Extending the school day for our youngest scholars: Learning gains in full- and half-day 4K classrooms

Authors: Rebecca Bier, Rosie Miesner, Eric Grodsky, Beth Vaade, Culleen Witthuhn, Grady Brown.

EXECUTIVE SUMMARY

The Madison Metropolitan School District (MMSD) began offering free, universal, half-day four-year-old kindergarten (4K) in 2011-12. Beginning in the 2021-2022 school year, MMSD began phasing in full-day 4K at select schools across the district. The Madison Education Partnership (MEP), in collaboration with the MMSD Departments of Early Learning and Research & Innovation, conducted an evaluation of the program to understand how enrolling in full-day 4K affects student learning relative to half-day 4K. In addition to assessing gains in achievement over the course of the year, we observed in classrooms and interviewed teachers to examine qualitative differences in instruction, time use, and culturally responsive practices across full- and half-day classrooms. Results from the qualitative analysis will be discussed in an upcoming report.

We found:

- On average, students across both full- and half-day sections saw growth on literacy, numeracy, and executive functioning assessments from fall 2021 to spring 2022.

- There were no reliably estimated differences in growth, on average, between students enrolled in the full- and half-day programs, even after controlling for differences in student demographics across the two groups.

- These findings are consistent across demographic groups. For example, when looking solely at black students or Hispanic students, we did not find differences in achievement growth across full- and half-day classrooms. Further, we did not see differences for students receiving free-/reduced-priced lunch nor those entering 4K with special education designations.
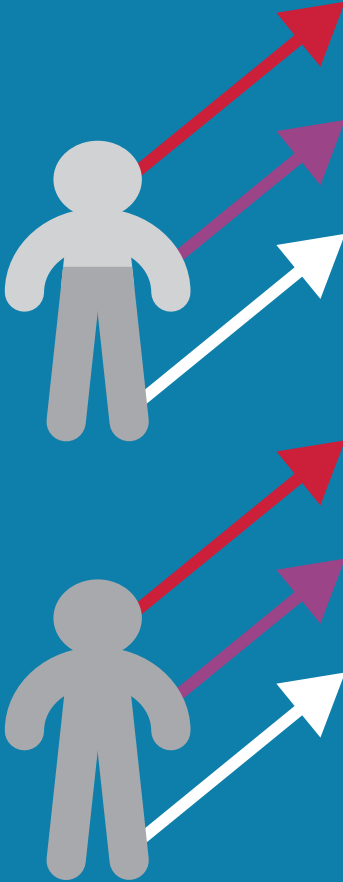
How did we evaluate the program?

This evaluation explores differences in student learning in literacy, numeracy, and executive functioning in full-day and half-day 4K. We measured achievement in these areas at the beginning and end of the school year for around 12 randomly chosen students from each of the 16 full-day sections (16 teachers) and 27[1] half-day 4K sections (14 teachers). As part of an equity strategy to address persistent gaps in outcomes, MMSD chose to initially offer full-day 4K programming at schools that serve relatively high numbers of students of color and students from families that are economically constrained. We therefore selected 29 half-day 4K sections that were most similar to the full-day sections based on demographic characteristics of the students they serve. In total, we assessed 168 full-day students and 238 half-day students in the fall and spring of the 2021-22 school year.

We measured learning using the following assessments:

- **Phonological Awareness Literacy Assessment (PALS):** 4K teachers administer PALS one-on-one with students, evaluating students' alphabet knowledge, sound and print awareness, and writing ability.

- **Woodcock-Johnson IV Achievement - Applied Problems (WJIV):** MEP graduate students conducted WJIV one-on-one with students to assess their ability in number recognition, counting, and ability to solve basic math problems.

- **Head Toes Knees Shoulders-Revised (HTKS):** MEP graduate students administered the HTKS which assesses students' self-regulation, working memory, and attention span.

- **Teaching Strategies - GOLD (TS GOLD):** 4K teachers record whether a given student has reached certain objectives in four domains: language, literacy, math, and social-emotional skills, based on observing students in class.

