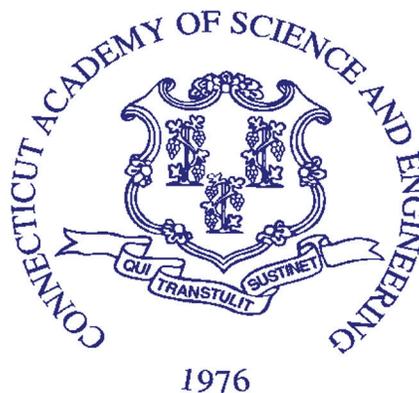


# EARLY CHILDHOOD REGRESSION DISCONTINUITY STUDY

JUNE 2016

A REPORT BY

THE CONNECTICUT  
ACADEMY OF SCIENCE  
AND ENGINEERING



FOR

THE CONNECTICUT GENERAL ASSEMBLY  
AND THE  
EDUCATION COMMITTEE



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ORIGIN OF INQUIRY:

THE CONNECTICUT  
GENERAL ASSEMBLY

DATE INQUIRY

ESTABLISHED:

MAY 9, 2014

DATE RESPONSE

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JUNE 6, 2016

This study was initiated at the request of the Connecticut General Assembly on May 9, 2014. The project was conducted by an Academy Study Committee with the support of faculty from the Neag School of Education, University of Connecticut with Bianca Montrosse-Moorhead, PhD serving as study manager. W. Steven Barnett, PhD, National Institute for Early Education Research, Rutgers University and Mary Beth Bruder, PhD, UConn Health served as study advisors. The content of this report lies within the province of the Academy's Education and Human Resources, and Technology Technical Boards. The report has been reviewed by Academy Members Theodore Holford, PhD and Nalini Ravishanker, PhD. Martha Sherman, the Academy's Managing Editor, edited the report. The report is hereby released with the approval of the Academy Council.

Richard H. Strauss  
Executive Director

## COMMITTEE MEMBERS FOR THE EARLY CHILDHOOD REGRESSION DISCONTINUITY STUDY

**Elizabeth Aschenbrenner**

Education Consultant; School Readiness  
Liaison: Killingly, Plainfield, Putnam; Director  
of Early Childhood Initiatives, EASTCONN

**Regina S. Birdsell**

Assistant Executive Director  
Connecticut Association of Schools

**Gary Henry, PhD**

Patricia and Rodes Hart Professor of Public  
Policy and Education, Dept. of Leadership,  
Policy & Organizations, Vanderbilt University

**Jessica Powell, PhD**

Assistant Professor, Elementary Programs  
Southern Connecticut State University

**Chin Reyes, PhD**

Associate Research Scientist  
The Edward Zigler Center in Child  
Development & Social Policy, Yale School of  
Medicine

**Wendy Rayack, PhD**

Associate Professor of Economics  
Wesleyan University

**Sudha Swaminathan, PhD**

Professor, Early Childhood Education  
Eastern Connecticut State University

**William Teale, EdD**

Professor, Director of Center for Literacy  
University of Illinois at Chicago

## RESEARCH TEAM

*NEAG SCHOOL OF EDUCATION, UNIVERSITY OF CONNECTICUT*

### STUDY MANAGER

**Bianca Montrosse-Moorhead, PhD**, Assistant Professor,  
Measurement, Evaluation and Assessment

**Shaun Dougherty, EdD**, Assistant Professor, Educational Policy and Leadership

**Hannah Dostal, PhD**, Assistant Professor, Literacy Education

**Tamika La Salle, PhD**, Assistant Professor, School Psychology Program

**Jennie Weiner, PhD**, Assistant Professor, Educational Leadership

### STUDY ADVISORS

**W. Steven Barnett, PhD**, Director, National Institute for Early Education Research,  
Rutgers University

**Mary Beth Bruder, PhD**, Professor of Pediatrics; Director, The A.J. Pappanikou Center for  
Excellence and Developmental Disabilities Research, Education, and Service,  
UConn Health Center

