Evaluation of the Tennessee Voluntary Prekindergarten Program: Kindergarten and First Grade Follow-Up Results from the Randomized Control Design

Research Report

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Some of the details in this report may differ from those in earlier reports because of the availability of additional data, information, or further analysis.

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Executive Summary

In 2009, Vanderbilt University's Peabody Research Institute, with the assistance of the Tennessee Department of Education's Division of Curriculum and Instruction, initiated a rigorous, independent evaluation of the state's Voluntary Prekindergarten program (TN-VPK). TN-VPK is a full-day prekindergarten program for four-year-old children expected to enter kindergarten the following school year. The program in each participating school district must meet standards set by the State Board of Education that require each classroom to have a teacher with a license in early childhood development and education, an adult-student ratio of no less than 1:10, a maximum class size of 20, and an approved age-appropriate curriculum.

TN-VPK is an optional program focused on the neediest children in the state. It uses a tiered admission process with children from low-income families who apply to the program admitted first. Any remaining seats in a given location are then allocated to otherwise at-risk children including those with disabilities and limited English proficiency.

The evaluation was funded by a grant from the U. S. Department of Education's Institute of Education Sciences (R305E090009). It was designed to determine whether the children who participate in the TN-VPK program make greater academic and behavioral gains in areas that prepare them for later schooling than comparable children who do not participate in the program.

The current report is the second in a series that presents findings from this evaluation. The prior report described outcomes at the end of the pre-k year for the children in the Intensive Substudy sample who participated in TN-VPK in comparison to those who did not participate[1]. The present report summarizes the longitudinal effects of TN-VPK on kindergarten outcomes and those first grade outcomes that are currently available. At the end of prekindergarten, TN-VPK effects could be examined only on early achievement measures and teacher ratings of academic skills and behavior obtained at the very beginning of the kindergarten year. A notable addition in this current report is that results are now available on several other "non-cognitive" academic outcomes, including grade retention, attendance, recorded disciplinary actions, and special education services.

Research design. There are several components to the overall research design for this evaluation. The component reported here, and the one that provides the strongest test of the effects of TN-VPK, is a randomized control trial in which children applying to TN-VPK are admitted to the program on a random basis. The TN-VPK programs participating in this part of the evaluation study were among those where more eligible children were

1 That report, Evaluation of the Tennessee Voluntary Prekindergarten Program: End of Pre-K Results from the Randomized Control Design, is available on the Peabody Research Institute's website (http://peabody.vanderbilt.edu/research/pri/). A copy of the Executive Summary is in Appendix A of the present report.

expected to apply for the program than there were seats available. Under such circumstances, only some applicants can be admitted and, of necessity, some must be turned away. The participating programs agreed to make this decision on the basis of chance, a process rather like randomly selecting names out of a hat, to determine which children would be admitted. This procedure treats every applicant equally and, as a result, no differences are expected on average between the characteristics of the children admitted and those not admitted. Comparing their academic and behavioral outcomes after the end of the pre-k school year, then, provides a direct indication of the effects of the TN-VPK program on the children who were admitted.

To implement this procedure, TN-VPK programs across Tennessee that expected more applicants than they could accommodate and were willing to participate in the evaluation submitted lists of eligible applicants to the researchers at the Peabody Research Institute. The research team shuffled each list into a random order and the TN-VPK program staff were asked to fill the available seats by first offering admission to the child at the top of the list and then going down the list in order until all the available seats were filled. Once a program had admitted enough children to fill its seats, any remaining children were put on a waiting list and admitted, in order, if an additional seat became available. Those on the waiting list who were not admitted to TN-VPK became the control group for the study.

This procedure was used for two cohorts of children, TN-VPK applicants for the 2009-10 and 2010-11 school years, and resulted in more than 3000 randomly assigned children. Both the children who participated in TN-VPK and those who did not are being tracked through the state education database until their third grade year and information on various aspects of their academic performance and status is being collected each year. In addition, parental consent was obtained for a portion of this randomized sample, referred to as the Intensive Substudy. More than 1000 children in the Intensive Substudy are being directly assessed by the research team with a battery of early learning achievement measures, and are being rated by their teachers, in each year of the study.

Outcome measures. The outcome measures used to assess the effects of TN-VPK were divided into two groups. One group consisted of measures of achievement in the areas of emergent literacy, language, and math that we refer to as cognitive achievement outcomes. The second group included measures of student performance or status other than academic achievement that we refer to as non-cognitive outcomes. This second group is especially relevant for assessing the longer term effects of TN-VPK because other longitudinal studies of early childhood education programs have found that effects on cognitive outcomes often fade after the end of the program while cumulative effects on non-cognitive outcomes emerge over time.

Measures of Cognitive Achievement Outcomes. Academic gains of the children in the Intensive Substudy sample were measured with a selection of standardized tests from the Woodcock Johnson III Achievement Battery. These were individually administered at the beginning and end of the pre-k year, and one and two years afterwards when most of the children were nearing the end of their kindergarten and first grade years respectively.

These tests assessed early literacy, language, and math skills and included the following:

Literacy

- *Letter-Word Identification*: Assesses the ability to identify and pronounce alphabet letters and read words.
- *Spelling*: Assesses prewriting skills, such as drawing lines and tracing, writing letters, and spelling orally presented words.

Language

- *Oral Comprehension*: Assesses children's ability to fill in a missing word in a spoken sentence based on semantic and syntactic cues.
- *Picture Vocabulary*: Assesses early language and lexical knowledge by asking the child to name objects presented in pictures and point to the picture that goes with a word.
- *Passage Comprehension* (not used in pre-k): Assesses reading comprehension through matching picture or text representations with similar semantic properties.