While we selected half-day classrooms with students who were most similar to full-day students, there were several differences across the two groups. Full-day classrooms on average include more students of color and fewer children whose parents enrolled in college than do half-day classrooms. However, differences in fall assessment scores across full- and half-day sections were small. We control for differences in student characteristics and fall assessment scores and we do not believe these differences account for the results described in this report. For more information on baseline differences across the full- and half-day sections, see our report here.

---

1   We originally selected 29 half-day sections. Two sections at one school were unable to participate in spring assessments and therefore we only include 27 half-day sections in this analysis.
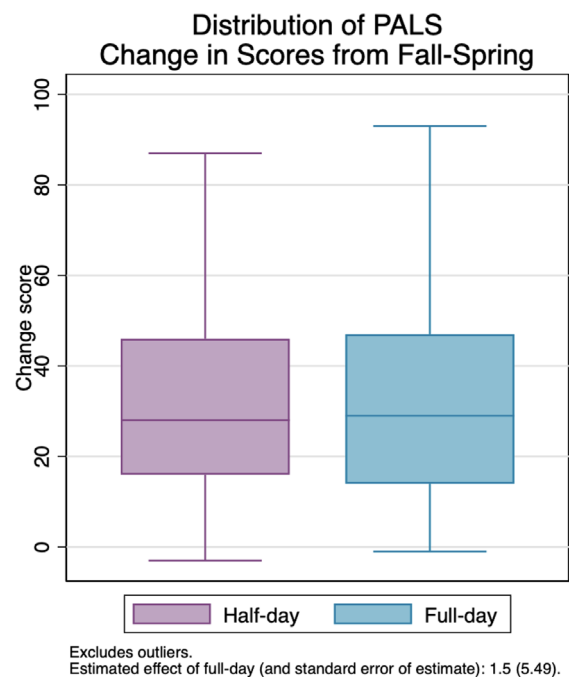
What did we find?

On average, students experienced gains in achievement across all measured domains. These gains, however, were about the same for students enrolled in full- and half-day classes. Full-day students began the school year with slightly lower scores than half-day students, which aligns with the district's intentions of serving the students deemed the highest need for full-day 4K. Over the course of the year, those full-day students gained similar amounts in literacy, numeracy, and executive functioning as the half-day students.

In addition to estimating the effects of enrolling in full-day 4K on all students, we analyzed whether there were different effects across different types of students. We did not find differences between achievement gains made by Black and Hispanic students and those made by other students across all classrooms. We also did not find a difference in the effect of full-day 4K across racial/ethnic groups. Similarly, there were not substantive differences in gains in full- or half-day across other subgroups of students: by participation in the free- or reduced-priced lunch program, English language learner status, special education status (designated in the fall 2021), or gender. See tables 1 through 3 in the Appendix for further details.

Literacy: On average, full-day students entered 4K scoring 38 points on PALS and gained an average of 33 points over the school year. Half-day students entered scoring 45 points and gained an average of 31 points over the course of the school year. Figure 1 plots the range of observed gains for students in half-day (purple, left) and full-day (teal, right) 4K programs. The shaded box indicates the range of literacy growth for the middle 50% of students. The line in the middle of the box indicates the expected growth in literacy for the typical student (the median) by program type. The median level of growth, as well as the range of growth for the middle 50% of students, are essentially identical across groups. After adjusting for differences among students in race, gender, parent education, English language learner status, and free/reduced-price lunch participation, the two-point difference in gains is not reliably different from no difference at all.
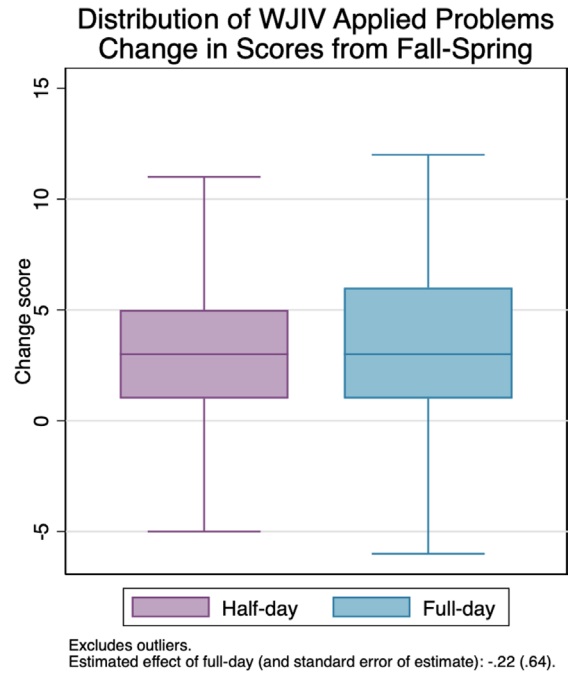
Figure 1: Fall-spring gains in literacy