### ACADEMY PROJECT STAFF

**Richard H. Strauss**, Executive Director

**Terri Clark**, Associate Director

**Ann G. Bertini**, Assistant Director for Programs



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## **EXECUTIVE SUMMARY**

### **WHAT WAS THE PURPOSE OF THIS STUDY?**

This evaluation study was conducted by the Connecticut Academy of Science and Engineering (CASE) on behalf of the Connecticut General Assembly (CGA) at the request of the Education Committee. The purpose of this study is to investigate the immediate effects associated with children who attend Connecticut's state-funded School Readiness full-day or school-day prekindergarten program. The primary research questions include:

1. Do children who attend full-day or school-day, state-funded preschool programs enter kindergarten with better language and literacy skills than if they had not attended the program?
2. Do children who attend full-day or school-day, state-funded preschool programs enter kindergarten with better mathematics skills than if they had not attended the program?
3. Do children who attend full-day or school-day, state-funded preschool programs enter kindergarten with better social skills than if they had not attended the program?

### **WHAT DID THE STUDY FIND?**

The findings show evidence that attending state-funded prekindergarten in Connecticut, as delivered through the School Readiness program funding stream, positively impacts students' early literacy and early numeracy skills. An overview of results is included in Table ES.1.

TABLE ES.1. OVERVIEW OF IMPACT OF STATE-FUNDED PRESCHOOL PROGRAMS

| Claim   | Test Evidence      | Measures                          | What Students Do on this Test  | Skill Focus                             |
|---|--------------------|-----------------------------------|--|---|
| <b>Large, positive and statistically significant effects on a subset of student’s early literacy skills (0.69 SD)</b> | Basic reading      | WJ-IV: Letter-word identification | Recognizing and naming printed letters and words   | Letter/word recognition                 |
|   |                    | WJ-IV: Word attack                | Reading made-up words that conform to conventional spelling rules  | Phonemic awareness                      |
| <b>Large, positive and statistically significant effects for most student’s early numeracy skills (0.48 SD)</b>       | Broad math         | WJ-IV: Calculations               | Arithmetic computation with paper and pencil   | Writing numbers to numerical operations |
|   |                    | WJ-IV: Math Fluency               | Simple calculations for three minutes  | Quickly solving numerical operations    |
|   |                    | WJ-IV: Applied Problems           | Oral, math “word problems,” solved with paper and pencil   | Math problem solving                    |
| <b>Suggested positive, but non-statistically significant, effects on student’s early vocabulary skills</b>            | Picture vocabulary | PPVT-IV                           | Listening to a word describing one of four pictures and then pointing to the picture that the word describes | Picture-to-word recognition             |
| <b>Suggested positive, but non-statistically significant, effects on student’s early oral language skills</b>         | Oral Comprehension | WJ-IV: Picture Vocabulary         | Listening to a word describing one of four pictures and then pointing to the picture that the word describes | Picture-to-word recognition             |
|   |                    | WJ-IV: Oral Comprehension         | Listening to an oral passage and identifying a missing key word that makes sense                             | Listening comprehension                 |

TABLE ES.1. (CONTINUED)

| Claim  | Test Evidence      | Measures | What Parents and Teachers Do on this Test | Skill Focus                       |
|--|--------------------|----------|---|-----------------------------------|
| <b>Unknown effects for student's early social skills</b>   | Social Development | BASC-3   | Answer survey questions                   | Student Externalizing Problems    |
|  |                    |          |   | Student Internalizing Problems    |
|  |                    |          |   | Student Behavioral Symptoms Index |
|  |                    |          |   | Student Adaptive Skills           |
| <p><i>Note: Effect sizes are included in the second column of this table in parentheses only for outcomes that are statistically and practically significant. Woodcock-Johnson, Fourth Edition (WJ-IV). Peabody Picture Vocabulary Tests, Fourth Edition (PPVT-IV). Behavior Assessment Scale for Children, Third Edition (BASC-3)</i></p> |                    |          |   |                                   |

*Considering Some Trade-Offs*

Though these results are promising, as is typical with any study, there are trade-offs regarding the scope of the conclusions based on the research design. For this study, the Regression Discontinuity design (RD) that was used allowed for a causal interpretation of the data. This made the findings far more powerful than a simple correlative study. However, the ability to make such claims came with some trade-offs regarding the conclusions that could be drawn from the findings. Table ES.2 highlights what can and cannot be concluded for the present RD study.

