Leaving Growth on the Table: Classroom-Level Effects of Kindergarten Readiness on Student Outcomes

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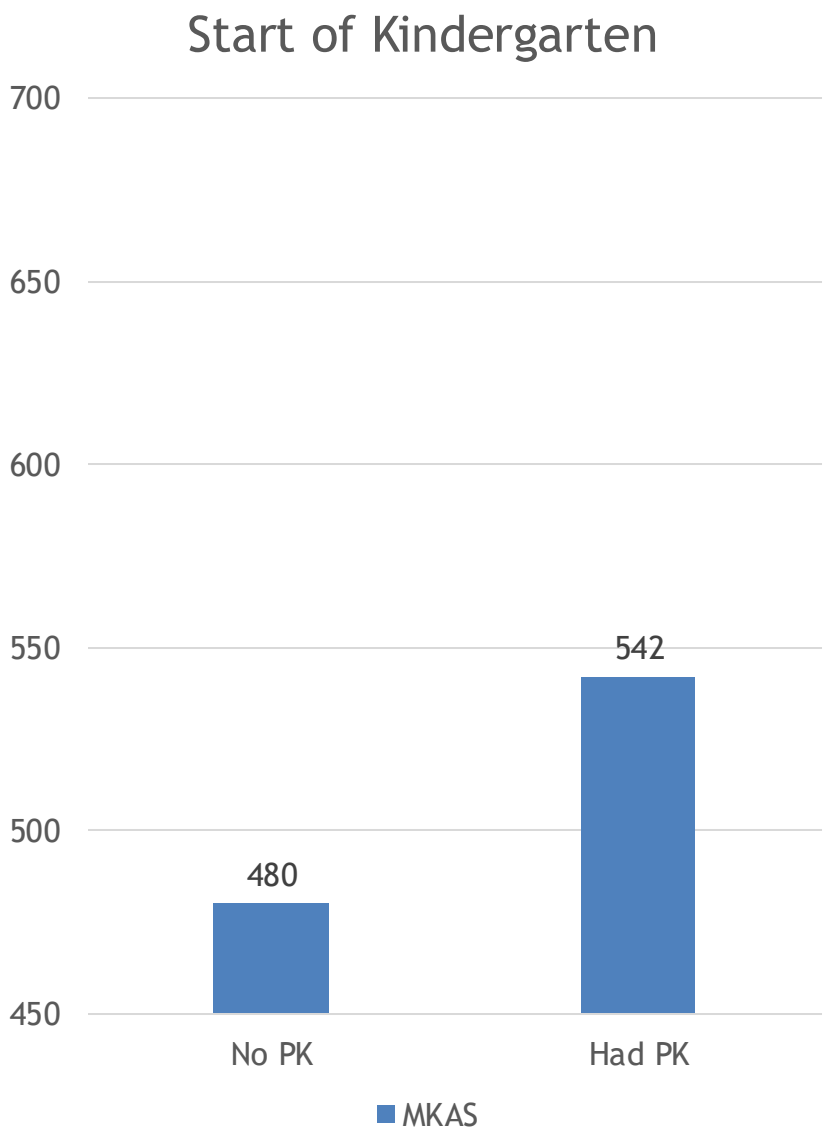
Why This Matters

- Large state investment
  - Mississippi's Early Learning Collaborative Act of 2013

- Expanded access to high-quality pre-K
  - Programs serve only 20% of four-year-olds statewide (NIEER, 2025)
- Use case for multilevel modeling in policy/simulation cases