Distribution of PALS
Change in Scores from Fall-Spring

Excludes outliers.
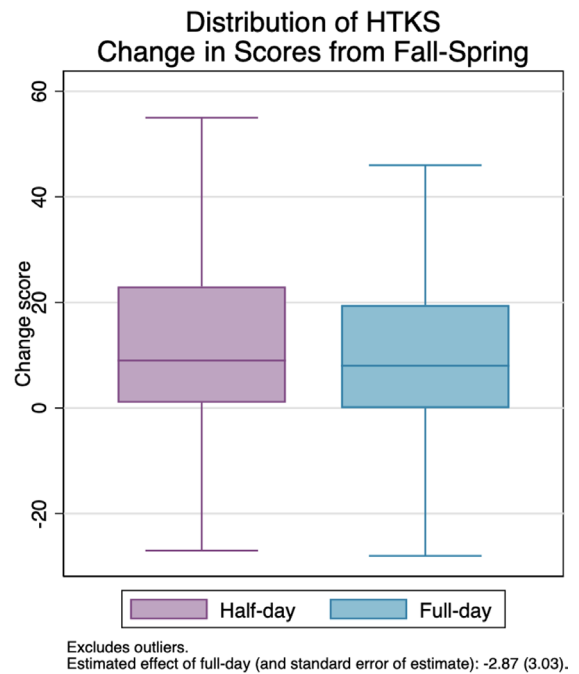Estimated effect of full-day (and standard error of estimate): 1.5 (5.49).

Math: On average, full-day students entered 4K scoring 9 points on WJIV and gained an average of 3 points over the school year. Half-day students entered scoring 10 points and gained an average of 3 points over the course of the school year. Figure 2 shows that, while the median gains across program types were identical, the range of growth for the middle 50% of students in full-day program may have been slightly greater than that of half-day students. Adjusting for differences among students in other attributes did not change this result.

Executive Functioning: On average, full-day students entered 4K scoring 22 points on HTKS and gained an average of 10 points over the school year. Half-day students entered scoring 27 points and gained an average of 12 points over the course of the school year. There were no differences in growth at the median, as shown in Figure 3. The difference in average growth was due to slightly higher levels of growth among half-day students above the median. Adjusting for differences among students in other attributes did not change this result.

Figure 2: Fall-spring gains in math

Distribution of WJIV Applied Problems
Change in Scores from Fall-Spring

Excludes outliers.
Estimated effect of full-day (and standard error of estimate): -.22 (.64).

Figure 3: Fall-spring gains in executive functioning

Distribution of HTKS
Change in Scores from Fall-Spring

Excludes outliers.
Estimated effect of full-day (and standard error of estimate): -2.87 (3.03).

We also analyzed domains assessed using TS-GOLD, an observational tool teachers use three times during the year to record student growth in four domains: language, literacy, math, and social-emotional skills. Similar to other measures, median gains in scores across all domains were similar for full- and half-day students, as seen in Figure 4. Adjusting for differences among students in other attributes, we did not find differences in average gains across the two groups on any domains.