TABLE ES.2: WHAT CAN AND CANNOT BE CONCLUDED FROM THIS STUDY

| Can Conclude from RD   | Cannot Conclude from RD  |
|--|--|
| <ul style="list-style-type: none"> <li>On average, the School Readiness full-day or school-day prekindergarten programs makes a positive difference in the areas identified as statistically significant. Specifically, prekindergarten students who attend School Readiness full-day or school-day programs do better, on average, in early literacy and early numeracy.</li> </ul> | <ul style="list-style-type: none"> <li>What about the School Readiness program makes a positive impact?</li> <li>What is the best of all possible School Readiness programs?</li> <li>Which aspects of the School Readiness program generated the most valuable outcomes?</li> </ul> |

However, it is important to note that the findings indicate that being enrolled in the School Readiness full-day or school-day program produces positives results in early literacy and early numeracy skills for students, on average.

## HOW IMPORTANT ARE THESE FINDINGS?

Although it has been standard practice for researchers, policymakers, educators, program staff, and other key stakeholder groups to use Cohen's (1988) benchmarks to draw inferences about whether the size of an effect is substantively important, this study follows that of methodological leaders (Cooper, Hedges, & Valentine, 2009; Hill, Bloom, Black, & Lipsey, 2008) who argue that more appropriate inferences can be drawn using other benchmarks. To assist readers of this report in drawing inferences regarding the importance of findings, effect sizes for this study are compared to effect size results from past research in three different ways.

First, effect size benchmarks calculated by Hattie (2009) were used. As illustrated in Figure ES.1, both benchmarks further support the claims that large, positive, and statistically significant effects on student's early literacy and numeracy skills were detected and are noteworthy, with early literacy and early numeracy skills effect sizes both above these benchmarks.

