

Supplementary Online Content

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This supplementary material has been provided by the authors to give readers further information about their work.

eAppendix A: Study Background for the Midwest Child-Parent Centers

Based on the accumulated evidence in the Chicago Longitudinal Study on the effects of the Child-Parent Center (CPC) Education Program,¹⁻⁴ the Midwest CPC Expansion began in the fall of 2012 under an Investing in Innovation (i3) Grant from the U. S. Department of Education to the University of Minnesota. The goals of the project, implemented over five years, are as follows: (1) implement the CPC program with a high degree of fidelity, (2) evaluate the implementation of the program, (3) assess the impact on child well-being and parent involvement, (4) assess impacts by child, family, program, and community characteristics, (5) estimate the initial costs and benefits, and (6) develop plans to sustain the program and increase opportunities for expansion.

In the overall project, the preschool cohort of over 2,500 children from low-income neighborhoods included families in the Chicago Public Schools, Saint Paul Public Schools, McLean County Unit District 5 (Normal, IL), Evanston-Skokie School District 65, and the Virginia (MN) School District. In addition to 29 schools, three community-based child care/early education centers also participated. Project partners with the University team include the Erikson Institute (professional development), Illinois State University (sustainability), SRI International (independent evaluator), and philanthropic organizations that provided required matching funding to the i3 project.

Because the Chicago Public Schools is the largest district and the context of the full-day preschool expansion, it is the focus of the current report on the association with well-being at the end of the preschool year. In 2012-2013, 16 Chicago schools implemented the program, including 10 existing centers and 6 new centers. The nonCPC comparison group included 15 schools matched to CPC schools on propensity scores. Comparison schools offered the usual preschool services available.

As in the overall study, Chicago groups and comparison groups were matched on the following: (1) propensity-score probability of enrollment in schools with equivalent performance characteristics (based on family income, race & ethnicity, third-grade achievement), (2) enrollment in schools receiving Title I funding from the Elementary and Secondary Education Act, (3) availability of preschool classes, and (4) school agrees to participate in data collection, and (5) neighborhood location. Because of the accumulated positive evidence from prior studies, a randomized control trial was not feasible. The nonCPC comparison group in the larger Chicago study included 906 3- and 4-year-olds who participated in either state-funded prekindergarten or Head Start. They matched the CPC program group well on fall baseline and family characteristics. One school did not provide administrative data. The total program and comparison group sample in the Chicago Public School District was 2,630 children.

The study sample analyzed in the current report on full-day preschool is the 409 children from the 11 Chicago schools that offered full-day preschool (7 hours per day) and 573 children in the same schools who enrolled in part-day preschool (3 hours per day on average). Class sizes (maximum of 17 with a teaching assistant) and other elements were equivalent. Children enrolled for at least 3 months were included. For this same-school comparison, differences in school context are controlled.

Among all 16 CPC schools in Chicago, there were 1,315 children in part-day preschool classrooms for a total of 1,724 CPC participations (part-day and full-day). Although fall baseline performance was similar between groups, the full-day group showed more disadvantages than the part-day group.

The intervention was significantly changed from earlier phases. The 6 key elements of the Midwest CPC Education Program are (a) collaborative leadership team (Head Teacher, Parent Resource Teacher, and School-Community Representative in each site), (b) effective learning experiences, (c) menu-based system of parent involvement and engagement, (d) aligned curriculum across grades, (e) continuity and stability, and a (f) professional development system.⁵ With classes sizes limited to 17 children with a state-certified teacher and full-time teaching assistant, instruction emphasizes a balance of teacher-directed and child-initiated activities in all domains of learning.⁶ Common curricula across Chicago centers included Blueprint for Early Literacy and Message Time Plus. To comprehensively address children' learning needs, each site develops a principal-endorsed curriculum alignment plan and parent involvement plan for the year. Parent involvement includes a variety of workshops, events, and trainings to promote home, school, and community involvement as well as career development.