Figure 4: Fall-spring gains in TS-GOLD domains

Distribution of TS-GOLD
Change in Scores from Fall-Spring
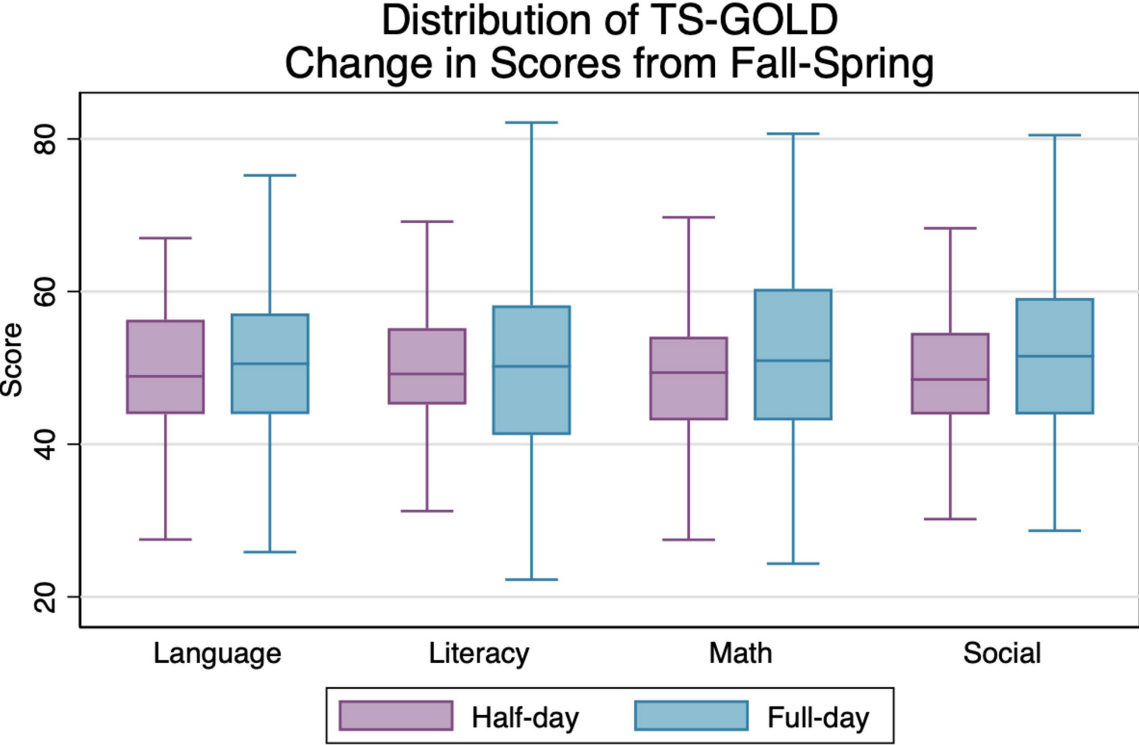
Scores standardized to a mean of 50, standard deviation of 10.
Excludes outliers.

What do these results mean for the full-day 4K program?

Why didn't students in full-day sections experience more growth over the school year than their peers attending half-day sections? There may be a few reasons why growth in the MMSD full-day 4K program did not exceed growth in the half-day program during the 2021-2022 school year. First, it may be that the pedagogical skills of full-day teachers are, on average, not as strong as those of half-day teachers. Given full-day 4K created the need for additional staff to cover the added sections, many full-day teachers were new to 4K classrooms and curricula. Less experienced teachers may not have been able to take advantage of the extra class time as effectively as more experienced teachers. In fact, 6 of 16 teachers in full-day sections were new to 4K (38%), as were 3 of 14 teachers teaching half-day sections (21%). Put another way, on average, full-day teachers had less total years of 4K teaching experience (3 years) than half-day teachers (4 years). However, when we consider only experienced 4K teachers, the results do not change substantively.

Another plausible explanation for the uniformity of growth across full- and part-day programs could be student attendance. Our expectation of a full-day advantage is predicated on the belief that full-day students spend more time in school. If absenteeism were greater in full- than in half-day classes, this advantage would be compromised. In analyses not shown, however, we find that average attendance across the full- and half-day sections was similar. When we restrict the analyses to include only students who attended school at least 80% of the year, the findings do not change.