Math

- *Applied Problems*: Assesses the ability to solve small numerical and spatial problems presented verbally with accompanying pictures of objects.
- *Quantitative Concepts*: Assesses quantitative reasoning and math knowledge by asking the child to point to or state answers to questions on number identification, sequencing, shapes, symbols, and the like.
- *Calculation* (not used in pre-k): Assesses mathematical computation skills through the completion of visually-presented numeric math problems.

WJ Composite

- The scores on the above tests were summarized in two composite measures that averaged them together to create overall measures of children's combined achievement in literacy, language, and math. One composite score combined the 6 tests given each year and the other also added the two tests given only in kindergarten and beyond.

Measures of Non-Cognitive Outcomes. In addition, reports of the children's work-related skills and behavior were obtained from their kindergarten teachers early in the fall of the school year after pre-k and from their first grade teachers near the end of the first grade year. Two teacher rating instruments were used for this purpose:

- *Cooper-Farran Behavioral Rating Scales*: Teacher ratings for each child on two scales:
  - *Work-Related Skills*: The ability to work independently, listen to the teacher, remember and comply with instructions, complete tasks, function within designated time periods, and otherwise engage appropriately in classroom activities.
  - *Social Behavior*: Social interactions with peers including appropriate behavior while participating in group activities, play, and outdoor games; expression of feelings and ideas; and response to others' mistakes or misfortunes.
- *Academic Classroom and Behavior Record*: Teacher ratings for each child on three scales:
  - *Readiness for Grade Level Work*: How well prepared the child is for grade level work in literacy, language, and math skills as well as social behavior.
  - *Liking for School*: The child's liking or disliking for school, having fun at school, enjoying and engaging in classroom activities, and seeming happy at school.

- *Behavior Problems*: Whether the child has shown explosive or overactive behaviors, attention problems, physical or relational aggression, social withdrawal or anxiety, motor difficulties, and the like.
- *Peer Relations*: Whether other children in the classroom like the target child and how many close friends the target child has.

Finally, data from the state education information system provided outcome measures for several additional aspects of student performance or status that might plausibly be affected by participation in TN-VPK:

- *Grade Retention:* Whether a child was held back in a given grade, that is, not promoted to the next grade and thus required to repeat the grade they were in the previous year.
- *School Attendance*: The total number of instructional days a child was marked as present summed across schools if a child was enrolled at more than one during a year.
- *Disciplinary Action*: Whether at least one disciplinary action was recorded in the state data system for a child in a given year.
- *Special Education Services*: Whether the state data system identified special education services for the child and the type of services indicated.

Summary of Results Presented Earlier on the End of Pre-K Outcomes. The prior report[2] presented findings from the Intensive Substudy portion of the randomized control design for outcomes at the end of the prekindergarten year. That sample included 1,076 children of families who applied to 58 TN-VPK programs across 21 school districts and was used to investigate two questions:

1. Does participation in TN-VPK improve the school readiness of the economically disadvantaged children eligible for the program?
2. What are the characteristics of the children who benefit the most from TN-VPK?

All the children in the Intensive Substudy sample qualified for the federal Free or Reduced Price Lunch program and those who participated in TN-VPK attended an average of 149 days during the school year. In contrast, more than half of the children who were not admitted to TN-VPK stayed home with a parent or other guardian and 27% were enrolled in Head Start or private center-based childcare.

During the course of the pre-k school year, the academic skills of all the children improved. However, the children who participated in TN-VPK gained significantly more on all the direct assessments of academic skills than the children who did not attend. The effect size for the WJ Composite scale was .24, and the effect sizes for the individual literacy, language, and math scales ranged from .10 to .46. Stated in terms of the gains made on these measures during the pre-k year, the children who participated in TN-VPK showed a gain on the WJ Composite measure that was 45% greater than that made by the children who did not attend TN-VPK. On the individual academic achievement measures, the analogous improvements for the TN-VPK participants relative to the nonparticipants ranged from 21% to 89%. Positive effects were also found on the kindergarten teachers' ratings of children's preparedness for kindergarten and, to a lesser extent, on their ratings of the children's classroom work behavior and social behavior. These effects were not different

[2] See footnote 1.

for boys and girls, but there were larger effects on the academic skills of children who were not native English speakers than for those who were.

The stated goal of TN-VPK is to increase the school readiness of the economically disadvantaged children it serves. These findings show that the Tennessee prekindergarten program is successful in producing significant improvements in a range of academic skills generally regarded as important for school readiness for the children who participate.

Summary of Results on the End of Kindergarten and First Grade Outcomes. This report presents findings for TN-VPK effects on kindergarten outcomes and on those first grade outcomes for which data are available to date for both the full randomized sample (N=3025) and the Intensive Substudy sample (N=1076). The analyses addressed three questions about what effects of TN-VPK are evident one and two years after children have participated in the program. Below we summarize the findings for each of those questions.

Does participation in TN-VPK have effects on children's cognitive achievement outcomes that are evident at the end of the kindergarten and first grade years?

Cognitive achievement outcomes were measured near the ends of the kindergarten and first grade years with Woodcock Johnson III scales selected to assess performance in the areas of literacy (Letter-Word Identification and Spelling), language (Oral Comprehension, Picture Vocabulary, and Passage Comprehension), and math (Applied Problems, Quantitative Concepts, and Calculation). Because administering these measures required parental consent and individual assessment of the children by the research team, data were available only for the Intensive Substudy sample.

For that Intensive Substudy sample, we found that the effects of TN-VPK on the WJ achievement measures observed at the end of the pre-k year had greatly diminished by the end of the kindergarten year and the differences between participants and nonparticipants were no longer statistically significant. The only exception was a marginally significant difference on Passage Comprehension with nonparticipants showing higher scores at the end of the kindergarten year than TN-VPK participants.