Site mentors provided support for program implementation throughout the year. Four on-line teaching modules were implemented with teachers and staff during the preschool year. These included (a) fostering children's thinking: conversations and read-alouds, (b) power of representation in fostering children's thinking, (c) construction and movement, and (d) continuity and transition from prekindergarten to kindergarten. Progress monitoring tools included classroom instructional activity reports, parent involvement logs and calendars, home involvement checklists, classroom learning activities checklists to assess classroom-level engagement in learning, and support for professional development.

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eAppendix B: Validity in Early Childhood Assessment

1. Established Principles of Validity in Early Childhood Assessments

The leading guide to validity is the National Research Council publication on early childhood assessment.¹ Key principles identified for assessments to be valid for reporting program-related outcomes are the following:

- a. aligned to state and district Early Learning and Development Standards
- b. assess progress in meeting Early Learning and Development Standards
- c. are directly linked to the curriculum and children have an opportunity to learn the skills assessed.
- d. results of which are used to guide and improve instructional practices
- e. covers all essential domains of school readiness (language, math, socio-emotional, physical health, etc.)
- f. reliable and valid for their intended purpose and for the target populations.

The Teaching Strategies GOLD (TS-GOLD) Assessment System, including as measured in Chicago, meets all of these validity principles.² This performance-based (observation) approach is also endorsed as a valid assessment system (pp. 202-204). The National Association for the Education of Young Children also endorses this approach. In contrast, direct assessments such as the Peabody Picture Vocabulary Tests and the Woodcock Johnson Achievement Tests would not meet several of these principles (e.g., aligned to state learning standards, linked to curriculum, covers all domains).

TS-GOLD is also consistent with the Head Start Child Development and Early Learning Framework and program goals and assessment model established and codified in 2011 by the U. S. Department of Health and Human Services. As a consequence, TS-GOLD is widely used as the assessment tool for program-related and child outcomes in Head Start Programs in all 50 states. There are also 22 state-level agreements in place for preschool assessment.²

Teachers typically receive 2 days of in-person training on the assessment from trained assessment coordinators as well as webinars as follow up support in implementing the assessment protocol. Research has found that this reduces bias and increases uniformity in ratings over the year. A web-based platform and application also is available, which increases efficiency and reliability of reporting. All of these elements are in place in Chicago.

2. TS-GOLD Reliability and Validity

The reliability coefficients (internal consistency) for the spring TS-GOLD subscales in the current study were as follows: literacy (.98), language (.98), math (.98), cognitive development (.98), socioemotional development (.98), physical health (.98), and the total scale score (.97). There were no differences by age or half-day versus full-day participation. Fall to spring correlations were of the expected magnitude ($r_s = .70$ to $.80$) and consistent with prior studies. The pattern was similar for children in full-day versus part-day classes. As also would be expected, TS-GOLD scores were positively associated with attendance. This supports concurrent validity. The significant association of full-day participation with attendance and chronic absences, which were measured by administrative records, indicates that program outcomes are independent of teacher ratings. The documented increase in instruction time between full-day and part-day classes further supports the validity of the link between CPC and school readiness skills (see eTable 2) rather than as partly a reflection of teacher bias.

3. Predictive Validity of Early Childhood Performance-Based Assessments and Teacher Ratings

Evidence supports the predictive validity of TS-GOLD and performance-based assessment by classroom teachers.³⁻⁷ For example, children rated as proficient in kindergarten readiness were 3.5 times more likely to exceed state norms in 3rd grade reading performance than children rated not proficient in kindergarten readiness.⁵ Extensive evidence from the Chicago Longitudinal Study and in other projects also demonstrate that teacher ratings beginning in early childhood predict later school achievement and performance, need for remedial education, rates of school completion, delinquency and crime, and adult well-being.⁷⁻¹⁰ The predictive validity of teacher ratings often exceeds that of standardized achievement tests.¹⁰

