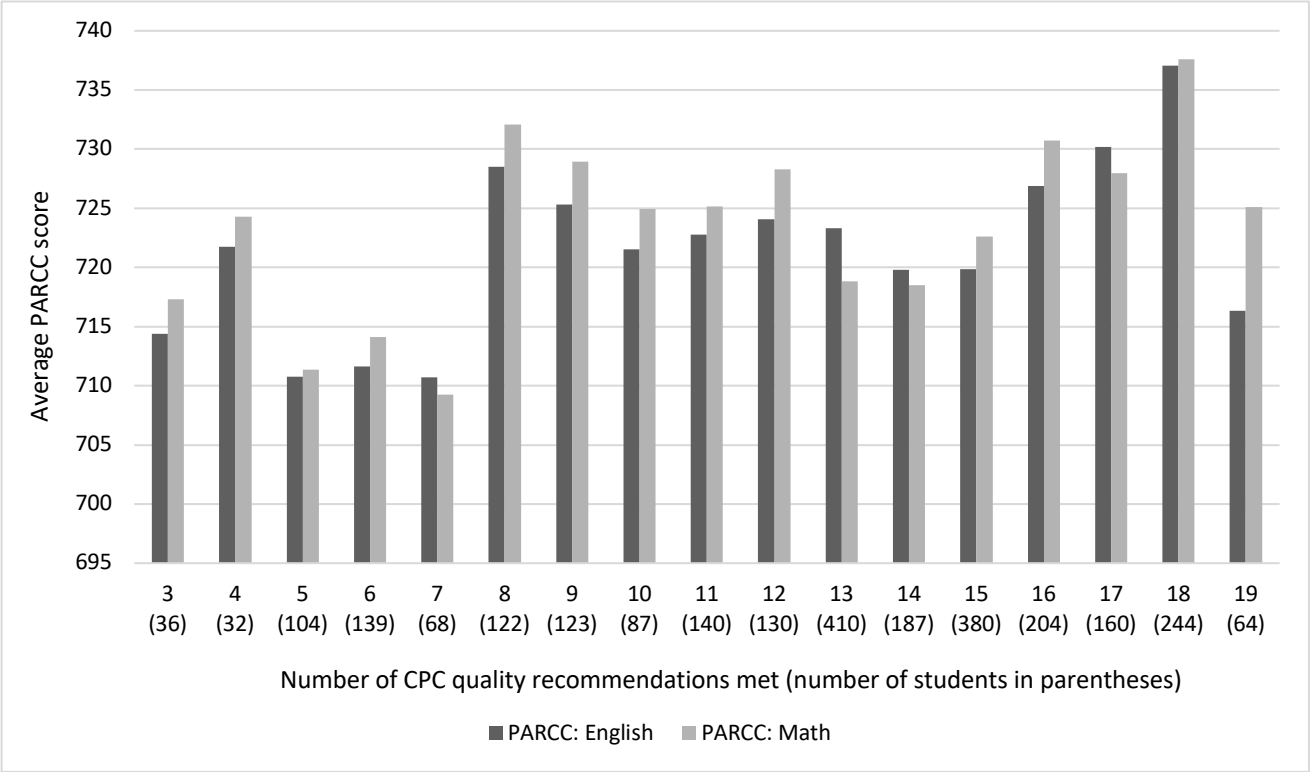


Figure 3. Association between numbers of Gates Foundation recommendations met in preschool and student scores on the third-grade MCA assessment in the St. Paul school district.

