Technical appendix for:
"Should kindergartners be redshirted? Costs likely outweigh academic benefits"

Megan Kuhfeld and Sofia Postell

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1. Introduction

The purpose of this technical appendix is to share detailed results and to more fully describe the sample and methods used in the research included in the brief *Should kindergartners be redshirted? Costs likely outweigh academic benefits*. We investigated three main research questions in this brief:

1. How prevalent is redshirting? Did it shift during the COVID-19 pandemic?
2. Which students are most likely to redshirt?
3. Do the students that redshirt maintain an academic advantage over on-time entrants as they move through elementary school?

2. Literature Review

Rates of redshirting reported by prior studies are shown in Table 1. Recent research that used national data from the kindergarten class of 2010-11 reported a 6% redshirting rate. Studies using state or district-level data found redshirting rates ranging from 3.5% - 7%, with rates being dependent on state policies on kindergarten entry cutoff dates.

Existing studies of the initial and longer-term effects of redshirting on test scores and other academic outcomes are described in Table 2. Initial effects of redshirting on kindergarten outcomes were positive and ranged from 0.2 to 0.7 standard deviations (SDs). The long-term effects are more variable, with redshirting in kindergarten having both positive and negative effects in later grades. One 2019 study found that redshirted students were more likely to take advanced courses in middle and high school, while other studies found negative or null effects or that redshirting widened existing achievement gaps.

3. Data

Sample

The data for this study are from the NWEA anonymized longitudinal student achievement database. School districts use NWEA® MAP® Growth™ assessments to monitor elementary and secondary students' reading and math achievement and gains, with assessments typically administered in the fall (usually between August and November), winter (usually December to March), and spring (late March through June). The NWEA data also include demographic information, including student race/ethnicity, gender, and age at assessment. An indicator of student-level socioeconomic status is not available. However, a set of school-level characteristics, including school-level free or reduced priced lunch (FRPL) eligibility was obtained from the 2019-20 school-level Common Core of Data (CCD) files from the National Center for Education Statistics. We classified schools into poverty levels based on the percentage of students with free or reduced price lunch (FRPL) eligibility, where low-poverty schools had less than or equal to 25% FRPL eligibility, mid-poverty schools had greater than 25% and less than or equal to 75% FRPL eligibility, and high-poverty schools had greater than 75% FRPL eligibility.

We have two primary samples in our study. First, to address the first two research questions, we focus on the school entry ages for the kindergarten classes entering school from fall 2017 to fall 2025. Descriptive information for the students in the first sample by cohort and subject is

provided in Table 3. Descriptive information for the schools in our main sample along with comparison information on the population of U.S. schools serving kindergarten is provided in Table 4. The schools in this sample represent roughly one in four U.S. public schools that enroll kindergarten students. Our samples reflect a diversity of schools from across various locales (urban, suburban, rural, and town). Relative to the population of U.S. schools, our first sample (when pooled across years) reflects schools serving a slightly lower percentage of White students, a slightly higher percentage of Black students and suburban schools, and a slightly higher percentage of urban and rural schools.

Second, to address the final research question, we follow students in the kindergarten class of 2021-22 longitudinally across four years. Students in this sample had observed test scores at the start of kindergarten in fall 2021 and at the end of 3rd grade in spring 2025. The schools in this sample represent roughly one in ten U.S. public schools that enroll kindergarten students. Relative to the population of U.S. schools, our second sample reflect schools serving a slightly lower percentage of White students, slightly higher percentages of Black and Hispanic students, and a higher percentage of urban schools.

Age of entry

State age cut offs are collected from the Education Commission of the States (ECS). Table 5 provides the entry cutoff date by state over three time periods. We used updated age cut offs reported by ECS in 2017, 2020, and 2023 and removed any state that allows each district to set its own cut off (Massachusetts, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, and Vermont) or that meaningfully changed their start date over the course of our study (Michigan, Nebraska, and Wyoming). State cutoff dates ranged from 7/31 to 10/15. The most common cutoff data was 9/1, with 22 states (43%) using 9/1 in 2023.