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eTable 1. Teaching Strategies GOLD Item and Subscale Means

Domain	Items*	Baseline (Oct.-Nov. 2012)	End of Year (May 2013)
Literacy	Notices and discriminates rhyme	2.92	4.66
	Notices and discriminates alliteration	2.76	4.58
	Notices and discriminates smaller & smaller units of sound	2.23	4.00
	Identifies and names letters	2.85	5.12
	Uses letter-sound knowledge	1.82	3.87
	Uses and appreciates books	3.66	5.38
	Uses print concepts	2.84	4.72
	Interacts during read-alouds and book conversations	2.94	4.76
	Uses emergent reading skills	2.84	4.59
	Retells stories	2.61	4.55
	Writes name	3.43	5.11
	Writes to convey meaning	2.67	4.05
	Subscale Average: Not imputed (Imputed)**	34.8 (33.3)	57.1 (57.2)
		n= 1724	1937
Language	Comprehends language	4.95	6.33
	Follows directions	4.75	6.25
	Uses an expanding expressive vocabulary	4.79	6.20
	Speaks clearly	5.14	6.35
	Uses conventional grammar	4.75	6.13
	Tells about another time or place	4.12	5.69
	Subscale Average:	28.8 (28.5)	37.8 (37.6)
	n= 1725	1927	
Math	Counts	3.66	5.35
	Quantifies	3.07	4.80
	Connects numerals with their quantities	2.90	5.01
	Understands spatial relationships	3.57	5.31
	Understands shapes	3.63	5.23
	Compares and measures	2.84	4.59
	Demonstrates knowledge of patterns	3.13	5.17
	Subscale Average:	23.7 (23.0)	36.3 (36.3)
	n= 1,723	1,937	
Cognitive	Attends and engages	4.48	5.88
	Persists	4.30	5.71
	Solves problems	4.24	5.68
	Shows curiosity and motivation	4.49	5.88
	Shows flexibility and inventiveness in thinking	3.94	5.54
	Recognizes and recalls	4.22	5.68
	Makes connections	4.39	5.82
	Uses classification skills	3.75	5.26
	Thinks symbolically	3.86	5.38
	Engages in socio-dramatic play	3.97	5.59
Subscale Average:	42.2 (41.8)	57.6 (57.5)	
	n= 1,826	1,998	
Socio-emotional	Manages feelings	4.50	6.02
	Follows limits and expectations	4.68	6.13
	Takes care of own needs appropriately	5.07	6.55
	Forms relationships with adults	5.66	7.02
	Responds to emotional cues	4.27	5.85
	Interacts with peers	4.23	5.85
	Makes friends	4.34	5.96
	Balances needs and rights of self and others	3.97	5.67
	Solves social problems	4.20	5.64
	Subscale average:	41.1 (40.6)	55.4 (55.4)
	n= 1,843	2,003	
Physical health	Demonstrates traveling skills	5.41	6.80
	Demonstrates balancing skills	5.24	6.73
	Demonstrates gross-motor manipulative skills	5.24	6.70
	Uses fingers and hands	5.18	6.72
	Uses writing and drawing tools	4.86	6.40
	Subscale average:	26.0 (25.7)	33.8 (33.8)
	n= 1,901	2,065	

*Items are rated on a scale of 0 to 9. Scores at or above the national average in spring are as follows for 3- and 4-year-olds: Literacy (39, 56), Language (31, 37), Math (27, 37), Cognitive (47, 58) , Socioemotional (46, 57) , and Physical health (29, 34).

eTable 2. Percentage of Time per Week in Instructional Activities by Full-Day and Part-Day Classes