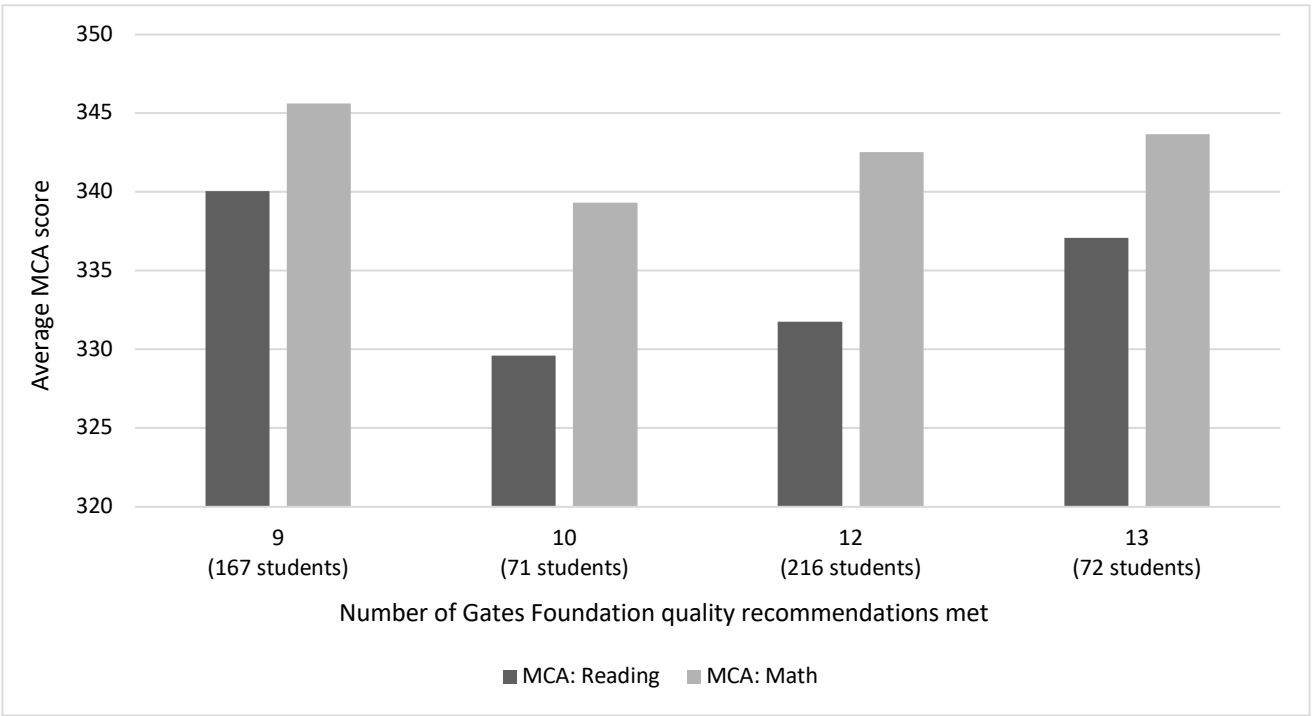
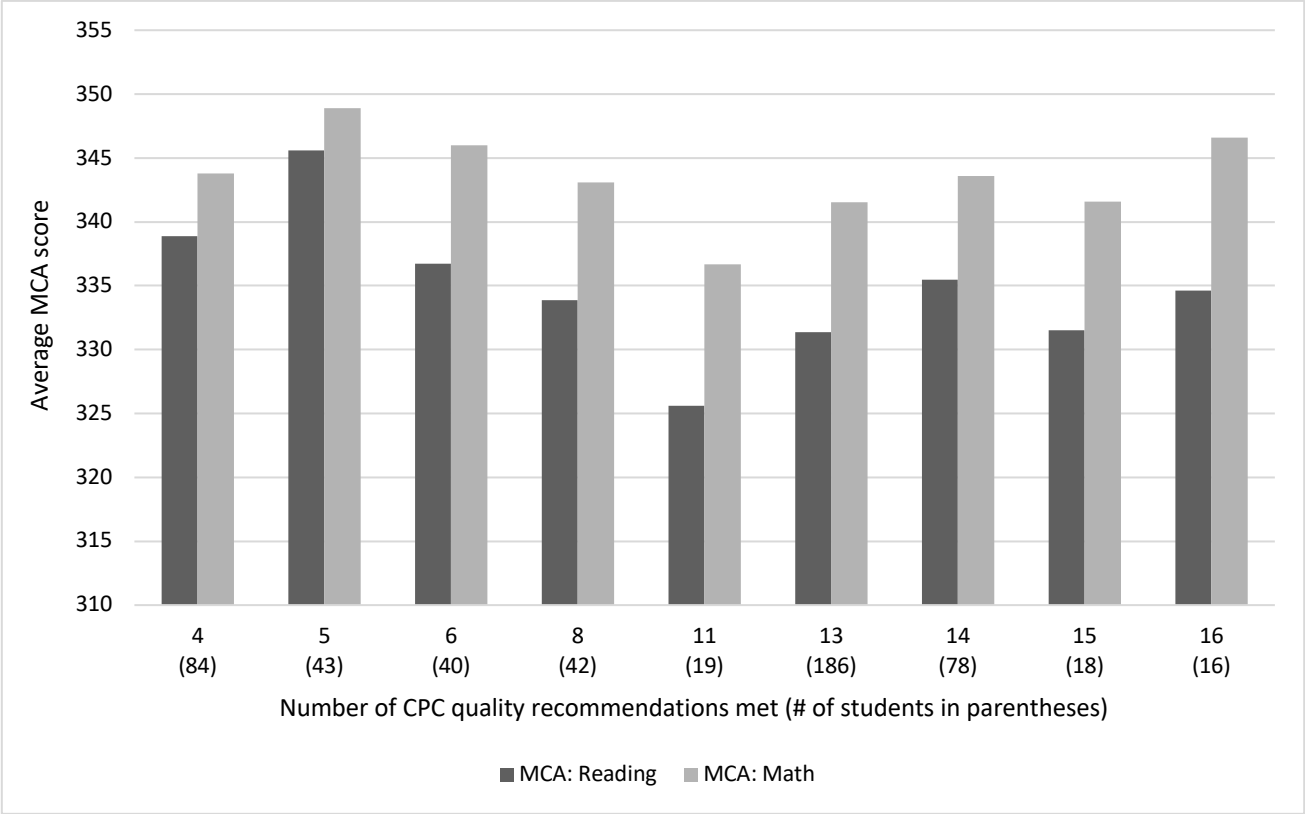