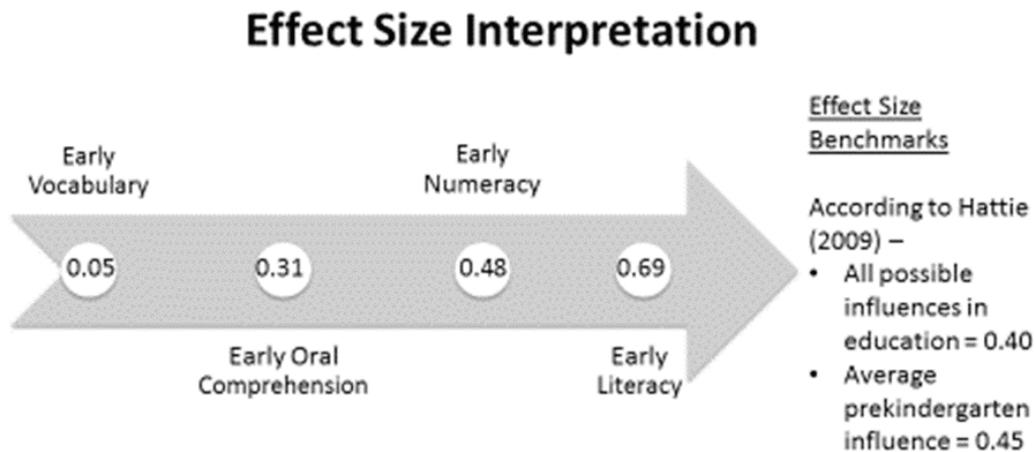


FIGURE ES.1: INTERPRETING CONNECTICUT EFFECTS IN RELATION TO HATTIE'S (2009) BENCHMARKS

Second, effect sizes were descriptively contextualized in relation to those found in other statewide prekindergarten evaluations (Figure ES.2). In examining results from Figure ES.2, it should be noted that this study was the first to use composite outcome measures. This is a strength of this study because it represents an outcome that assesses a wider content area than has been assessed in prior prekindergarten, statewide impact studies that used an RD design. At the same time, this creates a situation where one-to-one effect size comparisons are unavailable, as other states only looked at one sub-test (e.g., applied problems). Effect sizes included in Figure ES.2 for early numeracy are those that came only from the applied problems sub-test, as opposed to the Broad Math outcome used in this study. Similarly, as opposed to the Basic Reading outcome used in this study, effect sizes from other states for early literacy are those that came only from the letter-word sub-test.

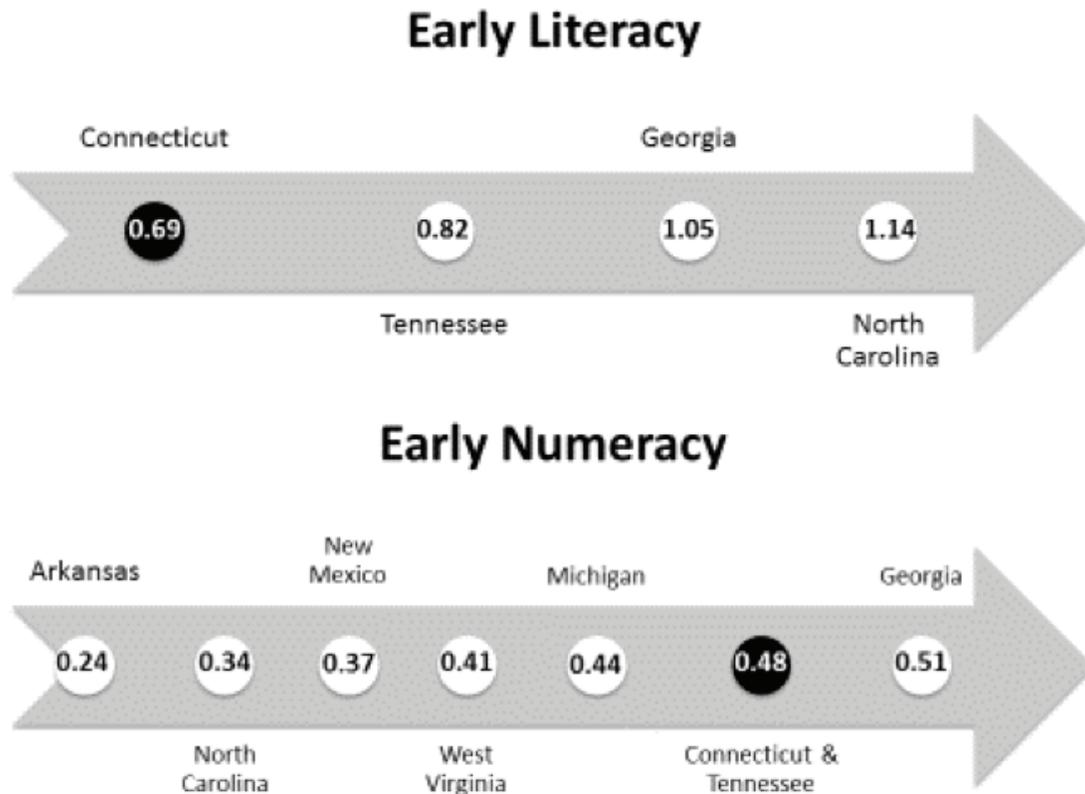


FIGURE ES.2: INTERPRETING CONNECTICUT EFFECTS IN RELATION TO PREKINDERGARTEN EFFECTS FOUND IN OTHER STATES

Third, effect sizes reported in Figures ES.1 and ES.2 can be descriptively compared to other prior research studies. For example, effect sizes reported for other state-funded prekindergarten programs range from .23–.53 (Gilliam & Zigler, 2001), and prekindergarten programs generally from .10 to .13 (Magnuson, Ruhm, & Waldfogel, 2004). Those reported for high-quality childcare programs seldom exceed .10 (NICHD Early Child Care Research Network & Duncan, 2003; Peisner-Feinberg et al., 2011). The Abecedarian project, widely acknowledged as a highly successful early intervention program, reported effect sizes of .73 and .79 for children ages 4 and 5 years old (Ramey, Campbell, Burchinal, Skinner, Gardner, & Ramey, 2000), and the highly praised Perry Preschool program reported effect sizes of .60 (Ramey, Bryant, & Suarez, 1985).