Similarly, at the end of first grade, there were no statistically significant differences between TN-VPK participants and nonparticipants on the WJ measures with one exception. There was a significant difference that favored the nonparticipant group on the Quantitative Concepts subscale.

These diminished effects were not entirely unexpected in light of the findings in other longitudinal studies of the effects of early childhood programs on economically disadvantaged children. For preschool programs, a typical finding is that the cognitive effects are not sustained for very long after the end of the program. Though none of those other studies investigated the effects of a single year of a scaled up state-funded public pre-k program, many involved more intensive programs that nonetheless also failed to show long-term effects on cognitive achievement measures. It should be noted that few of the programs, including TN-VPK, involved continuous, focused support in subsequent years for the gains made during the initial program year.

The especially rapid fall off of TN-VPK effects is somewhat surprising, however, and raises questions about why it occurs that cannot be answered directly by the data available in the

current study. There is reason to believe from prior research that early cognitive gains attained in pre-k can be sustained for a longer period if they are large enough to begin with and/or continuously supported with effective instruction in subsequent years.

Does participation in TN-VPK have effects on children's non-cognitive academic outcomes that are evident at the end of the kindergarten and first grade years?

Expectations for TN-VPK effects on these non-cognitive outcomes were different than for the cognitive achievement outcomes. Whereas longitudinal research on other early education programs provides little evidence of sustained effects on achievement, they show more encouraging effects on non-cognitive outcomes. However, it is important to note that those effects typically have been reported for follow-up periods that included many years after the initial program and thus seem to be more cumulative than immediate.

First Grade Teachers' Ratings. One set of measures of non-cognitive outcomes for TN-VPK was available from ratings made for the children in the Intensive Substudy sample by first grade teachers near the end of the first grade year. Those showed no statistically significant differences between the TN-VPK participants and nonparticipants on any of the scales for Social Skills, Work-related Skills, Preparation for Grade, Peer Relations, Behavior Problems, and Feelings About School.

Another set of measures of non-cognitive outcomes was available from the state data system for the Intensive Substudy sample and at least Cohort 1 of the full randomized sample, with some measures available for both cohorts. These outcomes included grade retention in kindergarten and attendance, officially recorded disciplinary actions, and identified special education services in kindergarten and first grade.

Retention. For the Intensive Substudy sample (N=1076), there was a statistically significant difference between the 4.1% of the TN-VPK participants retained in kindergarten compared to the 6.2% retention rate for the nonparticipants. This effect was confirmed in Cohort 1 of the full randomized sample, with retention data still unavailable for Cohort 2. In Cohort 1 (N=1764), 4.0% of the TN-VPK participants were retained in kindergarten compared to 8.0% of the nonparticipants.

Attendance. Attendance in kindergarten and first grade was high for both TN-VPK participants and nonparticipants, so there was little room for large differences. For the Intensive Substudy sample the difference in days attended between participants and nonparticipants was not statistically significant. In the full randomized sample, however, there was a marginally significant effect on the number of days attended that favored the TN-VPK participants, though the difference was small—less than two days of attendance.

Attendance data for first grade were available only for Cohort 1 of the full randomized sample. For that cohort, attendance was about three and a half days greater for the TN-VPK participants than the nonparticipants, a statistically significant difference. This effect was thus somewhat larger than the one found for kindergarten attendance.

Disciplinary Actions. Officially recorded disciplinary actions were very infrequent during the kindergarten and first grade years, appearing for less than 1.5% of the children in kindergarten and less than 3% in first grade. These low rates thus provide little scope for meaningful differences between TN-VPK participants and nonparticipants. During

kindergarten, there were no significant differences in the percentages of children with any recorded disciplinary action in the Intensive Substudy sample or the full randomized sample. For first grade, data were available only for Cohort 1 of the full randomized sample and also showed no significant difference between TN-VPK participants and nonparticipants.

Special Education Services. The final non-cognitive outcome examined in this report was recorded special education services. Only descriptive results are presented for that outcome because of the multiplicity of special education designations and ambiguity about how to interpret the identification of the children in our samples for special education services. TN-VPK participants had an opportunity to have their special needs identified and addressed during the pre-k year that was not afforded to the nonparticipants. Moreover, having that earlier year means those children are more likely to receive continued services in the kindergarten and first grade years. Arguably, this is a positive outcome—earlier identification and services for special needs for the TN-VPK participants should reduce their need for such services in later grades. On the other hand, if TN-VPK participants should need and receive more special education services over a long term, that would not be a positive outcome. The number of years that constitutes that long term is not clear, but we do not believe that two years after pre-k is sufficient to determine how special education needs and services will unfold as a result of participation in TN-VPK.

The findings so far, as expected, show that TN-VPK participants received more special education services in kindergarten than nonparticipants, though the difference was smaller when only services for needs other than the common speech/language problems were considered. However, the difference was reversed when only new special education designations were examined. Somewhat fewer TN-VPK participants had first designations for a special education service in kindergarten than nonparticipants. This too is not surprising; kindergarten is the first opportunity for the special needs of nonparticipants to be identified and addressed.

First grade special education data were available only for Cohort 1 of the full randomized sample. As with the kindergarten comparison, they showed a greater percentage of TN-VPK participants receiving special education services than nonparticipants, but with much smaller percentages for both when speech/language services are not counted.

The non-cognitive effects of TN-VPK are important because of their potential long-term influence on children's academic careers and the findings in other studies of early childhood education that show this to be the domain in which the largest effects occur. Further, the literature identifies these non-cognitive outcomes as those with the biggest cost saving implications for schools and communities. It is too early to expect such effects to appear with any consequential magnitude for TN-VPK, but there are early promising signs in the positive findings for kindergarten grade retention and first grade attendance. The further follow-up waves planned through at least third grade will, in time, provide a fuller picture of TN-VPK effects on these non-cognitive academic outcomes.