Figure 4. Association between numbers of CPC recommendations met in preschool and student scores on the third-grade MCA assessment in the St. Paul school district.



Dosage: Considering the kindergarten experience

While discussions of ECE program quality have often focused on preschool, growing evidence (including some of our findings from this project) highlights the importance of alignment and continuity between preschool and later school experiences.[28,29] It will thus be important for future research to examine not just the potential effects of preschool program quality but the effects of *continuous* high-quality educational experiences across preschool and subsequent grades.

By extending our operational definitions of CPC and Gates Foundation recommendations to the kindergarten year, we were able to define – for MCPC students who were four years old in the fall of 2012 and started kindergarten in 2013 – whether they experienced two, one, or no years of "high-quality" ECE based on each recommendation. This allowed us to begin assessing how the "dosage" of ECE quality that children experience across preschool and kindergarten might be associated with later outcomes. Tables 9 and 10 show correlations between the "dosage" of each indicator that Chicago MCPC students experienced, and their third-grade test scores. Note that these analyses do not statistically account for student demographics, baseline academic performance, or CPC program participation – and, as such, should be viewed as preliminary.

Table 9. Correlations between Chicago students' dosage of each CPC indicator (number of years, out of preschool and kindergarten, when their site/class met recommendations for that indicator) and third-grade test scores.

	PARCC: English	PARCC: Math
Class size	0.10*	0.07
Full day instruction	-0.01	-0.06
Balance of instruction	0.06	0.01
Task-oriented instruction	0.14*	0.14*
Consistent curriculum/practices	-0.03	-0.01
Curriculum coverage	0.02	0.06
Cross-grade collaboration	-0.02	0.06
Active head teacher	0.07	0.004
Engaged principal	0.08*	0.04
Complete leadership team	0.07	0.004
Guaranteed enrollment	-0.16*	-0.08*
Leadership team continuity	-0.03	-0.02
80% student retention	0.32*	0.35*
In-person and online coaching support	0.12*	0.12*
Review of PD modules	0.07	-0.003
Parent room	0.05	-0.01
PRT and SCR	0.02	-0.02
Ample PI activities	0.15*	0.05
PI activities match family needs	0.21*	0.16*

*Correlation is statistically reliable at a conventional significance level of $p < .05$
Note: Indicators with no dosage variation were excluded

Table 10. Correlations between Chicago students' dosage of each Gates Foundation indicator (number of years, out of preschool/ kindergarten, when their site/class met recommendations for that indicator) and third-grade test scores.

