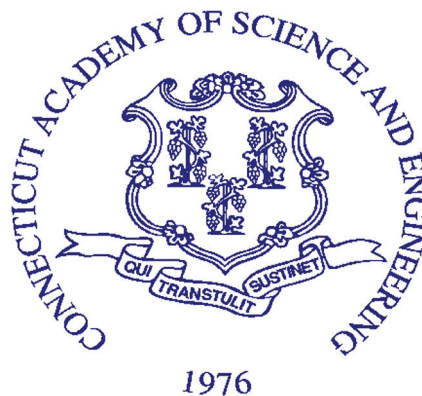


EARLY CHILDHOOD REGRESSION DISCONTINUITY STUDY

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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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.

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TABLE OF CONTENTS

TABLE OF CONTENTS.....	v
EXECUTIVE SUMMARY.....	vii
1.0 STUDY BACKGROUND.....	1
2.0 INTRODUCTION AND STUDY METHODS.....	3
3.0 IMPLEMENTATION PLAN.....	27
4.0 DATA COLLECTION AND ANALYSIS.....	37
5.0 DISCUSSION AND IMPLICATIONS.....	49
REFERENCES.....	59
APPENDICES.....	67
APPENDIX A: THE RESEARCH TEAM.....	67
APPENDIX B: SUMMARY OF AGE CUT-OFF RD STUDIES INVESTIGATING THE EFFECTS OF PUBLICLY FUNDED PREKINDERGARTEN PROGRAMS ON CHILDREN’S ACADEMIC AND SOCIAL-EMOTIONAL SKILLS.....	69
APPENDIX C: PARENT AND TEACHER QUESTIONNAIRES.....	79
APPENDIX D: UCONN’S INSTITUTIONAL REVIEW BOARD (IRB) APPROVALS.....	99
APPENDIX E: ANALYSIS OF POPULATION AND SAMPLES, AND OF TREATMENT AND CONTROL GROUPS.....	108
APPENDIX F: FINAL POWER ANALYSIS.....	114
APPENDIX G: ANALYSIS OF BASC-3 RESPONSES.....	115
APPENDIX H: ADDITIONAL TESTS OF ESTIMATE ROBUSTNESS.....	116

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
Large, positive and statistically significant effects on a subset of student’s early literacy skills (0.69 SD)	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
Large, positive and statistically significant effects for most student’s early numeracy skills (0.48 SD)	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
Suggested positive, but non-statistically significant, effects on student’s early vocabulary skills	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
Suggested positive, but non-statistically significant, effects on student’s early oral language skills	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
Unknown effects for student's early social skills	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"> 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. 	<ul style="list-style-type: none"> What about the School Readiness program makes a positive impact? What is the best of all possible School Readiness programs? Which aspects of the School Readiness program generated the most valuable outcomes?

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.

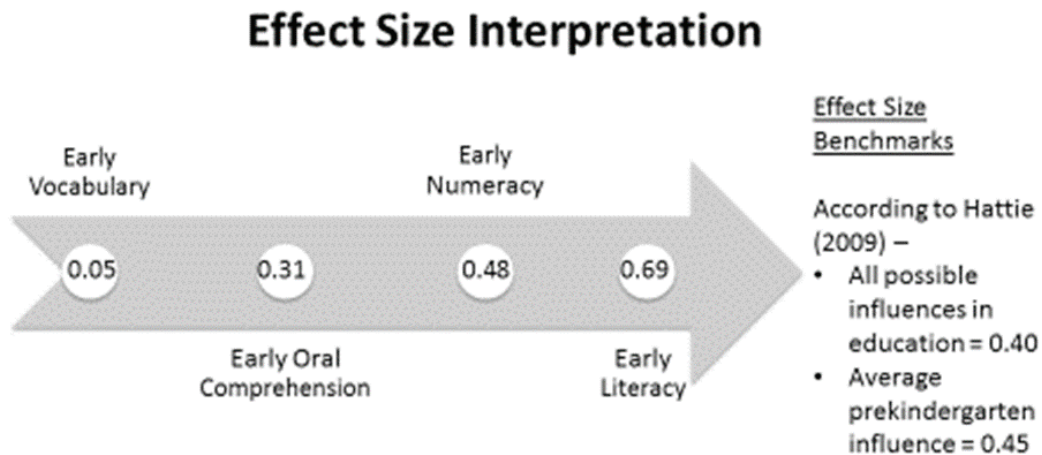


FIGURE ES.1: INTERPRETING CONNECTICUT EFFECTS IN RELATION TO HATTIE'S (2009) BENCHMARKS

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.

