Early Childhood Education: Lessons from Tulsa

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DOES PRE-K BOOST SCHOOL READINESS? (2005)

Perry Preschool Study (Schweinhart et al., 2005)
Abecedarian Project (Campbell & Ramey, 1995)
Chicago Child Parent Centers (Reynolds et al., 2002)
Georgia’s Universal Pre-K Program (Henry et al., 2003)
Oklahoma’s Universal Pre-K Program (Gormley & Gayer, 2005)
Oklahoma Pre-K

- Oklahoma established UPK in 1998
- Funded through school aid formula
- Public schools are primary service providers, but other providers may establish partnerships with public schools
- Every lead teacher must have B.A. and must be early childhood certified
- Pay comparable to K-12 teacher pay
Georgetown University’s TULSA Oklahoma Research

Fall 2001: Cognitive Test Data
Fall 2003: Cognitive Test Data + Parent Survey
Fall 2006: Cognitive Test Data (English/Spanish) + Parent Survey + Classroom Visits + Socio-emotional Assessments
Research Design

• Regression Discontinuity Strategy to minimize selection bias
• Possible if September 1 eligibility date is strictly enforced
• Necessary to test alumni (5 year olds) and entrants (4 year olds) at same point in time using same test
• Important to determine whether observables balance on both sides of cutoff point
Regression Discontinuity Design with Effective Treatment

Control (Younger Children)  Treatment (Older Children)

Test Score

Cut-off Birth Date
Age

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Testing

• Woodcock Johnson Achievement Subtests: Letter-Word ID (pre-reading); Spelling (pre-writing); Applied Problems (pre-math)

• Tests administered to incoming kindergarten, pre-K, and Head Start students

• Tests administered August 2006, just before classes begin

• Tests administered by new teacher, trained by Georgetown University
Sample Sizes

- TPS Pre-K Entrants: 1492
- TPS Pre-K Alumni: 1264
Snapshot of Tulsa Pre-K, 2005-06

• 40 % of eligible students enrolled in pre-K and 11 % in Head Start

• 74 % of pre-K entrants received free or reduced price lunch

• Pre-K entrants: 34 % white, 33 % black, 21 % Hispanic, 11 % Native American, 1 % Asian American
A Worm’s Eye View of Tulsa Pre-K in 2005-06
Mean Classroom Assessment Scoring System (CLASS) scores for Tulsa Public Schools pre-K classrooms \((n = 71)\) and multi-state school-based pre-K classrooms \((n = 241)\). \(\dagger p < .10\). \(* p < .05\). \(** p < .01\).
Tulsa Pre-K Spends More Time on Academics

**Panel 1: Percentage of Time Spent on Various Activities**

- **Being Read To**
- **Reading**
- **Practicing Letters & Sounds**
- **Engaged in Literacy Activities**
- **Engaged in Math**
- **Engaged in Science**

**Tulsa Public Schools Pre-K Classrooms**
**Multi-State Pre-K Classrooms**

- †p < .10.
- *p < .05.
- **p < .01.

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Effects of Tulsa Pre-K at the Beginning of Kindergarten in Fall 2006
Children in Tulsa Pre-K are Months Ahead of Peers, on Cognitive Skills

Test Score Gains, Months

- Letter-Word Identification: 9
- Spelling: 7
- Applied Problems: 5

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Children who Attended Tulsa Pre-K & Received FRL are Months Ahead of Peers

<table>
<thead>
<tr>
<th>Test Score Gains, Months</th>
<th>Free Lunch</th>
<th>Reduced-Price Lunch</th>
<th>Paid Lunch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Letter-Word Identification</td>
<td>11</td>
<td>10</td>
<td>7</td>
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<tr>
<td>Spelling</td>
<td>8</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Applied Problems</td>
<td>5</td>
<td>6</td>
<td>4</td>
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</tbody>
</table>

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Key Findings on School Readiness, Tulsa

- The TPS Pre-K program improves school readiness
- Disadvantaged students receive bigger boost but all students benefit
- The TPS pre-K program is above average in instructional quality
Longer Term Effects?

• Fadeout - Short term differences between treatment group and control group children diminish or disappear over time

• Persistence - Differences between treatment group and control group children remain discernible several years after the intervention
Two Possibilities

**FADE-OUT** – Short term impacts disappear over time

**FADE-OUT PLUS PERSISTENCE** – Short-term impacts diminish but do not disappear over time
Fragile Scaffolding
Durable Scaffolding
Results of Tulsa Pre-K in Kindergarten & 3rd Grade, Spring 2010
Propensity Score Matching

- Goal: identify comparison group children in the control group who are most similar to treatment group children.