	PARCC: English	PARCC: Math
Class Size/Ratio	-0.11*	-0.11*
Two adults in classroom	-0.12*	-0.09*
Learning time	-0.01	-0.06
Proven curriculum	0.13*	0.20*
Data-driven decisions	-0.11*	-0.20*
Professional development	0.08*	0.03
Integrated systems	0.04	0.02
Strong leadership	0.09*	0.05
Teacher-child interactions focused on learning	0.06	0.01

*Correlation is statistically reliable at a conventional significance level of $p < .05$
Note: Indicators with no dosage variation were excluded

Similar to our analysis of the preschool experience (summarized in Tables 7.1-8.2), these findings highlight student retention and provision of parent involvement activities that match families' needs as key program features that are robustly associated with better student outcomes. They also, however, expand our prior findings by suggesting that *continuously* experiencing these features across multiple years might be associated with even greater gains than just experiencing them in preschool.

Other findings from this analysis are more surprising – for instance, that spending more years in a site that reported making data-driven decisions was associated with *lower* achievement. It is important to note, however, that this analysis does not account for any other program or student factors that might also be associated with quality and help explain the associations. For instance, perhaps MCPC project schools that made data-driven decisions also tended to serve a higher-risk, lower-performing student population.

Future Directions

Our examination of program quality elements is an important step forward in understanding what makes ECE programs effective. However, it also highlights several key questions for future research to address:

1) ***Synthesis of elements:*** This report largely focused on the associations between individual ECE program quality recommendations and student achievement. However, the different patterns of results found across school districts suggest that the broader school/district context may determine how these program quality elements influence student achievement. In future research, it will be important to examine how the various program elements operate in concert with each other and with the broader school/district environment to support student learning and development.

2) ***Quality dosage:*** Our findings suggest that not just the preschool experience, but the "dosage" of high-quality ECE across preschool and kindergarten, might play a role in children's academic development. However, these preliminary analyses leave a number of unanswered questions. To what extent are high-quality kindergarten experiences associated with achievement *above and beyond* the quality of preschool experiences? Does the *continuity* of experiences from preschool to kindergarten matter, or simply the total amount of time spent in a high-quality environment? These questions and others will need to be addressed to better understand the cumulative effect of early educational experiences.

3) ***Expanded outcomes:*** Examining standardized test scores is a key first step to understanding the potential effect of ECE quality on academic development, since these tests target skills that educators and policymakers have identified as central to academic success. However, the effect of children's ECE experiences might also be reflected in other indices of school progress – including special education placement, in-grade retention, and socioemotional development.[30,31] To fully understand the role of ECE program quality in students' academic development, it will be important for future research to examine whether ECE quality metrics are associated with these alternate indices of academic functioning and to explore long-term associations with student achievement beyond the third grade.

Conclusions

1) Key elements of ECE program quality can be assessed using a combination of data routinely collected by school districts (e.g., enrollment information, staff rosters) and program monitoring tools that are relatively brief and easy to implement (e.g., curriculum alignment plans, classroom observations, teacher and principal questionnaires; see Table 2).

2) Findings from the MCPC project suggest that cross-grade continuity of student experiences and implementation of infrastructure to support parent/family involvement deserve particular attention in discussions of ECE program quality and its contribution to sustained achievement gains. This should include consideration of how other program quality and climate factors (e.g., school leadership) might help to promote retention of students in the same school/site.