Student birthdates are provided in the MAP Growth rostering process. Within each school year, we used students' birthdate and the state age cut-off to calculate a student's age at the entry cut off.

Measure of achievement

Student test scores from the NWEA MAP Growth reading and math assessments, called RIT scores, were used in this study. MAP Growth is a computer adaptive test that precisely measures achievement, even for students above or below grade level and is vertically scaled to allow for the estimation of gains across time. MAP Growth assessments are typically administered three times a year (fall, winter, and spring) and are aligned to state content standards. Test scores are reported on the RIT (Rasch unIT) scale[1], which is a linear transformation of the logit scale units from the Rasch item response theory model.

4. Methods

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[1] In the 2023-24 school year, NWEA began the phased implementation of an enhanced item-selection algorithm for the MAP Growth assessment. The enhanced item-selection algorithm (EISA) prioritizes grade-level content while still adapting to off-grade items where necessary to provide items of appropriate difficulty for students. All scores in this study are converted to be on the EISA scale.

RQ1: How prevalent is redshirting? Did it shift during the COVID-19 pandemic?

We examined trends in redshirting using MAP Growth kindergarten fall data for each kindergarten class that entered school from fall 2017 to fall 2025. Specifically, within each class, we calculated the percentage of redshirters (e.g., students who were 6 years old or older at the age cutoff date in the year of their enrollment AND did not have a kindergarten enrollment record in the prior year). We classified students into four groups based on their age of entry:

- **Early entrants:** These students are not yet 5 years old at the state's cut off. We removed these students from our analyses.
- **On-time entrants:** We classified children as on-time entrants if their birth month is in the 12 months before their state's cutoff and enroll in kindergarten in year y. They are between the age of 5.00 and 5.99 years at the cutoff in the year of enrollment.
- **Redshirters:** We classified children as redshirters if their fifth birthday falls before their state's cutoff date for kindergarten enrollment in year y-1, but they do not enroll in kindergarten until year y (a year after they are eligible). These students are 6 years old or older at the cut off age in the year of their enrollment.
- **Kindergarten repeaters:** Students with kindergarten enrollment records in both year y-1 and year y.

Figure A1 provides a visual display of the groupings relative to the state cut off point.

RQ2: Which students are most likely to redshirt?

To answer this research question, we calculated redshirting rates within each of four categories: (a) gender, (b) race/ethnicity, (c) school poverty level, and (d) school urbanicity using the previously described definition of redshirters. We then looked at trends within these samples and compared rates of redshirting between groups.

RQ3: Do the students that redshirt maintain an academic advantage over on-time entrants as they move through elementary school?

We followed one cohort of kindergartners from school entry to third grade to estimate whether redshirters' academic advantage was maintained as they moved through school. Specifically, we tracked the cohort of students who started kindergarten in fall 2021 through the end of their third-grade year in spring 2025. Within each term, we calculated the average math and reading scores of redshirters and on-time entrants and the standardized mean difference between the two groups. The standardized mean difference in term *t* in grade *g* was calculated as:

$$ES_{tg} = \frac{\overline{\text{RIT}}_{tgR} - \overline{\text{RIT}}_{tgOTE}}{\sqrt{\dfrac{(N_{tgR} - 1)\text{SD}^2_{tgR} + (N_{tgOTE} - 1)\text{SD}^2_{tgOTE}}{N_{tgR} + N_{tgOTE} - 2}}},$$

where $\overline{\text{RIT}}_{tgR}$ is the average test score for redshirters in term *t* and grade *g*; $\overline{\text{RIT}}_{tgOTE}$ is the average test score for on-time entrants in term *t* and grade *g*; SD_{tgR} and SD_{tgOTE} are the corresponding standard deviation (SD) estimates; and N_{tgR} and N_{tgOTE} are the observed sample size in term *t* and grade *g*, respectively. The standardized effect sizes by grade, term, and subject are reported in Table 7.