## WHAT SHOULD BE DONE AS A RESULT?

### *Recommendations for Future Evaluation Questions*

The findings from this study suggest the need for further studies regarding some of the mechanisms that helped to produce these results, as well as the non-findings. Table ES.3 includes recommendations for further exploration regarding these findings that may be of value.

TABLE ES.3: FUTURE EVALUATION QUESTIONS FOR CONNECTICUT BASED ON STUDY FINDINGS

| Question Category                                | Potential Evaluation Questions   |
|--|--|
| What works?                                      | <ul style="list-style-type: none"> <li>• Do replication studies support impact study findings across different cohorts of students?</li> <li>• Do longitudinal replication studies support impact study findings long-term?</li> <li>• Do children who attend full-day or school-day, state-funded preschool programs enter kindergarten with better social skills than if they had not attended the program?</li> </ul> |
| What works for whom?                             | <ul style="list-style-type: none"> <li>• Do results vary by state-funded preschool program type?</li> <li>• Do results vary by student characteristics (e.g., gender, race/ethnicity, income)?</li> <li>• Do results vary by student skill level (e.g., English proficiency)?</li> </ul>   |
| What works, for whom, and under what conditions? | <ul style="list-style-type: none"> <li>• Do results vary by program quality?</li> <li>• Do results vary by the amount of school/system instructional support?</li> </ul>   |
| Which aspects are valuable?                      | <ul style="list-style-type: none"> <li>• What is the relationship between program costs and outcomes observed?</li> <li>• Which aspects of the School Readiness program generated the most valuable outcomes?</li> </ul>   |

### *Recommendations for Commissioning Future Statewide Prekindergarten Studies*

This study represented the first statewide study of prekindergarten in Connecticut. The following lessons learned from this study will be useful in conducting future evaluation studies.

#### **LOW PARTICIPATION**

Historically, the state has been committed to a governance model that allows for local decision-making regarding participation, and ethical concerns regarding the ability of a parent/guardian to determine the participation of their child participate in this type of study. As this study demonstrated, this model contributed to a reduction in participation rates of districts, schools, centers, and students. Options for strategies to be considered to increase participation rates are included in Table ES.4:

TABLE ES.4: STRATEGIES FOR ADDRESSING LOW PARTICIPATION

| Strategy  | Pro  | Con  |
|---|--|--|
| Mandate that schools and centers receiving state funding for prekindergarten programs and kindergarten participate in state-mandated studies        | <ul style="list-style-type: none"> <li>Greater participation</li> </ul>  | <ul style="list-style-type: none"> <li>Would require schools and centers to notify parents/legal guardians of testing for such studies in the ways that are consistent with how parents are notified of annual state assessment testing periods</li> <li>Would require a change in Connecticut’s governance model in which decision-making would be shifted back to the state</li> </ul> |
| Require schools and centers to file a letter of cooperation with OEC and CSDE indicating their willingness to participate in state-mandated studies | <ul style="list-style-type: none"> <li>Potential for greater participation</li> </ul>                                  | <ul style="list-style-type: none"> <li>Limits generalizability to those that filed a letter.</li> <li>Does not necessarily address the question site-based opt outs.</li> </ul>  |
| Incorporate potential for low participation rates in the study planning process   | <ul style="list-style-type: none"> <li>Minimize concerns about study power beforehand</li> </ul>                       | <ul style="list-style-type: none"> <li>Increased monetary costs by increasing overall sample.</li> </ul>   |
| Consider alternative levels of stipends or alternative stipend disbursement methods   | <ul style="list-style-type: none"> <li>Potential for greater participation for parent/guardian and teachers</li> </ul> | <ul style="list-style-type: none"> <li>Increased monetary costs</li> <li>No research to inform incentive amount</li> <li>No research specific to teachers or parent/guardian</li> </ul>  |
| Alternative parent/legal guardian data collection strategies (e.g., telephone administration of surveys)  | <ul style="list-style-type: none"> <li>Potential for greater participation for parent/guardian</li> </ul>              | <ul style="list-style-type: none"> <li>Increased monetary costs</li> <li>Shorter, potentially less informative surveys</li> <li>Requires sharing parental contact and address information</li> </ul>   |