3) Future research on ECE program quality should examine how various program quality elements might dynamically interact to support student achievement. It should also consider the potential role of cross-grade continuity in the ECE programming that students experience (i.e., their "dosage" of low- or high-quality programming) in sustaining early achievement gains.

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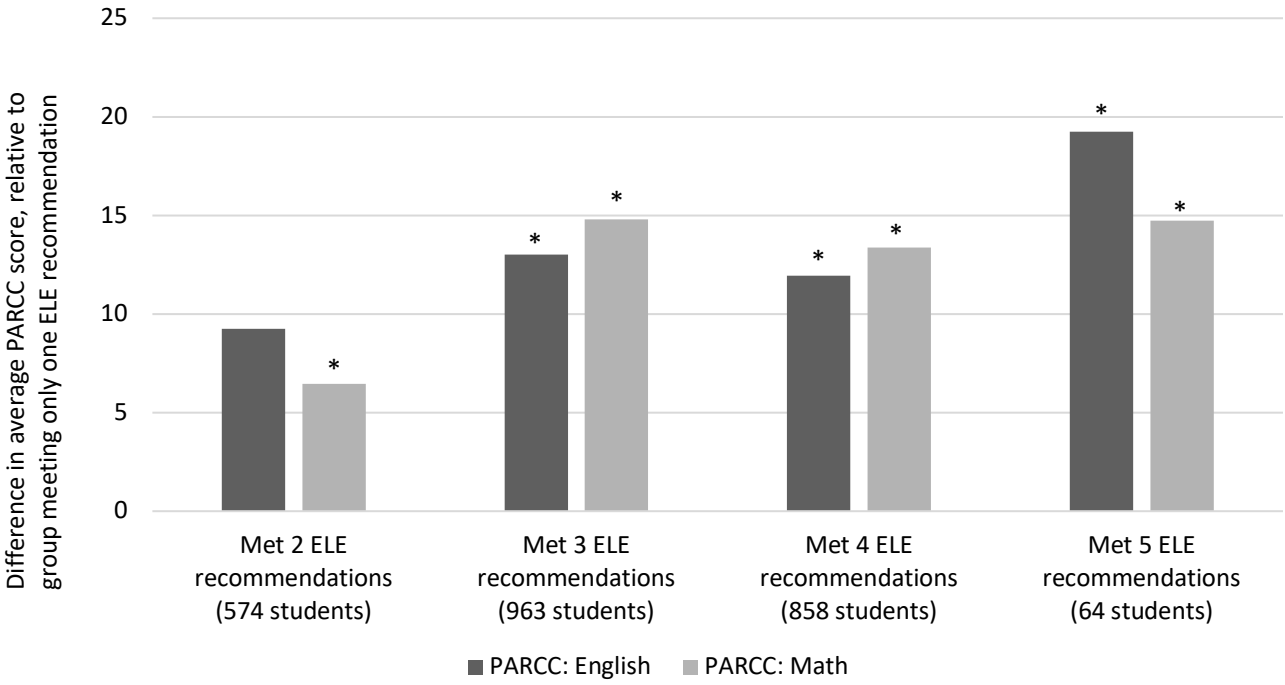
Appendix

Figure A1. Association between number of preschool ELE recommendations met and third-grade achievement, controlling for academic achievement in the fall of the preschool year.



*Indicates a statistically significant difference in scores relative to the group of 171 students whose site/classroom only met one ELE recommendation

Table A1. Associations between experiencing each CPC element and students' 3rd grade PARCC outcomes in the **Chicago school district**.