5. Supplemental Analyses

RQ1 Sensitivity Analysis

As a sensitivity analysis, we limited the sample to schools that consistently tested with MAP Growth each spring between fall 2017 and fall 2025. This analysis allows us to test whether the redshirting trends are sensitive to schools switching in and out of the MAP Growth sample over time. Results are presented in Table 8. Rates of redshirting are slightly higher in the consistent school sample but overall rates are still 5% and trends are parallel between the two samples.

RQ3 Sensitivity Analysis

Given that the K class of 2021-22 had the highest rates of redshirting (due to COVID-19), we also compare redshirters against on-time entrants in the next two kindergarten classes to see if the result replicated. Figure A2 presents the standardized mean differences between redshirters and on-time entrants by cohort and subject. While the more recent kindergarten cohorts have fewer available observed timepoints in the later grades, the trend of quick fadeout of redshirters' academic advantage is quite consistent in the recent cohorts.

6. References

Bassok, D., & Reardon, S. F. (2013). "Academic Redshirting" in Kindergarten: Prevalence, Patterns, and Implications. *Educational Evaluation and Policy Analysis*, 35(3), 283-297. https://doi.org/10.3102/0162373713482764

Cascio, E. U., & Schanzenbach, D. W. (2016). First in the class? Age and the education production function. *Education Finance and Policy, 11*(3), 225–250. https://doi.org/10.1162/EDFP_a_00191

Cook, P. & Kang, S. (2018). The School-Entry-Age Rule Affects Redshirting Patterns and Resulting Disparities in Achievement. NBER Working Paper 24492. https://doi.org/10.3386/w24492.

Dhuey, E., Figlio, D., Karbownik, K. and Roth, J. (2019). School Starting Age and Cognitive Development. J. Pol. Anal. Manage., 38: 538-578. https://doi.org/10.1002/pam.22135

Fidel, R., Shores, K. A., & Whitaker, A. (2024). Changes in Kindergarten Redshirting during the COVID-19 Pandemic. EdWorkingPaper No. 24-1038. Annenberg Institute for School Reform at Brown University.

Fortner, C. K., & Jenkins, J. M. (2017). Kindergarten redshirting: Motivations and spillovers using census-level data. *Early Childhood Research Quarterly*, 38, 44–56. https://doi.org/10.1016/j.ecresq.2016.09.002

Graue, M. E., & DiPerna, J. (2000). Redshirting and early retention: Who gets the" gift of time" and what are its outcomes? *American Educational Research Journal*, 37(2), 509-534.

Huang, F. L. (2015). Investigating the Prevalence of Academic Redshirting Using Population-Level Data. AERA Open, 1(2). https://doi.org/10.1177/2332858415590800

Raffaele Mendez, L. M., Kim, E. S., Ferron, J., & Woods, B. (2015). Altering School Progression Through Delayed Entry or Kindergarten Retention: Propensity Score Analysis of Long-Term Outcomes. *The Journal of Educational Research*, 108(3), 186–203. https://doi.org/10.1080/00220671.2013.867474

Reeves, R. (2022). Who redshirts? Brookings. https://www.brookings.edu/articles/who-redshirts/

Schanzenbach, D. W., & Larson, S. H. (2017). Is your child ready for kindergarten? Education Next, 17(3), 18–24.

Table 1. Summary of Studies on Prevalence of Redshirting

Citation	Sample	K Entry Year	Redshirting rates	Who is most likely to redshirt
Graue, & DiPerna (2000)	Random sample of 8000 Wisconsin students	1996	7%	Boys with summer birthdays; children with disabilities
Fortner & Jenkins(2017)	262,000 students in North Carolina public schools	2008-2010	4% in 2008-09	Children with disabilities
Schanzenbach & Larson (2022)	National (ECLS-K 2010-11)	2010	6.20%	Children of highly educated parents; Boys
Reeves (2022)	National (ECLS-K 2010-11)	2010	6%	Children of highly educated parents; White or Asian children; Boys
Bassok & Reardon (2013)	10,700 children born in 2001 from ECLS-B; 12,000 kindergarten in 1998 ECLS-K	2006; 1998	4-5.5%	White children; Boys; high-SES children
Huang. (2015)	80,000 children born in Virginia	2011-2013	3.50%	White children; Boys; high-SES children; Children with disabilities
Cook & Kang (2018)	86,000 North Carolina public school students	2012-2013	6.70%	Boys; White students
Fidel Shores & Whitaker (2024)	87,000 Delaware public school kindergarten students	2015-2023	3.6% prior to 2020; 5.6% in 2021; 4.5% in 2022	Increases in redshirting rates in 2021 found for groups not typically more likely to redshirt (Black and Hispanic children; Girls; Low-income children)