What are the characteristics of the children who show the largest effects of participation in TN-VPK at the end of the kindergarten and first grade years?

No differential TN-VPK effects on the WJ composite achievement measures were found for gender, age, or native English speaker subgroups after either the kindergarten or first grade year. There were thus no strong overall effects of TN-VPK for any of these subgroups when all of the achievement measures were combined into a single composite.

Nonetheless, there were some indications of differential TN-VPK effects in particular achievement domains. For participants who entered pre-k when they were younger, TN-VPK had greater effects on the literacy measures (Spelling and Letter-Word Identification) and one of the math measures (Calculation) in kindergarten with similar differential effects for two of the math measures (Applied Problems and Calculation) in first grade. An age differential also was found for the first grade teachers' ratings. According to those teachers, the younger children benefitted more from TN-VPK than their older counterparts on work-related skills. In contrast, they reported larger effects of TN-VPK on social skills for the older children.

Similarly, the effects of TN-VPK in kindergarten and first grade on some of the measures of literacy and language achievement were stronger for native English speaking children than for the non-native English speakers, though it is the latter that most need a boost in those skills. This pattern appeared in the Letter-Word identification measure in kindergarten and more strongly in two of the language measures (Picture Vocabulary and Passage Comprehension) in first grade. These findings are a reversal of the pattern of results at the end of the pre-k year—the non-native English speaking children showed larger TN-VPK effects than the native English speaking children at that time on all the achievement measures. In light of this reversal, it may not be surprising that participation in TN-VPK had less positive effects on feelings about school, as rated by the first grade teachers, for the non-native English speakers than for the native English speakers.

There were also some indications of differential TN-VPK effects on kindergarten retention. TN-VPK had larger effects (less retention) for native English speaking children than for non-native English speakers. This differential was statistically significant in the analysis with the full randomized sample and in the same direction, but not significant in the Intensive Substudy sample. A similar pattern was evident at a marginally significant level for TN-VPK effects on kindergarten attendance—native English speaking children showed larger effects than non-native English speaking children. That same pattern of differential effects appeared for first grade attendance but, again, was only marginally significant.

Concluding Note. The longitudinal effects found for TN-VPK so far are decidedly mixed. The encouraging achievement effects found at the end of the pre-k year were not sustained, but there are indications of possible effects on important non-cognitive academic outcomes. The kindergarten and first grade years are too early for any such effects to appear in anything but tentative form, however, so later waves of data will be required to paint the full picture of those effects. Also ahead are the state achievement tests that are administered in third grade with an open question of whether TN-VPK participation will have any effect on those critical performance measures.

Evaluation of the Tennessee Voluntary Prekindergarten Program: Kindergarten and First Grade Follow-Up Results from the Randomized Control Design

This report is the second in a series that presents findings from a large-scale evaluation of the Tennessee Voluntary Prekindergarten program (TN-VPK). The previous report in the series (hereafter referred to as the *end of pre-k report*) covered the end of prekindergarten results; the present report summarizes the longitudinal effects of TN-VPK on students' kindergarten outcomes and those first grade outcomes that are currently available. At the end of prekindergarten, TN-VPK effects could be examined only on early achievement measures and teacher ratings at the beginning of the kindergarten year. A notable addition in this report of the kindergarten and first grade follow-up results is that outcomes are now available on several "non-cognitive" academic outcomes, including grade retention, attendance, formally recorded disciplinary actions, and special education services.

These non-cognitive outcomes are especially interesting in light of the findings of other longitudinal studies of the effects of early childhood education programs. Though none of those other studies examined follow-up effects for a scaled-up state funded pre-k program such as TN-VPK, a number of them did include outcome measures for both achievement and non-cognitive variables similar to those used in the current study. A typical finding is that the effects on achievement and similar cognitive outcomes diminish over time. For example, a large meta-analysis of studies examining the persistence of program effects on cognitive outcomes from early education programs concluded that those outcomes generally lasted for only one to two years after the programs ended and, by four years out, the cognitive effects of all of the programs had largely gone away (Leak et al., 2010). In contrast, there have been nearly universal findings that early education programs produce longer-term effects on various non-cognitive outcomes such as grade retention, receipt of special education services, and graduation rates (e.g., Campbell et al, 2001; Deming 2009; Lazar et al., 1982; Reynolds, 1998). Such effects have typically not been detected as early as kindergarten and first grade, so later waves of data collection in the current study will be especially informative with regard to this category of outcomes.

The earlier end of pre-k report on this evaluation includes details about the design of this study and its components that are not repeated here. That report, *Evaluation of the Tennessee Voluntary Prekindergarten Program: End of Pre-K Results from the Randomized Control Design*, can be found on the Peabody Research Institute's website (http://peabody.vanderbilt.edu/ research/pri/). The Executive Summary from that previous report is provided in Appendix A of this follow-up report.

TN-VPK is an optional program for parents in Tennessee that prioritizes enrollment for the neediest children in the state. This evaluation of TN-VPK was funded by a grant from the U.S. Department of Education's Institute of Education Sciences and is being conducted in collaboration with the Tennessee Department of Education Division of Curriculum and Instruction. The overall design for the evaluation includes several different components. The component discussed in this report is a randomized control trial (RCT) in which children who applied to TN-VPK were admitted on a random basis. To implement this procedure, TN-VPK programs across Tennessee that expected more applicants than they

could accommodate, and were willing to participate in the evaluation, submitted lists of eligible applicants to the researchers at the Peabody Research Institute. The research team then shuffled each list into a random order, and the TN-VPK program staff were asked to fill the available seats by first offering admission to the child at the top of the list and then going down the list in order until all the available seats were filled. Once a program had admitted enough children to fill its seats, any remaining children were put on a waiting list and were admitted, in order, if additional seats became available. Those on the waiting list who were not admitted to TN-VPK became the control group for the study.