It is also possible that teachers in a full-day setting were simply unable to take full advantage of the additional time afforded them to extend their students' learning. This could reflect challenges the school district confronted following the initial phases of the pandemic, when the district experienced serious personnel shortages and needed to deploy substitutes from outside and inside the district to cover classrooms. It could also highlight a need for professional and/or curricular development to support teachers as they move from a half- to a full-day format. For these explanations, we can only speculate as to if they may contribute. In this report, we cannot reliably know why full-day 4K did not produce the learning gains we expected.

Finally, evaluations of full-day 4K programs in other contexts have found a range of results. Several rigorous studies have provided evidence that attending full-day 4K improves student learning in literacy, numeracy, social emotional skills, and motor skills (Atteberry et al., 2019; Herry et al., 2007; Reynolds et al., 2014; Robin et al., 2006). However, two other studies found no effects of full-day 4K on academic growth (Leow & Wen, 2017; Valenti & Tracey, 2009). Mixed results may point to heterogeneity in the ways in which full-day 4K has been implemented and potential contextual factors that influence its efficacy.

What are the limitations of the study?

There are several limitations of the study design. While we control for many student characteristics that might affect a student's achievement growth over the course of the year, there are several characteristics we are unable to control for, such as income level (beyond free/reduced lunch participation). If students' in full-day section are different on average in these unobserved characteristics, this may affect our ability to draw comparisons between the two groups. However, we believe that given the similarities across the schools selected in the sample and controlling for many observable characteristics likely to influence student learning, it is unlikely that these unobserved differences would substantially change the interpretation of the results.

Further, it is possible that full-day 4K extends substantial unobserved benefits to children and their families. The semi-structured time they enjoy with peers may further the social development of children in ways we do not observe and may ease their transition into the full-day format of five-year-old kindergarten. Full-day may also ease the scheduling constraints of parents, freeing them to increase their engagement in the labor market and/or making it possible for them to choose from a wider range of labor market or educational opportunities, both of which are likely to confer future benefits on their children. These and other possible effects of full-day 4K were outside of the scope of our evaluation, but that does not make them unimportant.

What's Next

Working closely with the Departments of Early Learning and Research & Innovation, MEP is helping MMSD understand these findings and what they may mean for programming decisions in the near future. MMSD is expanding its full-day 4K program to include an additional 12 sections in 5 schools, including 3 community sites. In August, the Department of Early Learning began using the preliminary findings to create focused professional learning for principals, teachers, educational assistants at welcome back and future professional learning throughout the year. In addition, MMSD is planning for a second year of the evaluation to continue gathering qualitative and quantitative data on program implementation and outcomes. It is extremely important to MMSD to ensure continuous improvement and growth of the full-day 4K program in Madison.

mep Madison Education Partnership

Want to know more about MEP and 4K?

Here's a comprehensive list of our previous early education work.

References

Atteberry, A., Bassok, D., & Wong, V. C. (2019). The Effects of Full-Day Prekindergarten: Experimental Evidence of Impacts on Children's School Readiness. *Educational Evaluation and Policy Analysis, 41*(4), 537–562. https://doi.org/10.3102/0162373719872197

Herry, Y., Maltais, C., & Thompson, K. (2007). Effects of a Full-Day Preschool Program on 4-Year-Old Children. *Early Childhood Research & Practice, 9*(2). https://eric.ed.gov/?id=EJ1084948

Leow, C., & Wen, X. (2017). Is Full Day Better Than Half Day? A Propensity Score Analysis of the Association Between Head Start Program Intensity and Children's School Performance in Kindergarten. *Early Education and Development, 28*(2), 224–239. https://doi.org/10.1080/10409289.2016.1208600

Reynolds, A. J., Richardson, B. A., Hayakawa, M., Lease, E. M., Warner-Richter, M., Englund, M. M., Ou, S.-R., & Sullivan, M. (2014). Association of a full-day vs part-day preschool intervention with school readiness, attendance, and parent involvement. *JAMA, 312*(20), 2126–2134. https://doi.org/10.1001/jama.2014.15376