Note. Full citations are presented in the references section.

Table 2. Summary of Studies on the Effects of Redshirting

Citation	Sample	K Entry Year	Initial Effects of Redshirting	Long-Run Effects of Redshirting
Dhuey, Figlio, Karbownik, & Roth (2019)	989,054 children born in Florida	1999-2004	~ 0.2 SD increase in kindergarten test scores	In middle school, Sept. births are more likely to take advanced courses (0.5 SD), and are 0.48 SD more likely to take AP courses in high school (after controlling for demographic differences)
Cook & Kang (2018)	86000 children in North Carolina public schools	2012-2013	N/A	0.36 SD in reading and 0.3 in math (grade 3 EOY)
Cascio & Whitmore Schanzenbach (2016)	~6000 students in Tennessee public schools	1986	0.7 SD impact on kindergarten test scores	0.22 SD impact on test scores in eighth grade
Raffaele Mendez, Kim, Ferron, & Woods (2015)	~7000 students in a Florida public school district	1989	N/A	Redshirted students performed worse (~0.4-0.5 SD) on grade 3, 5, and 7 assessments
Lenard & Peña (2018)	~23,000 students in large North Carolina school district	2005-2013	N/A	In the third grade, redshirted students widened the White-minority achievement gap by 28-30% for boys and 8-11% for girls
Fortner & Jenkins (2017)	262,000 students in North Carolina public schools	2008-2010	N/A	Among students with disabilities in the third grade, redshirted students performed 0.20 SD behind non-redshirted students
Graue & DiPerna (2000)	Random sample of 8000 Wisconsin students	1996	N/A	No sig. difference in mean third-grade scores between redshirted and typical entry students

Note. Full citations are presented in the references section.

Table 3. Student Sample Characteristics

| Year | Subject | % Redshirters | % K Repeaters | Counts | | | Male | Race/ethnicity Percentages | | | | | | |
				Students	Schools	Districts		White	Black	Hispanic	Asian	AIAN	Multi-ethnic	Other Race
						Cross-sectional sample								
All Years	—	4.8%	1.5%	3,327,074	12,432	3,950	51%	41%	17%	26%	4%	1%	5%	6%
2017	—	4.6%	1.8%	350,664	5,730	1,897	51%	45%	20%	19%	4%	1%	4%	6%
2018	—	4.6%	1.8%	381,959	6,056	2,032	51%	45%	19%	20%	4%	1%	4%	7%
2019	—	4.5%	1.8%	382,032	6,019	2,165	51%	44%	18%	22%	4%	1%	4%	7%
2020	—	4.5%	1.5%	292,545	5,084	1,931	51%	44%	16%	25%	4%	1%	4%	6%
2021	—	6.4%	1.4%	429,096	7,053	2,312	51%	41%	17%	27%	4%	1%	5%	5%
2022	—	5.1%	1.6%	416,415	6,787	2,324	51%	39%	17%	28%	4%	1%	5%	6%
2023	—	4.4%	1.5%	379,661	6,254	2,135	51%	39%	17%	28%	4%	1%	5%	6%
2024	—	4.8%	1.1%	390,570	6,411	2,099	51%	37%	17%	31%	5%	1%	5%	4%
2025	—	4.4%	1.2%	346,437	5,824	1,846	51%	36%	17%	30%	5%	1%	6%	4%
						Longitudinal sample								
2021-2025	Math	6.1%	1.4%	197,742	5,227	1,451	51%	41%	14%	31%	4%	1%	5%	4%
2021-2025	Reading	6.4%	1.4%	155,866	4,598	1,367	51%	43%	15%	27%	4%	1%	5%	4%

Note. AIAN= American Indian or Alaska Native.