This procedure was used for two cohorts of children—TN-VPK applicants for the 2009-10 and 2010-11 school years—and resulted in the random assignment of more than 3000 children. That full randomized sample is being tracked through the state data system. In addition, we obtained parental consent for a portion of this randomized sample, referred to as the Intensive Substudy (ISS) sample. Children in the Intensive Substudy are being assessed annually by the research team and periodically being rated by their teachers.

This report presents end of kindergarten findings and the first grade findings available to date from both the full randomized sample and the ISS sample. Three questions about what effects of TN-VPK are evident one and two years after participation for the economically disadvantaged children eligible for the program were investigated:

1. Does participation in TN-VPK have effects on children's cognitive achievement outcomes that are evident at the end of the kindergarten and first grade years?
2. Does participation in TN-VPK have effects on children's non-cognitive academic outcomes that are evident at the end of the kindergarten and first grade years?
3. What are the characteristics of the children who show the largest effects of participation in TN-VPK at the end of the kindergarten and first grade years?

The Tennessee Voluntary Pre-K Program

TN-VPK is a statewide program administered by the Division of Curriculum and Instruction in the Tennessee Department of Education. It began as a pilot program in 1998 and expanded rapidly after 2005. The program operates through competitive grants to local school systems who apply for approval and funding of one or more TN-VPK classrooms. However, those grants support only a portion of the actual cost; the balance must come from other sources. This arrangement permits and encourages collaboration between school systems and other organizations. In this "collaboration model," school districts may, at their option, operate their TN-VPK programs through collaborative agreements with local non-profit and for-profit child care providers or Head Start programs so long as those agencies have attained the highest rating from the licensing system administered by the Tennessee Department of Human Services and their programs meet the State standards for TN-VPK.

TN-VPK is a full-day prekindergarten program for four-year-old children expected to enter kindergarten the following year. By statute, the program gives priority to children eligible for the federal free or reduced price lunch programs and, secondarily, to students with disabilities, identified as English Language Learners (ELL), or otherwise at-risk. The program in each participating school district must meet standards set by the State Board of Education that require each classroom to have a licensed teacher with an Early

Development and Learning Pre-K-K Endorsement or a Pre-K-3 or Pre-K-4 license, an adult-student ratio of no less than 1:10, a maximum class size of 20, and an approved age-appropriate curriculum. Currently, 934 state-funded TN-VPK classrooms serve more than 18,000 children across all 95 Tennessee counties.

Results from the Investigation of the TN-VPK End of Pre-K Effects (Summary of the Previous Report)

The Executive Summary from the previous report in this series is provided in Appendix A. That report focused on the following two questions about the effects of the TN-VPK program on the participating children at the end of the pre-k year:

1. Does participation in TN-VPK improve the school readiness of the economically disadvantaged children eligible for the program?
2. What are the characteristics of the children who benefit the most from TN-VPK?

During the course of the pre-k school year, the academic skills of all the children improved, as measured by a battery of Woodcock-Johnson III (WJ) achievement measures. However, the children who participated in TN-VPK gained significantly more on all the direct assessments of academic skills than the children who did not attend. In standard deviation units, the average effect size on an overall WJ composite achievement measure was .24, and the effect sizes for the individual literacy, language, and math scales ranged from .10 to .46[3]. These standard deviation units allow the proportionately greater gains for TN-VPK participants relative to nonparticipants to be represented as a percentage increases over the period from the beginning to the end of the school year. On the WJ Composite measure, TN-VPK resulted in a gain that was 45% greater than the gain made by the children who did not attend TN-VPK. The analogous improvements on the individual academic achievement measures for TN-VPK participants relative to nonparticipants were as follows:

Literacy: Letter-Word Identification, 89%; Spelling, 30%.
Language: Oral Comprehension, 26%; Picture Vocabulary, 83%.
Math: Applied Problems, 21%; Quantitative Concepts, 49%.

Positive effects of TN-VPK were also found at the beginning of the kindergarten year on the kindergarten teachers' ratings of children's preparedness for kindergarten and, to a lesser extent, on their ratings of the children's classroom work behavior and social behavior. We also investigated whether the TN-VPK program was differentially effective for different subgroups of children. The program's positive effects were not different for boys compared to girls, but there were larger effects on the academic skills of children who were not native English speakers than for those who were. Most of these English Language Learners were Hispanic, so no separate analysis was done for differences among ethnic groups. The current report continues the longitudinal investigation by adding kindergarten and first grade outcomes to what has already been reported on the end of

[3] These effect sizes differ slightly from those reported in the earlier end of pre-k report. The values reported here are a result of further analyses that used a more advanced procedure for dealing with missing data.

pre-k effects. Because many of the sample and analytic decisions were described in full detail in that earlier report, these are only briefly described in the present report.

TN-VPK Effects at the End of Kindergarten and First Grade

The Full Randomized Sample

As mentioned earlier, there were two cohorts in the RCT portion of the evaluation, children who applied to TN-VPK for the 2009-10 school year and children who applied for the 2010-11 school year. Across these cohorts, 80 different schools in 29 Tennessee school districts submitted applicant lists for randomization that proved to be eligible for inclusion in the RCT sample. These 80 schools were spread across the state with the largest number in the Central West region (Nashville and surrounding counties). Overall, their distribution was:

- 15 schools (8 districts) in the West region (including Shelby County and Memphis);
- 33 schools (10 districts) in the Central West region (including Davidson County and Nashville);
- 14 schools (3 districts) in the Central East region (including Hamilton County and Chattanooga);
- 17 schools (8 districts) in the East region (including Knox County and Knoxville).