	PARCC English	PARCC Math	PARCC English	PARCC Math	PARCC English	PARCC Math	PARCC English	PARCC Math	PARCC English	PARCC Math	PARCC English	PARCC Math
Class size	0.648	-0.442										
	(3.428)	(2.618)										
Full day	-2.739	-2.193										
	(4.178)	(3.467)										
Balanced Instruction	-5.091	-2.463										
	(3.862)	(1.979)										
Task Orientation	4.849	4.716*										
	(3.011)	(2.446)										
Curriculum Alignment			-0.810	-0.0188								
			(3.569)	(2.992)								
Curriculum Coverage			-2.342	-3.840								
			(3.432)	(2.514)								
Collaboration			-3.960	0.0642								
			(4.342)	(2.947)								
Active Head Teacher					4.118	3.825						
					(3.452)	(2.631)						
Involved Principal					-4.935	-5.631						
					(4.487)	(4.251)						
Guaranteed Enrollment							-17.58***	-5.450				
							(3.095)	(3.708)				
Team Continuity							-5.401**	-2.121				
							(2.611)	(2.201)				
80% Retention							11.49**	12.55*				
							(5.425)	(6.852)				
In person and online support									0.0523	-1.727		
									(4.366)	(2.990)		
Online PD modules									2.921	3.035		
									(3.845)	(3.530)		
Parent Room											4.345	3.629
											(3.780)	(3.005)
PRT & SCR											-4.916	-3.643
											(4.666)	(3.438)
Ample PI activities											-0.385	-3.770*
											(4.165)	(1.871)
PI activities match needs											5.807	7.901*
											(4.051)	(4.415)
Constant	708.5***	708.3***	708.5***	711.2***	706.6***	708.2***	742.5***	726.0***	704.8***	706.8***	704.5***	705.1***
	(8.180)	(8.045)	(8.480)	(8.582)	(11.03)	(9.110)	(8.644)	(7.833)	(10.23)	(8.495)	(10.85)	(8.449)
Observations	1,509	1,510	1,509	1,510	1,509	1,510	1,509	1,510	1,509	1,510	1,509	1,510
R-squared	0.132	0.166	0.128	0.164	0.128	0.164	0.147	0.174	0.127	0.163	0.129	0.170

Note: Indicators within each elements were run together in the regression model. Omitted indicators due to no variation in variable are not shown.
Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A2. Associations between experiencing each CPC elements and students' 3rd grade MCA outcomes in the **St. Paul school district**.

	MCA English	MCA Math	MCA English	MCA Math	MCA English	MCA Math	MCA English	MCA Math	MCA English	MCA Math	MCA English	MCA Math
Class Size	1.847	1.847										
	(2.136)	(2.136)										
Balanced Instruction	-8.764***	-8.764***										
	(1.785)	(1.785)										
Task Orientation	4.441**	4.441**										
	(1.709)	(1.709)										
Curriculum Alignment			-8.447***	-1.705								
			(1.393)	(1.692)								
Curriculum Coverage			-1.521	-2.962								
			(2.647)	(3.374)								
Collaboration			4.117**	1.949								
			(1.464)	(1.806)								
Active Head Teacher					-1.523**	-0.449						
					(0.648)	(0.632)						
Team Continuity							-2.149***	-3.372***				
							(0.543)	(0.426)				
80% Retention							1.899**	1.813**				
							(0.638)	(0.749)				
Online PD modules									-1.899**	-1.813**		
									(0.638)	(0.749)		
In person and online support									-0.376	-1.364**		
									(0.579)	(0.526)		
Parent Room											2.149***	3.372***
											(0.543)	(0.426)
PRT & SCR											-1.523**	-0.449
											(0.648)	(0.632)
Ample PI activities											-0.251	-1.559**
											(0.615)	(0.592)
Constant	328.4***	328.4***	328.3***	324.4***	324.3***	325.3***	326.4***	328.7***	324.6***	326.7***	324.3***	325.3***
	(12.74)	(12.74)	(13.42)	(8.666)	(12.73)	(8.069)	(12.72)	(8.293)	(13.10)	(8.468)	(12.73)	(8.069)
Observations	449	449	449	449	449	449	449	449	449	449	449	449
R-squared	0.313	0.313	0.309	0.266	0.308	0.262	0.308	0.262	0.308	0.262	0.308	0.262

Note: Indicators within each elements were run together in the regression model. Omitted indicators due to no variation in variable are not shown. Two sites were excluded in the analyses due to not being assessed on district achievement measures or having more advantaged baseline and demographic characteristics compared to other sites.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1