Table 4. Sample School Descriptive Statistics Relative to U.S. Population of Schools Serving Kindergarten

Sample	Year	Number of Schools	Average School Enrollment	% FRPL	% White	% Black	% Hispanic	% Asian	City	Suburb	Rural	Town
Population of U.S. Schools Serving K	2023-24	53,599	451	56%	48%	15%	26%	4%	31%	33%	26%	10%
Population of U.S. Schools Serving K (in 42 states with set age cutoffs)	2023-24	44,282	462	57%	46%	15%	28%	4%	32%	31%	27%	10%
NWEA Cross-sectional Sample	Pooled Across Years	12,432	474	60%	44%	18%	28%	3%	36%	26%	29%	10%
NWEA Cross-sectional Sample	2017-18	5,730	463	60%	47%	20%	23%	3%	35%	26%	29%	11%
NWEA Cross-sectional Sample	2018-19	6,056	466	59%	47%	19%	23%	3%	34%	26%	30%	10%
NWEA Cross-sectional Sample	2019-20	6,019	466	60%	47%	18%	24%	3%	35%	25%	30%	10%
NWEA Cross-sectional Sample	2020-21	5,084	473	59%	49%	16%	24%	3%	30%	26%	35%	10%
NWEA Cross-sectional Sample	2021-22	7,053	475	60%	45%	17%	27%	3%	35%	26%	29%	9%
NWEA Cross-sectional Sample	2022-23	6,787	478	60%	45%	17%	28%	3%	34%	27%	30%	9%
NWEA Cross-sectional Sample	2023-24	6,254	482	60%	45%	17%	28%	3%	34%	28%	30%	9%
NWEA Cross-sectional Sample	2024-25	6,411	494	60%	43%	16%	30%	3%	36%	28%	28%	8%
NWEA Cross-sectional Sample	2025-26	5,824	502	59%	42%	16%	31%	3%	37%	28%	27%	8%
NWEA Longitudinal Sample (Math)	2021-22 to 2024-25	5,227	496	58%	44%	17%	30%	4%	38%	31%	24%	8%
NWEA Longitudinal Sample (Reading)	2021-22 to 2024-25	4,598	484	59%	44%	17%	29%	4%	35%	31%	25%	8%

Note: FRPL=free or reduced priced lunch. The source of the variables is the Common Core of Data (CCD) collected by the National Center for Educational Statistics. The U.S. public school population comparison was determined by limiting to the schools that were operational in 2023-24 and enrolled students in kindergarten. The second population row shows operational schools serving kindergarten in the 42 states listed in Table 5 with fixed school entry age cut-off dates. The NWEA cross-sectional sample is the sample of schools that tested kindergarteners in each year. The NWEA longitudinal samples are those that tested a longitudinal cohort of students from kindergarten in 2021-22 to 3rd grade in 2024-25.