Type of Activity	Part-Day (n = 29)	Full-Day (n = 21)	P-value
Language & Literacy	53.0 (9.9)	48.1 (6.1)	.051
Math	21.3 (6.1)	19.3 (3.2)	.180
Social-Emotional	6.4 (2.3)	8.8 (3.5)	.004
Science	7.3 (2.3)	8.4 (2.5)	.150
Focus of Instruction			
Language & Literacy			
Teacher-Directed	57.9 (11.4)	52.4 (12.13)	.111
Child-Initiated	42.1(11.4)	47.6 (12.13)	.111
Math			
Teacher-Directed	57.4 (10.3)	50.6 (12.0)	.037
Child-Initiated	42.6 (10.3)	49.4 (12.2)	.041
Science			
Teacher-Directed	52.8 (17.4)	53.1 (15.0)	.937
Child-Initiated	47.7 (18.5)	46.2 (16.3)	.760
Mean hours of total instruction for the school year	417.6 (39.3)	936.0 (44.7)	<.001
Total available hours for the year	543	1267	<.001

Note. The sample size is the number of classrooms. 2 full-day and 4.5 part-day (9 sessions, A.M & P.M.) classrooms did not report time use. Teachers provided monthly ratings for instructional time and focus of instruction. Standard deviations are in parentheses. Total hours of instruction are estimated from ratings on language & literacy, math, socioemotional development, and science exclusive of lunches, recess, and snack times. The 2012-2013 school year had 181 instructional days, which included 7 make-up days due to a teachers' strike in September 2012. The total available hours for the year is the class time per day x 181. Full-day classes had 45 minutes per day allocated to lunch and recess. Part-day classes had 20 minutes of equivalent activities. Based on the percentage time values reported by teachers (first section of table), the total number of hours of instruction for the year by domain were as follows (full-day[SD], part-day[SD]): language & literacy (451[72], 224[59]), math (181[33], 89[27]), socio-emotional (83[34], 26[9]), and science (79[22], 31[12]).

eTable 3. Child-Parent Center Same-School Full-Day Versus Part-Day Preschool: Fully Imputed Marginal Means

	Full-Day Group (N = 409)	Part-Day Group (N = 573)	Difference (95% CI)	<i>P</i> -value	Stand. Mean Diff.
School Readiness Skills					
Literacy (Raw score; 12 items)	64.1	58.3	5.8 (.3-11.2)	.04	.33
At/above the national norm (%)	87.4	78.9	8.5 (.01-.17)	.04	.32
Language (6 items)	39.8	37.3	2.5 (.8-4.2)	.004	.33
At/above the national norm (%)	82.2	67.3	14.8 (.01-.29)	.04	.55
Math (7 items)	39.8	36.3	3.5 (.9-6.1)	.008	.37
At/above the national norm (%)	85.8	75.6	10.2 (.04-.16)	.001	.37
Cognitive development (10 items)	59.4	57.6	1.8 (-1.8-5.5)	.32	.15
At/above the national norm (%)	72.1	68.8	3.3 (-.17-.23)	.93	.08
Socioemotional development (9 items)	58.3	54.6	3.7 (.7-6.7)	.02	.31
At/above the national norm (%)	74.8	60.6	14.2 (-.02-.31)	.18	.39
Physical health (5 items)	35.3	33.6	1.7 (.6-2.8)	.003	.29
At/above the national norm (%)	82.3	73.5	8.8 (-.04-.21)	.19	.28
Total Score (49 items, 6 subscales)	296.7	277.7	19.0 (.2-34.8)	.02	.31
At/above the national norm (%)	81.3	64.7	16.6 (.02-.32)	.03	.58

Note. Sample includes 982 CPC children from 11 sites offering full-day preschool. Coefficients are from linear or probit regression analysis (generalized linear models via maximum likelihood) transformed to marginal means, and they are adjusted for child gender, race/ethnicity, age (months), subsidized lunch status, special education, school-level achievement, and fall baseline performance (school readiness or attendance). For school readiness, a dichotomous indicator for a later fall assessment also was included. The *P*-value is the probability level of the adjusted mean or percentage difference. CIs are for the 95% level. Standard errors, and, thus, *p*-values, are adjusted for variation among program sites by the Huber/White/sandwich correction. The input variables for multiple imputation through the Expectation-Maximization approach were as follows: school, age, CPC participation, full-day participation, race/ethnicity, special education, eligibility for subsidized lunch, gender, and fall and winter TS-GOLD scores.