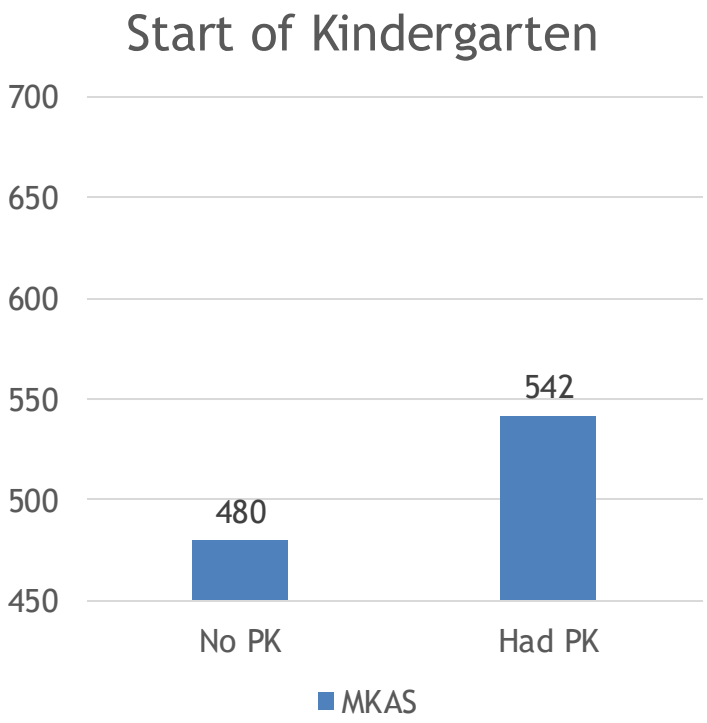
Kindergarten Entry Scores

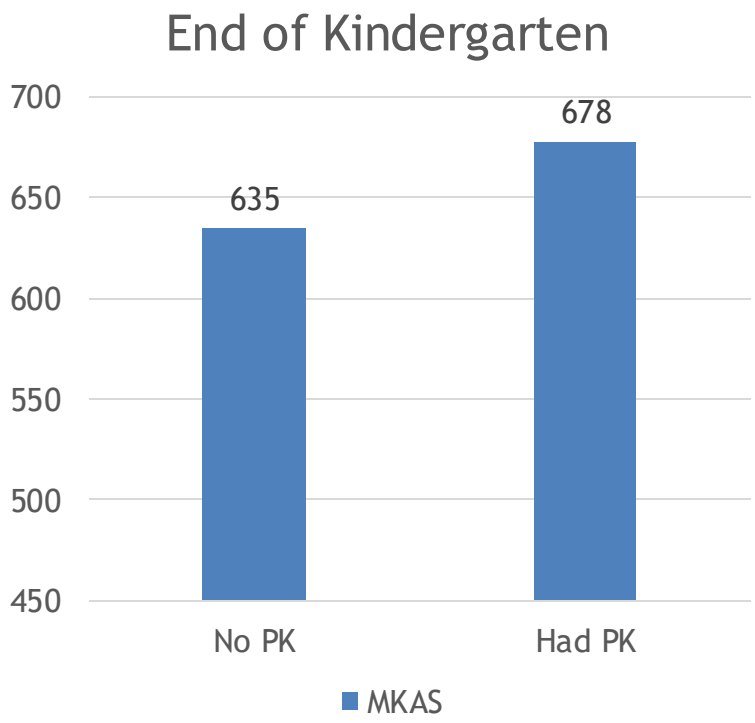
- Pre-K students enter K ~62 points higher than peers
- Confirms strong initial readiness advantage