Table 5. State School Entry Age Cut-off Dates

State	Age Cut-off Date		
	2017	2020	2023
Alabama	9/1	9/1	9/1
Alaska	9/1	9/1	9/1
Arizona	8/31	8/31	9/1
Arkansas	8/1	8/1	8/1
California	9/1	9/1	9/1
Colorado	10/1	10/1	10/1
Connecticut	—	—	—
Delaware	8/31	8/31	8/31
District of Columbia	9/30	9/30	9/30
Florida	9/1	9/1	9/1
Georgia	9/1	9/1	9/1
Hawaii	7/31	7/31	7/31
Idaho	9/1	9/1	9/1
Illinois	9/1	9/1	9/1
Indiana	8/1	8/1	8/1
Iowa	9/15	9/15	9/15
Kansas	8/31	8/31	8/31
Kentucky	8/1	8/1	8/1
Louisiana	9/30	9/30	9/30
Maine	10/15	10/15	10/15
Maryland	9/1	9/1	9/1
Massachusetts	—	—	—
Michigan	10/1	9/1	9/1
Minnesota	9/1	9/1	9/1
Mississippi	9/1	9/1	9/1
Missouri	7/31	7/31	8/1
Montana	9/10	9/10	9/10
Nebraska	7/31	9/30	9/30
Nevada	9/30	9/30	9/30
New Hampshire	—	—	—
New Jersey	—	—	10/1
New Mexico	8/31	9/1	9/1
New York	—	—	—
North Carolina	8/31	8/31	8/31
North Dakota	7/31	7/31	8/1
Ohio	—	—	—
Oklahoma	9/1	9/1	9/1
Oregon	9/1	9/1	9/1
Pennsylvania	—	—	—
Rhode Island	9/1	9/1	9/1
South Carolina	9/1	9/1	9/1
South Dakota	9/1	9/1	9/1
Tennessee	8/15	8/15	8/15
Texas	9/1	9/1	9/1
Utah	9/1	9/1	9/1
Vermont	—	—	—
Virginia	9/30	9/30	9/30
Washington	8/31	8/31	8/31
West Virginia	9/1	9/1	9/1
Wisconsin	9/1	9/1	9/1
Wyoming	9/15	9/15	8/1

Note. State age cut offs are collected from the Education Commission of the States (ECS).
— represents that the state does not have a uniform cut date.

Table 6. Rates of Redshirting Overall and by Subgroup

| Year	N Students	N Schools	Overall Rate	Gender		Student Race/Ethnicity				School Poverty Level		School Urbanicity			
				Girls	Boys	White	Asian	Black	Hispanic	Low-Poverty	High-Poverty	City	Suburb	Town	Rural
2017	350,664	5,730	4.6%	3.4%	5.9%	6.6%	1.9%	2.5%	2.5%	6.8%	2.8%	3.4%	3.9%	6.6%	7.1%
2018	381,959	6,056	4.6%	3.3%	5.8%	6.7%	2%	2.4%	2.6%	7.2%	2.6%	3.4%	3.7%	6.5%	6.6%
2019	382,032	6,019	4.5%	3.4%	5.5%	6.6%	1.7%	2.1%	2.5%	7.1%	2.5%	3.3%	3.8%	6.4%	6.4%
2020	292,545	5,084	4.5%	3.2%	5.7%	6.9%	2.2%	1.8%	2.1%	7.7%	2.2%	3.2%	3.8%	6.5%	6.2%
2021	429,096	7,053	6.4%	5%	7.6%	9%	2.8%	4.2%	3.8%	8.2%	4.7%	5.1%	5.2%	8.8%	9%
2022	416,415	6,787	5.1%	4%	6.2%	7.6%	2.6%	2.9%	3.1%	7.5%	3.5%	4.1%	4%	7.4%	7.2%
2023	379,661	6,254	4.4%	3.3%	5.4%	6.5%	2.4%	2.2%	2.7%	6.7%	2.9%	3.5%	3.3%	6.5%	6.2%
2024	390,570	6,411	4.8%	3.8%	5.7%	6.9%	2.6%	2.7%	3.5%	6.8%	3.6%	3.8%	4.1%	6.5%	6.5%
2025	346,437	5,824	4.4%	3.5%	5.4%	6.7%	2.5%	2.4%	3%	6.8%	3.2%	3.6%	3.9%	6.5%	6.1%

Table 7. Standardized Mean Differences Between On-Time Entrants and Redshirters in 2021-22 Kindergarten Cohort