### STUDENT-LEVEL DATA

OEC and CSDE eliminated the Prekindergarten Information Management System (PKIS) as of the summer 2014 in anticipation of replacing it with a new data collection system to be administered by OEC. The PKIS information previously collected was paramount to this study, a short term alternative student data collection process was developed by the Research Team/CASE in cooperation with OEC. The following suggestions should be considered to support future evaluation studies:

- Provide user-friendly mechanisms to facilitate the efficient transfer of school and center student data for both prekindergarten and kindergarten in a timely manner. For this study, having information such as classroom rosters (for students who attended prekindergarten last year that are attending kindergarten this year) and student demographic data (e.g. race/ethnicity, socio-economic status, gender, etc.) much sooner would have accelerated the data collection timeline and may have increased participation rates. It is noted that for the analyses conducted for this study, statistical controls were included to address shifts in the study's timeline, but it would have been preferable to be able to begin data collection in schools and centers much earlier in the school year.
- Include student demographic information (e.g. race/ethnicity, socio-economic status, gender, etc.) necessary to conduct this type of evaluation study in the new student data collection system to be administered by OEC.

### *Recommendations for Funding Future Research Studies*

In addition to state-funded research studies, federal funding sources may be available to support studies to answer the questions cited in Table ES.3 including the U.S. Department of Education's Institute for Education Sciences (Evaluation of State and Local Education Programs and Policies program, Preschool Curriculum Evaluation Research program, and Early Learning Programs and Policies program), and the U.S. Department of Health and Human Service's National Institutes of Health.

### **HOW WERE THESE CONCLUSIONS AND RECOMMENDATIONS DRAWN?**

A random sample of 529 students (40.7 % compliance rate) who attended the full-day or school-day, state-funded School Readiness prekindergarten program during the 2015-16 and 2014-15 were assessed using two standardized, psychometrically sound instruments: Woodcock-Johnson, Fourth Edition (WJ-IV) and Peabody Picture Vocabulary Tests, Fourth Edition (PPVT-IV).

Data were then statistically analyzed within a RD framework. Specifically, an RD approach can be used when there is a clear external means of distinguishing between two groups in such a way that the only difference between these groups is that some get a "treatment" and some do not. In other words, the two groups are treated as if they were randomly assigned and that the individuals within them are "equal in expectation" (i.e., they are only different because some are assigned to the treatment and some are not).

For this to occur, first, there has to be a treatment to which individuals are selected (e.g., prekindergarten). Second, the selection criteria have to be externally created values on a numeric rating (e.g., an age limit or requirement). By properly controlling for the value of the rating variable in the RD design, any unobserved differences between the treatment and comparison group can be accounted for. In other words, it can be assumed that the children very close to the cut-off for the rating variable are the same in all ways but their numeric score.

In essence, because the RD design relies on the use of some type of cut-off, it makes it both feasible and ethical to implement across a wide-variety of situations and allows for answers to the question, on average, across a group of people, of “what works?” In the last nine years, 16 studies have employed an age cut-off RD approach in evaluations of state-funded prekindergarten programs (Appendix B). Figure ES.3 illustrates how this process worked for this study of prekindergarten students using birth date as the cut-off mechanism, which is consistent with best practice in prekindergarten impact studies.