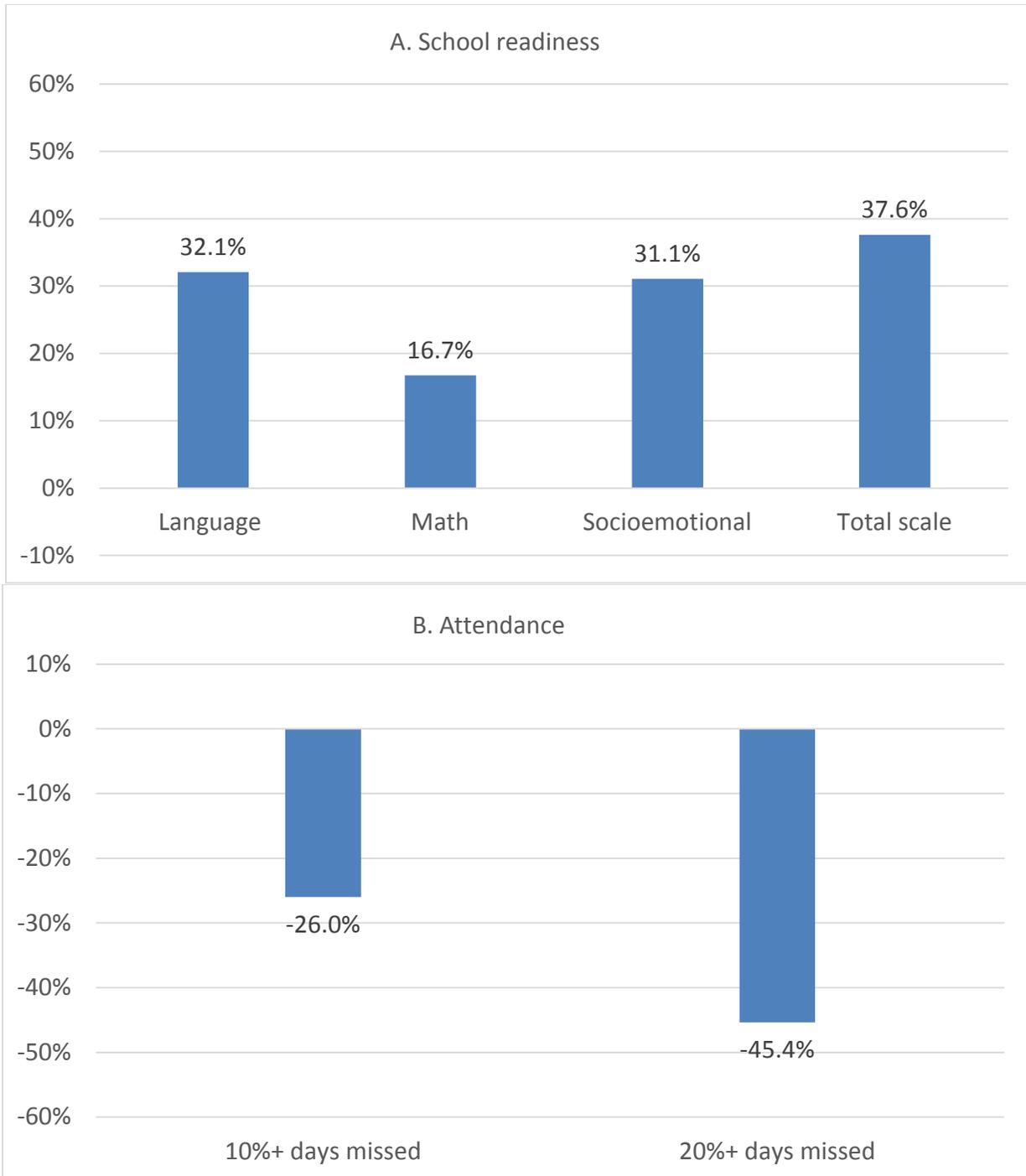
eTable 4. Multiple Imputation Procedure for Missing Teaching Strategies GOLD Scores