These schools included 20 in urban areas (12 in large cities and 8 in mid-size cities), 29 in suburban areas, and 31 in rural areas.

The full randomized analysis sample for this report was comprised of 3025 children from 111 randomized school applicant lists in 28 districts across Tennessee. This analysis sample came from 3305 children who were originally on the randomized lists. Forty-nine children on those lists were ineligible for the sample because they were not randomized with the rest of their list applicants, were over the income eligibility requirement, attended a blended pre-k classroom, or their date of birth and grade progression indicated they were older or younger than appropriate for a pre-k sample. Of the remaining 3256 children, 119 were not definitively located in the state database with valid enrollment information as of January, 2013. Finally, 112 children were removed from the analysis sample because they were on randomized lists without at least one TN-VPK participant and one nonparticipant. This left 3025 children. The demographic characteristics for this sample of 3025, taken from the state database, are given in Table 1 below.

Table 1. Demographic Characteristics of the Children in the Full Analysis Sample, Both Cohorts

Characteristic	N	Mean
Age in months at start of pre-k year	3025	52.0
Black	3025	.26
Hispanic	3025	.22
Male	3025	.50
Native English Speaker [a]	2992	.76

[a] This information was missing in the state database for 33 of the 3025 children, 1% of the analysis sample.

TN-VPK Participants and Nonparticipants in the Full Sample. There are two ways to define the TN-VPK participant and nonparticipant groups in the full sample. One way is to designate participants as those children who actually attended TN-VPK and nonparticipants as those children who did not attend. Another way is to define participants as those who were randomly assigned to attend and nonparticipants as those randomly assigned not to attend, whether or not they actually attended. Though substantially similar, the resulting participant and nonparticipant groups are not identical under these two definitions because not all children randomly assigned to one or the other condition actually complied with that assignment. The parents of some of those assigned to participate did not actually receive an offer of admission from the school (e.g., could not be reached or were skipped over) or did not accept the offer, and thus crossed over to the nonparticipant group. Conversely, some of those assigned as nonparticipants received offers, often because places were still available after skips or refusals earlier in the list, and did participate, thus crossing over to the participant group.

For the full sample, we defined participants and nonparticipants both ways. Comparing outcomes for those randomly assigned to participate or not is known as the intent to treat analysis (ITT) and has the advantage of preserving the initial randomization with its ability to avoid any systematic differences between the groups on baseline characteristics. However, it has the disadvantage of potentially underrepresenting the program effects by diluting each group with the crossovers. Comparing outcomes for those who actually participated and those who did not participate is known as the treatment on the treated analysis (TOT). It has the advantage of correctly representing what each group actually experiences, but breaks the randomization and thus is open to possible bias stemming from initial baseline differences. We have focused on the TOT results in this report, but also present the ITT results.

The TOT groups were defined based on the state database records for the appropriate pre-k year. Children located in the state database in pre-k during the appropriate year were considered to be in the participant group. Children not located in the state database in pre-k during the appropriate year, or children found in the database but with enrollment and withdrawal dates that were the same and missing attendance information (indicating that the child did not attend at all), were considered to be in the nonparticipant group.

The ITT condition definition involved both the TOT status described above and the order in which a child's name appeared on the initial randomized applicant list. We first used the TOT status to determine how many eligible children on each randomized list actually attended any TN-VPK classroom during the appropriate pre-k year. Then we counted down the randomized list until we reached that number of participants actually attending as indicated by the TOT designation. Those were the children that should have been the TN-VPK participants if the randomization had been the sole determinant of participation. All children on the list ranked at or higher than that number, whether they actually participated or not, were designated as ITT participants, and all children ranked below that number on the list, whether they actually participated or not, were designated as ITT nonparticipants. As an example, on a randomized list of 35 eligible applicants from which 25 were confirmed by the state database as attending pre-k during the appropriate year, the first 25 on that list would be identified as participants for the ITT analysis even though

some of those 25 did not attend TN-VPK and some of the remaining 10, who were coded as ITT nonparticipants, actually did attend. For 80.7% of the full randomized analysis sample of 3025, the children's ITT designation was identical to their TOT designation. The other 19.3% of the sample were crossovers, evenly divided between those assigned to participate who did not and vice versa.

The Intensive Substudy Sample

Different procedures for obtaining parental consent were used with Cohort 1 than with Cohort 2 due to logistical issues more fully described in the earlier end of pre-k report. The procedure used for Cohort 1 produced an overall consent rate for the ISS of 42%, with a 46% consent rate for TN-VPK participants and 32% for non-participants. The procedure used for Cohort 2 resulted in an overall consent rate of 71%, with 74% of the participants and 68% of the non-participants consenting. The poor to modest consent rates overall and the differential consent rates for participants and non-participants in each cohort created the potential for the TN-VPK participant and nonparticipant groups in the ISS sample to differ on important initial characteristics despite the randomization applied to the applicant lists from which they were drawn. As described later, there were some significant baseline differences between the participant and nonparticipant groups and efforts were made in the analysis to adjust for those differences in the estimation of TN-VPK effects on the various outcome measures.

The ISS analysis sample for this report began with the full randomized sample. Of the randomized applicant lists in the full sample, 76 lists from 58 unique schools in 21 districts across the state included at least one TN-VPK participant and one non-participant whose parents consented to their inclusion in the ISS and who were assessed at the end of the pre-k year. Those applicant lists identified 1078 children[4], 308 from Cohort 1 and 770 from Cohort 2 (774 TN-VPK participants and 304 non-participants). However, two children were subsequently trimmed from the sample because of their outlier propensity scores (described in the earlier end of pre-k report), which left 1076 children in the final analysis sample, 773 TN-VPK participants and 303 nonparticipants. The randomized lists that generated this sample of children were contributed by 10 schools in the West region of the state, 24 schools in the Central West, 12 schools in the Central East, and 12 schools in the East. Nineteen of the schools were near cities (10 large, 7 mid-size, and 2 small), 11 were in the suburbs, 12 were in towns, and 16 were considered rural. Three of them were public pre-k centers affiliated with public schools. None of the 58 schools was a partnership site (i.e. received funding from multiple sources). The demographic characteristics for this sample of 1076 are given in Table 2 below.