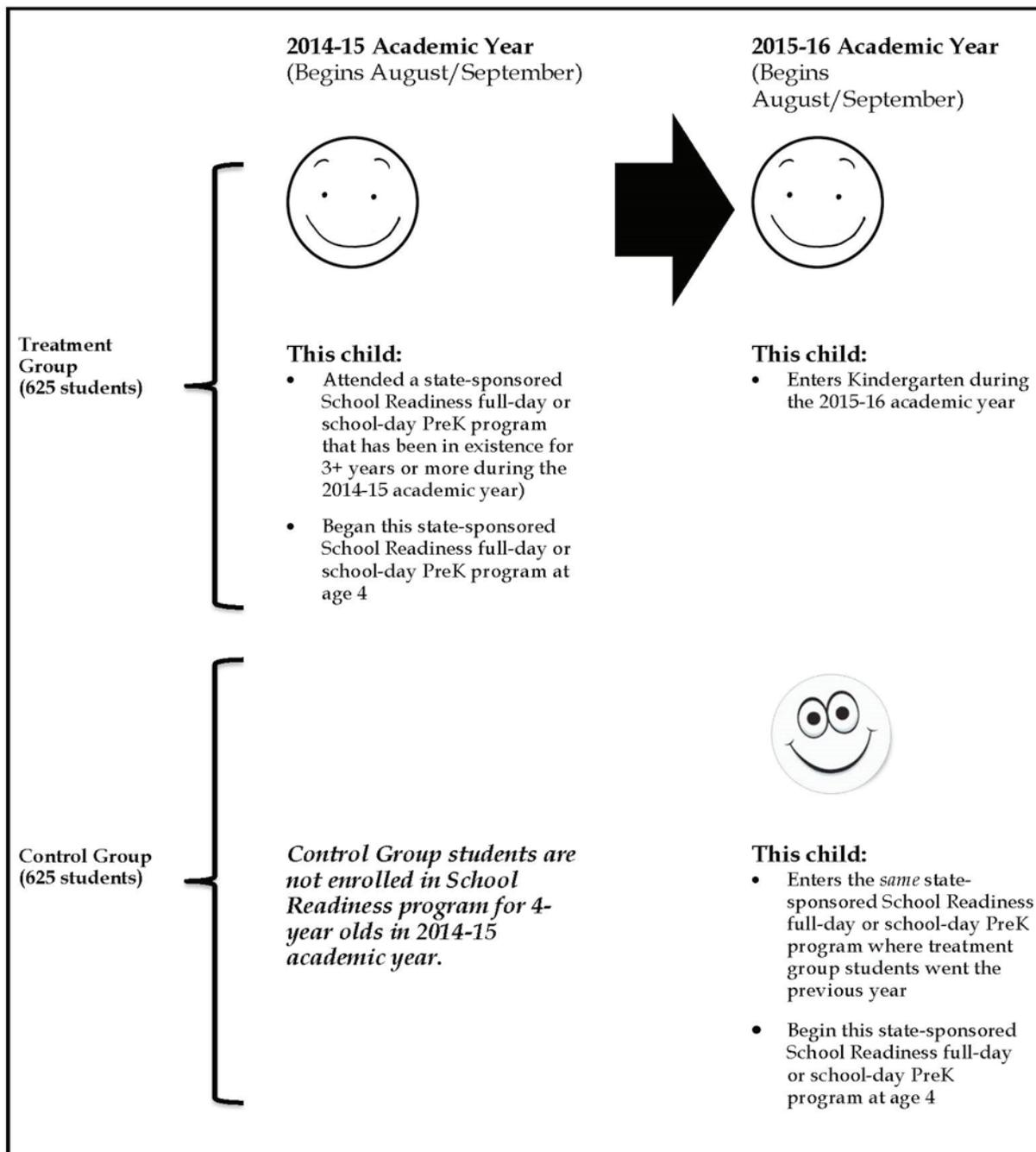


FIGURE ES.3: HOW THE RD PROCESS WORKS IN THIS STUDY