Subject	Grade	Term	Effect Size	On-Time Entrants			Redshirters		
				N	M	SD	N	M	SD
Math	K	F21	0.38	182,412	143.88	12.12	11,996	148.46	12.78
Math	K	S22	0.25	178,186	161.86	12.23	11,683	164.96	12.80
Math	1	F22	0.26	170,402	163.31	12.51	11,103	166.53	13.22
Math	1	S23	0.18	173,860	179.72	13.30	11,383	182.10	14.28
Math	2	F23	0.14	162,836	175.85	14.99	10,697	177.96	16.23
Math	2	S24	0.07	172,388	192.54	14.94	11,300	193.54	16.41
Math	3	F24	0.06	163,810	188.65	14.64	10,567	189.52	16.16
Math	3	S25	0.00	182,412	204.44	16.21	11,996	204.38	18.19
Reading	K	F21	0.34	142,726	138.56	9.92	10,104	141.99	10.65
Reading	K	S22	0.24	138,813	155.25	12.66	9,818	158.31	13.04
Reading	1	F22	0.23	130,211	156.75	13.12	9,083	159.73	13.70
Reading	1	S23	0.14	135,082	171.93	14.47	9,491	173.97	15.20
Reading	2	F23	0.08	122,147	172.00	16.23	8,665	173.29	17.14
Reading	2	S24	0.05	134,383	186.27	16.08	9,454	187.05	17.33
Reading	3	F24	0.02	120,507	186.93	16.46	8,514	187.29	17.74
Reading	3	S25	0.00	142,726	197.33	16.56	10,104	197.39	18.16

Table 8. Comparison of Redshirting Rates By Sample

Year	Cross-sectional sample (All Students)		Counts			Cross-sectional sample (Consistent Schools)		Counts		
	% Redshirters	% K Repeaters	Students	Schools	Districts	% Redshirters	% K Repeaters	Students	Schools	Districts
All Years	4.8%	1.5%	3,327,074	12,432	3,950	5.2%	1.7%	1,165,072	1,751	576
2017	4.6%	1.8%	350,664	5,730	1,897	5.1%	1.6%	123,747	1,751	576
2018	4.6%	1.8%	381,959	6,056	2,032	4.7%	1.7%	143,485	1,751	576
2019	4.5%	1.8%	382,032	6,019	2,165	4.5%	1.8%	148,702	1,751	576
2020	4.5%	1.5%	292,545	5,084	1,931	4.8%	2.0%	104,648	1,751	576
2021	6.4%	1.4%	429,096	7,053	2,312	6.9%	1.6%	140,669	1,751	576
2022	5.1%	1.6%	416,415	6,787	2,324	5.5%	1.8%	138,146	1,751	576
2023	4.4%	1.5%	379,661	6,254	2,135	4.8%	1.7%	134,447	1,751	576
2024	4.8%	1.1%	390,570	6,411	2,099	5.2%	1.5%	132,087	1,751	576
2025	4.4%	1.2%	346,437	5,824	1,846	5.3%	1.5%	116,405	1,751	576

Figure A1. Visual Depiction of Classification of Redshirters, K Repeaters, On-Time Entrants, and Early Entrants
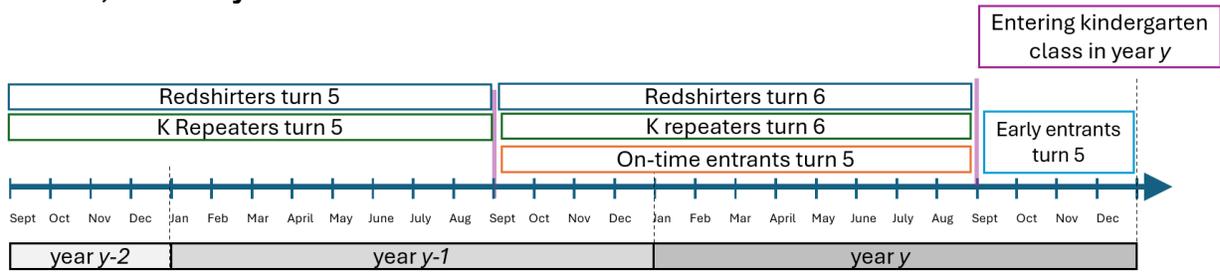
Figure A2. Comparison of Standardized Mean Differences Between Redshirters and On-Time Entrants by Cohort and Subject