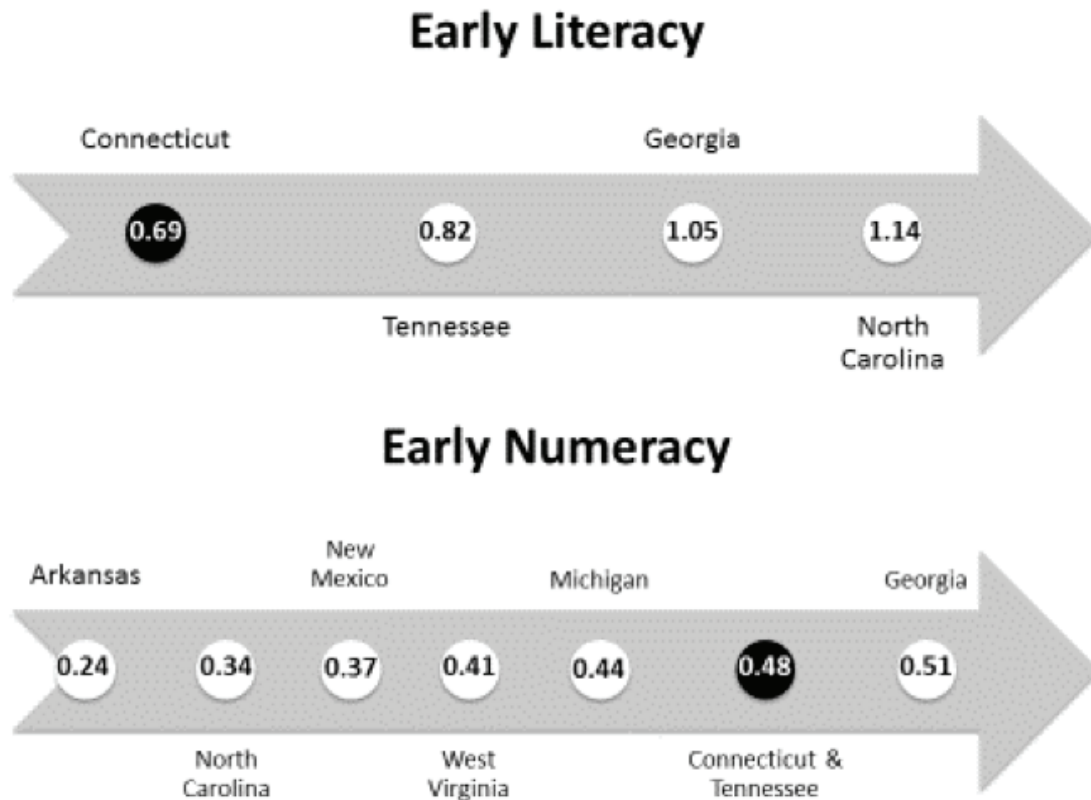


FIGURE ES.2: INTERPRETING CONNECTICUT EFFECTS IN RELATION TO PREKINDERGARTEN EFFECTS FOUND IN OTHER STATES

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"> • Do replication studies support impact study findings across different cohorts of students? • Do longitudinal replication studies support impact study findings long-term? • 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 works for whom?	<ul style="list-style-type: none"> • Do results vary by state-funded preschool program type? • Do results vary by student characteristics (e.g., gender, race/ethnicity, income)? • Do results vary by student skill level (e.g., English proficiency)?
What works, for whom, and under what conditions?	<ul style="list-style-type: none"> • Do results vary by program quality? • Do results vary by the amount of school/system instructional support?
Which aspects are valuable?	<ul style="list-style-type: none"> • What is the relationship between program costs and outcomes observed? • Which aspects of the School Readiness program generated the most valuable outcomes?

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"> Greater participation 	<ul style="list-style-type: none"> 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 Would require a change in Connecticut’s governance model in which decision-making would be shifted back to the state
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"> Potential for greater participation 	<ul style="list-style-type: none"> Limits generalizability to those that filed a letter. Does not necessarily address the question site-based opt outs.
Incorporate potential for low participation rates in the study planning process	<ul style="list-style-type: none"> Minimize concerns about study power beforehand 	<ul style="list-style-type: none"> Increased monetary costs by increasing overall sample.
Consider alternative levels of stipends or alternative stipend disbursement methods	<ul style="list-style-type: none"> Potential for greater participation for parent/guardian and teachers 	<ul style="list-style-type: none"> Increased monetary costs No research to inform incentive amount No research specific to teachers or parent/guardian
Alternative parent/legal guardian data collection strategies (e.g., telephone administration of surveys)	<ul style="list-style-type: none"> Potential for greater participation for parent/guardian 	<ul style="list-style-type: none"> Increased monetary costs Shorter, potentially less informative surveys Requires sharing parental contact and address information

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.