End of Kindergarten

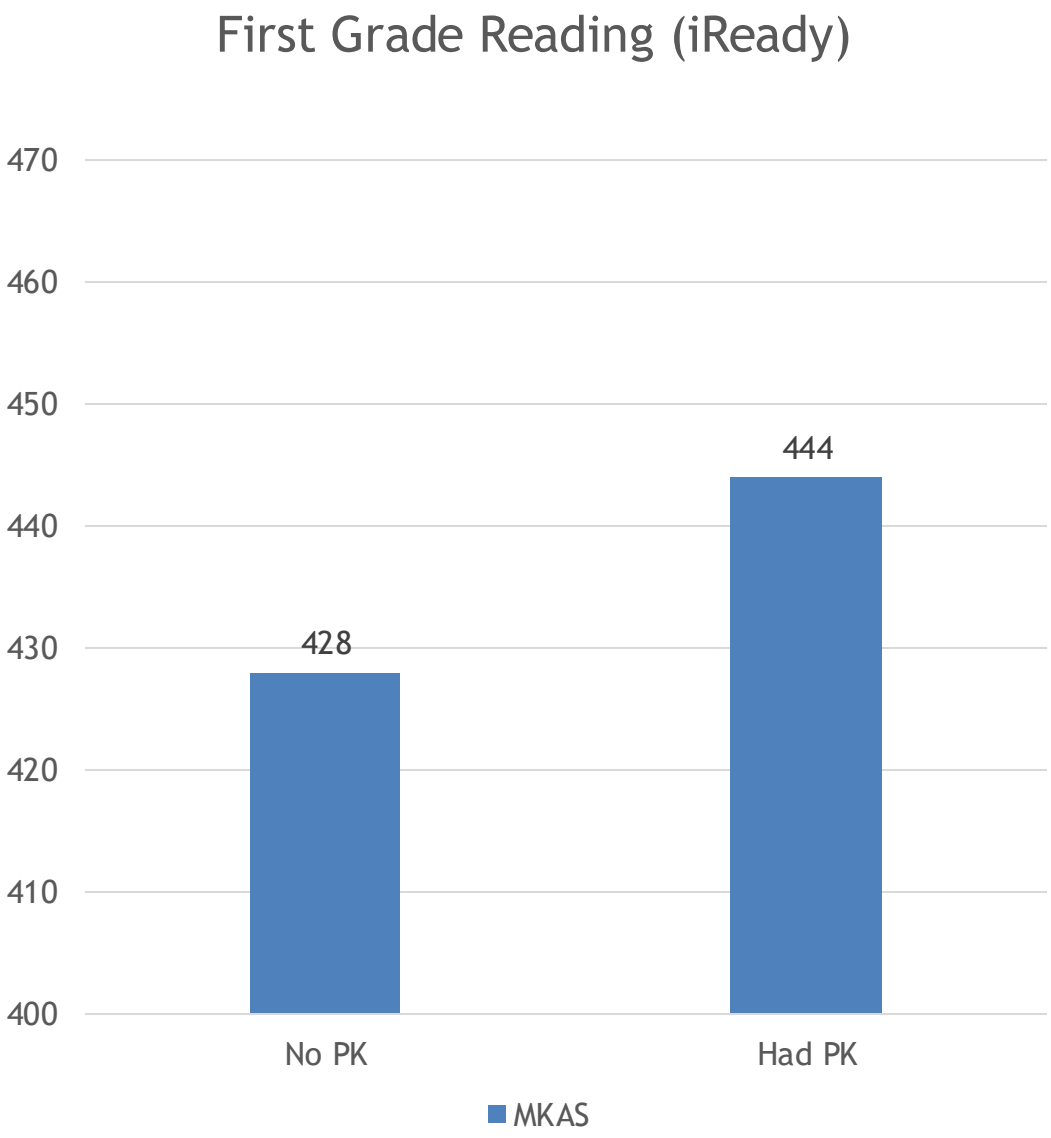
- Pre-K students remain ahead by 31 points
  - Non-PK students experience **faster** growth than PK students
  - Gap persists





First Grade Scores

- Pre-K students still lead by 15 points
- Gap narrows but remains statistically significant