From a telephone interview of parents of children in the ISS sample during the pre-k year, we were able to obtain information about the childcare arrangements for children who were not admitted to TN-VPK. Those responses are displayed in Figure 1 below, and show that the majority of children who applied for, but did not attend TN-VPK stayed home with a parent or some other relative or caretaker (more than half of the nonparticipant group).

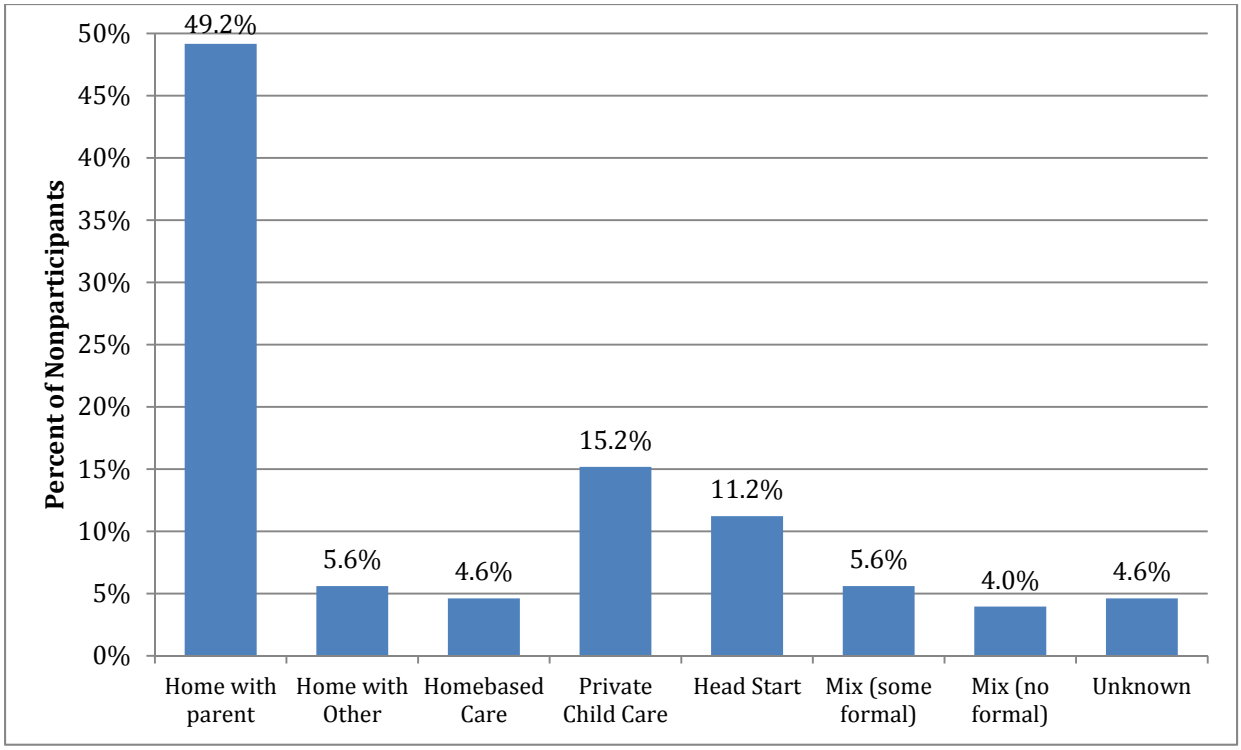
[4] Earlier reports included 1079 children but more recent information revealed that one child previously included was actually ineligible for the sample due to age/grade progression.

Only 11.2% were able to attend a Head Start program as an alternative to the TN-VPK program to which they had applied while 15.2% were enrolled in private childcare.

Table 2. Demographic Characteristics of the Children in the ISS Analysis Sample (Both Cohorts)

Characteristic	N	Mean
Age in months at start of pre-k year	1076	51.8
Black	1076	.23
Hispanic	1076	.18
Male	1076	.45
Native English Speaker	1076	.80

Figure 1. Childcare Arrangements for Children in the ISS Analysis Sample Who Did Not Participate in TN-VPK (Both Cohorts)



TN-VPK Participants and Nonparticipants in the ISS Sample. For the analyses with the ISS sample in this report (and the previous one) we elected to compare outcomes only for the children who actually participated in TN-VPK with those who did not participate irrespective of the conditions designated for them on the original randomized applicant lists. All these analyses thus estimate treatment on the treated (TOT) effects. The non-consent rates for the two cohorts in the ISS sample mean that we do not have data on the

main ISS outcomes for many of the children who were initially randomized, so analysis on the basis of that randomization is not possible. The randomization nonetheless provides a substantial chance component to the determination of which children participated and thus aids the effort to produce valid estimates of the TN-VPK effects.

For the ISS sample, therefore, we have conducted the analysis on the assumption that the TN-VPK participants and nonparticipants whose outcomes we are comparing may be different at baseline in ways that could bias the estimates of the TN-VPK effects. To account for any such differences as much as possible, we have used the available baseline data to create propensity scores to adjust for those differences in the analysis. This procedure is described later in this report and reported in more detail in the earlier end of pre-k report.