Robin, K. B., Frede, E. C., & Barnett, S. W. (2006). *Is More Better? The Effects of Full-Day vs. Half-Day Preschool on Early School Achievement* (NIEER Working Paper, p. 22). National Institute for Early Education Research. http://nieer.org/wp-content/uploads/2016/08/IsMoreBetter.pdf

Valenti, J. E., & Tracey, D. H. (2009). Full-Day, Half-Day, and No Preschool: Effects on Urban Children's First-Grade Reading Achievement. *Education and Urban Society, 41*(6), 695–711. https://doi.org/10.1177/0013124509336060

Appendix

Subgroup analyses

Below we present the main effects (second column), the effect of full-day 4K on achievement for all sampled students, and the effect of full-day 4K on the subgroup of students relative to other students (third column). For example, in Table 1, the first row (Race/ethnicity = Black) and third column (Subgroup effect) shows the effect of enrolling in full-day 4K on literacy for black students relative to the effect of enrolling in full-day 4K for students of other race/ethnicities. In this case, there is no meaningful difference in the effect of full-day 4K on literacy scores for Black students than other students. We include standard errors (se) in parentheses.

Table 1: Subgroup analysis on literacy (PALS)

Subgroup	Main effect (se)	Subgroup effect (se)
Race/ethnicity = Black	0.59 (6.85)	2.92 (9.82)
Race/ethnicity = Hispanic	5.43 (5.45)	-14.79 (12.44)
Free/reduced-priced lunch participation	0.46 (6.92)	2.48 (8.71
English language learner	4.47 (5.60)	-9.34 (11.24)
Special education status	1.61 (5.68)	-1.72 (14.66)
Sex = female	2.78 (6.96)	-2.24 (8.65)

No effects are statistically significant at the 5% confidence level.

Table 2: Subgroup analysis on math (WJIV)

Subgroup	Main effect (se)	Subgroup effect (se)
Race/ethnicity = Black	-0.01 (0.75)	-0.82 (1.16)
Race/ethnicity = Hispanic	-0.53 (0.66)	0.98 (1.68)
Free/reduced-priced lunch participation	-0.06 (0.76)	1.08 (0.83)
English language learner	-0.66 (0.63)	1.52 (0.43)
Special education status	-0.05 (0.67)	1.99 (0.26)
Sex = female	-0.18 (0.92)	0.99 (0.91)

No effects are statistically significant at the 5% confidence level.

Table 3: Subgroup analysis on executive functioning (HTKS)

Subgroup	Main effect (se)	Subgroup effect (se)
Race/ethnicity = Black	-2.51 (4.00)	-0.14 (6.85)
Race/ethnicity = Hispanic	-3.43 (3.36)	0.25 (6.38)
Free/reduced-priced lunch participation	-1.22 (3.74)	-2.16 (5.18)
English language learner	-3.54 (3.33)	1.15 (5.79)
Special education status	-2.87 (3.20)	0.06 (8.28)
Sex = female	-2.33 (4.52)	-0.68 (5.14)

No effects are statistically significant at the 5% confidence level.

Madison
Education
Partnership

MEP brings together the Madison Metropolitan School District (MMSD) and the Wisconsin Center for Education Research (WCER) at the University of Wisconsin-Madison in a locally based, nationally relevant, research-practice partnership. MEP joins research and practice by engaging in mutually defined, high-quality, problem-based research that contributes to policy, builds capacity, and strengthens practice.

Collaborating on MEP are UW Madison researchers and faculty; MMSD administration, teachers and staff; and stakeholders from the broader Madison community. The partnership enables research to be conducted more quickly and results released more efficiently—to advance strategies that benefit Madison students, families, and schools.

mep.wceruw.org

MADISON METROPOLITAN SCHOOL DISTRICT

Wisconsin Center for
Education Research
SCHOOL OF EDUCATION
UNIVERSITY OF WISCONSIN–MADISON