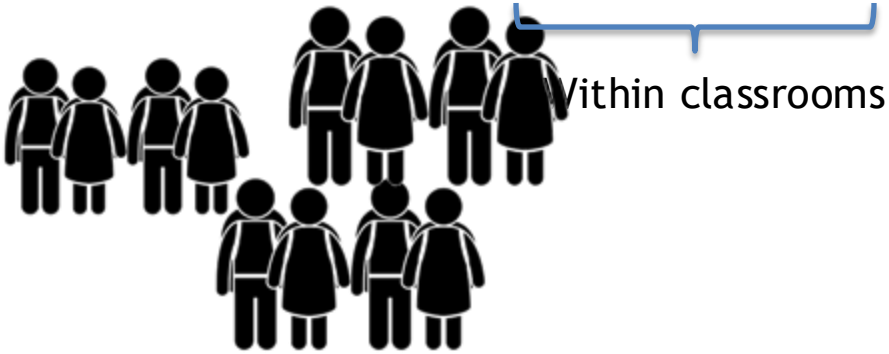


Research Question

- These comparisons don't tell the whole story of PreK impact
- Most research focuses on individuals, not classrooms
- **Does kindergarten class composition—the share of pre-K attendees—predict student test scores?**

Data & Context

- Longitudinal MSIS data: 1 school district, n=1007
- 63 kindergarten classrooms (avg 18 students each)
- Multilevel modeling: students nested in classrooms



Key Variables

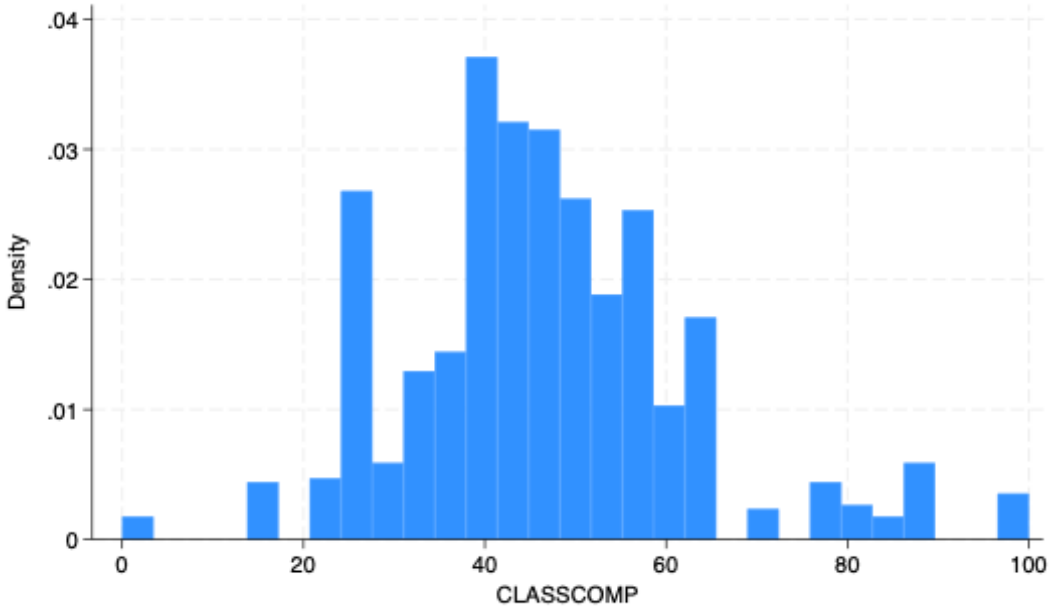
Individual-level predictors: HadPK, retention, chronic absence