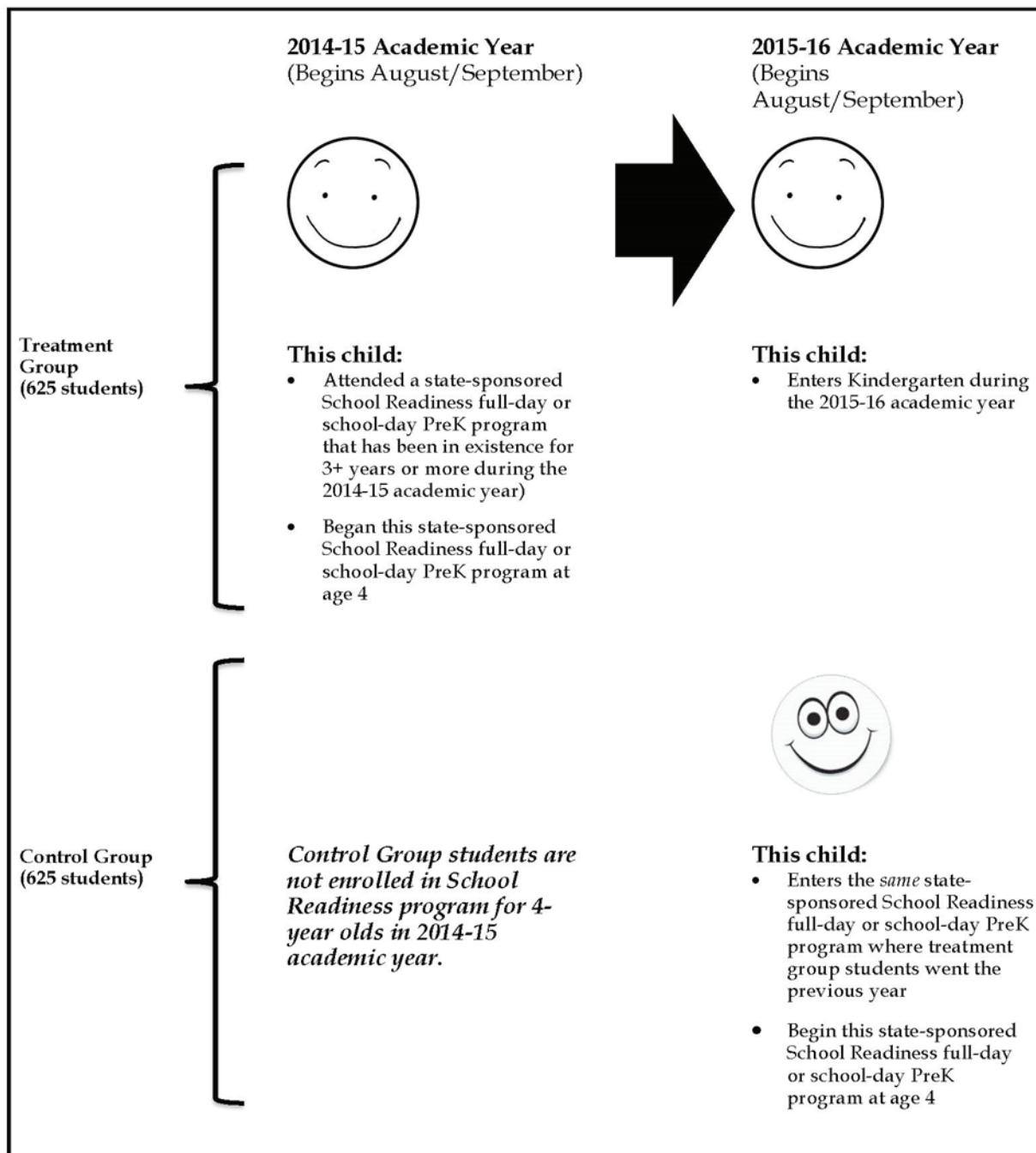


FIGURE ES.3: HOW THE RD PROCESS WORKS IN THIS STUDY