Missing data were imputed using the Expectation-Maximization procedure in SPSS Version 22. Estimates were made simultaneously using maximum likelihood. Any available fall, winter, or spring score for each TS-GOLD domain was used to estimate missing fall, winter, or spring values. The input variables to estimate scores were as follows: age of child in months, CPC participation, full day (vs. part-day) preschool participation, race/ethnicity (Hispanic and black), special education status, free lunch eligibility status, gender, and the unique school attended by the child. This process imputed any TS-GOLD value if at least one was collected throughout the year, for a final sample size of 982. The predictors of 3 spring program outcomes and of missing on TS-GOLD are shown below.

Variable	(1) Average Attendance	(2) Spring Total Score	(3) Spring Literacy	(4) Missing Spring Score	(5) Missing Any Score
CPC full-day	0.0683** (0.0100)	30.71** (4.247)	8.458** (1.319)	-0.0823* (0.0356)	0.0112 (0.0391)
Age in months	-0.000251 (0.000730)	4.966** (0.310)	1.446** (0.0962)	-0.000335 (0.00262)	-0.00655* (0.00283)
Female	-0.00261 (0.00870)	6.378 (3.710)	1.938 (1.148)	-0.0322 (0.0312)	-0.00569 (0.0337)
Free lunch status	-0.0542** (0.0162)	-14.26 (7.972)	-5.741* (2.487)	-0.228** (0.0629)	-0.141* (0.0625)
Hispanic	-0.00317 (0.0228)	0.249 (11.88)	1.668 (3.708)	-0.0415 (0.0762)	-0.00994 (0.0910)
Black	0.00361 (0.0217)	13.19 (11.84)	3.924 (3.695)	-0.0912 (0.0837)	-0.0214 (0.0898)
School	-0.00236** (0.000480)	-1.063** (0.232)	-0.214** (0.0718)	0.0150** (0.00172)	0.0207** (0.00194)
Special education	0.0172 (0.0218)	-34.22** (11.29)	-10.78** (3.271)	0.171* (0.0847)	0.232** (0.0780)
Constant	0.892** (0.0401)	45.12* (19.92)	-8.871 (6.196)	-0.112 (0.402)	0.389 (0.407)
Observations	982	650	661	982	982
R-squared	0.078	0.463	0.420	0.092	0.115

Note. 808 children (82.3%) had valid spring scores before imputation. 707 children (72%) had valid fall and spring scores before imputation. Models 1-3 are linear regressions. Models 4 and 5 are probit regression (marginal effect coefficients) for missing Spring TS-GOLD scores and missing any TS-GOLD score, respectively.

** p<0.01, * p<0.05



eFigure. Percentage Change Relative to Part-Day Preschool Associated with Full-Day Preschool Participation. Section A shows select subscale percentage changes and the total score for Teaching Strategies GOLD at the end of the preschool year (May 2013). Section B shows chronic absences for official school records. Values are the ratio of the mean group difference divided by the adjusted mean of the part-day group. Mean differences used in the percentage change metric were significant at the 95% level (two-tailed). The covariates for the adjusted means were fall baseline performance, gender, race/ethnicity, age in months, subsidized lunch status, special education, and school-level achievement. For school readiness the timing of the fall assessment is also taken into account. Values are corrected for clustering based on the Huber/White/sandwich method. Based on raw score mean differences, improvements in school readiness associated with full-day preschool were equivalent to about one-third of the school year (3-4 months) for language, math, socioemotional development, the total score, and physical health. Improvements for literacy were 4-5 months and cognitive 1-2 months.