- Use boosted regression to obtain propensity scores

- Construct matches using propensity scores: we use nearest neighbor one-to-one matching, with replacement

- Using matched samples, estimate regression (with covariates) to obtain treatment effect
Children Enrolled in Tulsa’s Pre-K Program in 2006 Perform Better on Kindergarten Cognitive Scores & 3rd Grade Test Scores

**Late Cohort (2006-2007 K) Pre-K Program Effects**

- **Effect Size**
  - K PSM
  - 3rd PSM

- **Year and Method**

**Legend**:
- Letter-Word ID
- Spelling
- Applied Problems
- Reading OPI
- Math OPI

* p < 0.1; ** p < 0.05; *** p < 0.01

Meta-Analysis (Duncan & Magnuson, 2013)
Meta-Analysis (Kay & Pennucci, 2014)
Head Start Impact Study (ACF, 2012)
Tennessee Voluntary Pre-K Program (Lipsey et al., 2013)
New Jersey Abbott School Program (Barnett et al., 2013)
Oklahoma Universal Pre-K Program (Hill et al., 2015)
NEW FOCUS: EFFECTS ON 7th GRADE SCHOOL OUTCOMES

Cohort – kindergarten students in Tulsa Public Schools, 2006-07

- 7th & 6th graders combined
- Students in TPS and three surrounding districts
- State data for Oklahoma standardized test scores
- A wide range of outcomes: letter grades, standardized test scores, honors courses, gifted student, special education student, grade retention, absenteeism, retention
CONTROL VARIABLES
Categorized By Data Source

Administrative Data (enrollments, gender, race/ethnicity, school lunch eligibility, academic success, overage at Kindergarten entry (redshirting), school site, district, etc.)

Parent Surveys (mother’s education, presence of biological father at home, Internet access at home, etc.)

Census Bureau Data (neighborhood median income)
SUMMARY OF FINAL SAMPLE

Approximately 58% of original sample from 2006 (identified in 2014)
- Original sample and analytic sample have similar gender and school lunch eligibility percentages; differences in race/ethnicity

Approximately 75% of original sample for state test score data
ESTIMATION

Propensity score weighting
- Goal: identify comparison group members most similar to treatment group members
- Use boosted regression to obtain propensity scores
- Using propensity scores, construct analytic weights to estimate ATT
- Estimate weighted regression (with covariates) to obtain treatment effect

Missing data (parent survey) with 40 imputed datasets
Pre-K Results, 7th Grade (Spring, 2014)
Standardized Math Test Results

For students as a whole, we see a modest statistically significant positive relationship between pre-K enrollment and standardized math test scores, for the equivalent effect size of 0.10.
Honors Courses

We also see a statistically significant positive relationship between pre-K enrollment and enrollment in an honors course eight years later.

Pre-K increases honors course enrollment by 10 percent.
Grade Retention

Pre-K is associated with a 7 percentage point reduction in grade retention.

Pre-K decreases grade retention by 26 percent.
Enrollment in Algebra 1 in middle school

Pre-K is associated with a 6 percentage point increase in middle school enrollment in Algebra 1.
DO THE BENEFITS EXCEED THE COSTS?
Ratio of Expected Adult Earnings to Costs, Tulsa Pre-K Program

Source: Bartik, Gormley, & Adelstein, 2012
Benefit-Cost Analysis of Tulsa Pre-K Program Based on Grade Retention and Crime Effects

<table>
<thead>
<tr>
<th></th>
<th>B/C Ratio</th>
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<tbody>
<tr>
<td>Overall</td>
<td>1.89</td>
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<tr>
<td>Free Lunch</td>
<td>1.73</td>
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<tr>
<td>Reduced Lunch</td>
<td>3.10</td>
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<tr>
<td>Paid Lunch</td>
<td>1.15</td>
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**Source:** Bartik, Gormley, Belford & Anderson, 2016
HOW DOES PRE-K PARTICIPATION INFLUENCE HIGH SCHOOL OUTCOMES?

Magnet Schools (more likely to apply to/attend magnet schools)

Stability (more likely to remain within Tulsa Public Schools)

Peer Effects
Factors that Promote Persistent Pre-K Effects

Pre-K Program Quality

Pre-K Program Maturity + Penetration Rate

Magnet School Enrollment
CONCLUSIONS

The strong positive effects of the Tulsa pre-K program on academic success diminish over time but do not disappear.

Math effects are more durable, reading effects are more fragile.

Grade retention effects are substantial and extend to all key subgroups.

Both disadvantaged and middle class students experience longer term benefits from pre-K.
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CROCUS website:
http://www.crocus.Georgetown.edu