Classroom-level predictors: class composition, class size

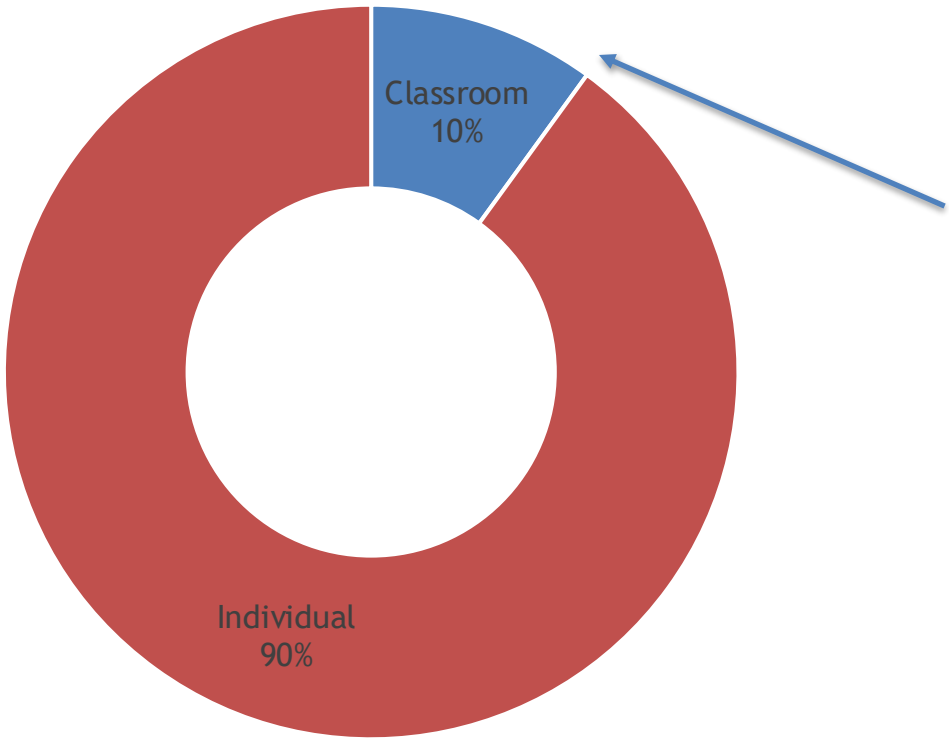
Outcomes measured: MKAS Fall, MKAS Spring, 1st Grade iReady

- For this presentation, we'll focus on 1st grade

Why Classroom Composition Matters



- Classroom context matters alongside individual readiness
- The distribution in class composition is wide
- 10.5% of test score variance lies between classrooms



About 10% of the variance in test scores can be attributed to between-classroom measures

Multi level models

```
Performing gradient-based optimization:
Iteration 0:  Log restricted-likelihood = -5331.9407
Iteration 1:  Log restricted-likelihood = -5331.9407

Computing standard errors ...

Mixed-effects REML regression                   Number of obs     =      1,007
Group variable: gid                             Number of groups  =         63
                                                Obs per group:
                                                              min =          2
                                                              avg =       16.0
                                                              max =         33
                                                Wald chi2(5)      =      48.15
Log restricted-likelihood = -5331.9407          Prob > chi2       =     0.0000
```

overallscalescore	Coefficient	Std. err.	z	P>|z|	[95% conf.	interval]
CLASSCOMP_c	.3860531	.1413175	2.73	0.006	.109076	.6630302
HadPK	12.97794	3.086764	4.20	0.000	6.927998	19.02789
retained	-82.27907	34.36453	-2.39	0.017	-149.6323	-14.92582
chronicabsent	-18.94777	5.534999	-3.42	0.001	-29.79617	-8.099374
class_size_c	-.6001632	.4367293	-1.37	0.169	-1.456137	.2558106
_cons	432.0819	3.065588	140.95	0.000	426.0735	438.0904

Random-effects parameters		Estimate	Std. err.	[95% conf.	interval]
gid: Identity	var(_cons)	254.6676	71.46589	146.9285	441.4093
	var(Residual)	2242.353	103.0231	2049.256	2453.645

LR test vs. linear model: chibar2(01) = 48.95 Prob >= chibar2 = 0.0000

```
Performing gradient-based optimization:
Iteration 0:  Log restricted-likelihood = -6113.8274
Iteration 1:  Log restricted-likelihood = -6113.8274

Computing standard errors ...

Mixed-effects REML regression                   Number of obs     =      1,007
Group variable: gid                             Number of groups  =         63
                                                Obs per group:
                                                              min =          2
                                                              avg =       16.0
                                                              max =         33
                                                Wald chi2(5)      =      57.39
Log restricted-likelihood = -6113.8274          Prob > chi2       =     0.0000
```

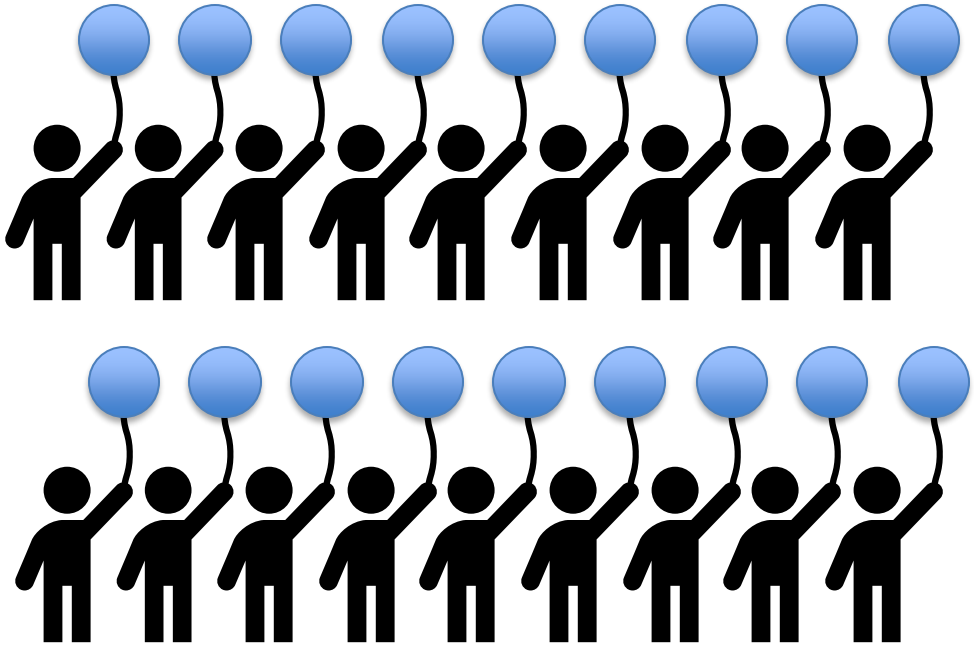
ss4	Coefficient	Std. err.	z	P>|z|	[95% conf.	interval]
CLASSCOMP_c	.7195345	.3331821	2.16	0.031	.0665095	1.372559
HadPK	27.17438	6.750467	4.03	0.000	13.94371	40.40505
retained	-172.1373	74.79592	-2.30	0.021	-318.7346	-25.53999
chronicabsent	-62.26778	12.05762	-5.16	0.000	-85.90028	-38.63529
class_size_c	-.9374518	1.04577	-0.90	0.370	-2.987123	1.112219
_cons	659.5248	7.239243	91.10	0.000	645.3361	673.7135

Random-effects parameters		Estimate	Std. err.	[95% conf.	interval]
gid: Identity	var(_cons)	1639.388	436.6504	972.6674	2763.115
	var(Residual)	10565.34	486.875	9652.905	11564.02

LR test vs. linear model: chibar2(01) = 65.91 Prob >= chibar2 = 0.0000

In real terms

- Switching one child from NoPK → PK adds:
  + 13 points for that child
  + 2.2 points to each classmate
- **The classroom spillover, in total, is larger than the individual effect**



Class average score:

48326

Implications

- Two levers shape outcomes: individual readiness and classroom composition
- Expanding pre-K lifts both individuals and classrooms
- Takeaway: The classroom benefit is larger than the individual benefit

- ROI underestimated if we count only individual gains
- Expanding pre-K yields multiplied community benefits