To identify the children in the ISS analysis sample who participated in TN-VPK and those who did not participate for purposes of comparison, we made use of all the information available to us about each child's pre-k experience. This information included the records in the State Education Information System showing enrollment status and information gathered during our data collection that was provided by parents, teachers, and school personnel. We then defined TN-VPK participants as children for whom the available information indicated that they attended any TN-VPK program for at least 20 days during the school year, whether at the school that included them on a randomized applicant list or not. This 20-day attendance requirement was identified by the administrator of TN-VPK at the State Department of Education as the minimum number of days they required to consider a child as having participated in TN-VPK; it constitutes one attendance reporting period. TN-VPK nonparticipants, conversely, were defined as children for whom the available information indicated that they did not attend any TN-VPK program or, if they attended, it was for fewer than 20 days.

Measures

Parent Questionnaire. Questionnaires were administered via telephone to the parents of the consented children and thus are available for the ISS sample. These were conducted during the pre-k year to provide information about child and family characteristics that might impact achievement such as demographic information and activities at home with the child. These were completed with the parent or guardian of 1033 of the 1076 children in the analysis sample (96%). Among the items on that questionnaire were questions about the parents' education, the number of working parents, the home language environment, and various literacy activities of the child or the child and parent at home including library card use and newspaper and magazine subscriptions.

Cognitive Achievement Outcomes

Direct Child Assessments. Achievement on emergent literacy, language, and math school readiness measures was assessed for the children in the ISS sample (only) at the beginning and end of the pre-k school year and again at the end of the kindergarten and first grade years by trained members of the research team. The standardized assessments administered to each child included the scales listed below from the Woodcock Johnson III Achievement Battery (WJ; Woodcock, McGrew, and Mather, 2001). These instruments are

widely used in prekindergarten research to assess emergent literacy, language, and math skills related to young children's readiness to begin kindergarten. In addition, they have the advantage of being longitudinally scaled so that they are applicable through the later grades.

Literacy

- *Letter-Word Identification*: Assesses children's ability to identify and pronounce alphabet letters and read words.
- *Spelling*: Assesses children's prewriting skills, such as drawing lines and tracing, writing letters, and spelling orally presented words.

Language

- *Oral Comprehension*: Assesses children's ability to fill in a missing word in a spoken sentence based on semantic and syntactic cues.
- *Picture Vocabulary*: Assesses children's ability to name the objects presented in pictures and point to the picture that goes with a word; it measures early language development and lexical knowledge.
- *Passage Comprehension* (not used in prekindergarten): Assesses reading comprehension through matching picture and/or text representations that have similar semantic properties.

Math

- *Applied Problems*: Assesses children's ability to solve small numerical and spatial problems presented verbally with accompanying pictures of objects.
- *Quantitative Concepts*: Assesses children's ability to point to or state answers to questions on number identification, sequencing, shapes, symbols, and the like; it measures aspects of quantitative reasoning and math knowledge.
- *Calculation* (not used in prekindergarten): Assesses mathematical computation skills through the completion of visually-presented numeric math problems.

Composite Measure

- *WJ Composite Score*: A principal components factor analysis revealed that all the scales above were intercorrelated with high loadings on a single factor. The W-scores on those scales were therefore averaged to create a composite measure representing children's overall achievement in literacy, language, and math. The scores on all of the above tests were summarized in two different composite measures:
  - The *WJ Composite 6* aggregates the six subscales used in the assessments before and after the pre-k school year.
  - The *WJ Composite 8* aggregates all the subscales used in the kindergarten and first grade battery.

For the Woodcock Johnson tests, the IRT scaled W-scores were used in the analyses unless otherwise indicated. The W-scores are the ones suitable for longitudinal comparisons and thus capable of showing gains from year to year.

Non-Cognitive Outcomes

Data from teacher ratings and the state education information system provided a number of measures for aspects of student performance or status other than academic achievement

that might plausibly be affected by participation in TN-VPK. We refer to these generally as "non-cognitive" outcomes. These measures are available for both the ISS sample and at least Cohort 1 of the full sample (Cohort 2 data are not currently complete) and include:

Teacher Ratings. In addition to the direct assessments, the children in the ISS sample were rated by their kindergarten teachers (at the beginning of the kindergarten year as an end of pre-k outcome) and their first grade teachers (during the second half of the year). Effects on the end of pre-k ratings were reported in the previous report in this series; the current report presents effects on the ratings in year 3 (first grade for most students). Two teacher rating instruments were used for this purpose:

- *Cooper-Farran Behavioral Rating Scales:* Teacher ratings for each child on two scales:
  - *Social Behavior*: Social interactions with peers including appropriate behavior while participating in group activities, play, and outdoor games; expression of feelings and ideas; and response to others' mistakes or misfortunes.
  - *Work-Related Skills*: The ability to work independently, listen to the teacher, remember and comply with instructions, complete tasks, function within designated time periods, and otherwise engage appropriately in classroom activities.
- *Academic Classroom and Behavior Record*: Teacher ratings for each child on four scales:
  - *Readiness for Kindergarten*: How well-prepared the child is for kindergarten in literacy, language, and math skills, and social behavior.
  - *Peer Relations*: Whether other children in the classroom like the target child and how many close friends the target child has.
  - *Behavior Problems*: Whether the child has shown explosive or overactive behaviors, attention problems, physical or relational aggression, social withdrawal or anxiety, motor difficulties, and the like.
  - *Liking for School*: The child's liking or disliking for school, having fun at school, enjoying and engaging in classroom activities, and seeming happy at school.

Grade Retention. Grade retention in a given year was determined by the grade assignment recorded in the state data system in the following year. For this report, we were able to analyze the effect of TN-VPK on children's grade retention in kindergarten, or the year immediately following the intervention year, by looking at their grade assignment in first grade. If a child's grade assignment in what would typically be the first grade year (two years after the intervention year) was anything lower than first grade, that child was considered to have been retained in kindergarten. This outcome was available for both cohorts of the ISS sample but only for Cohort 1 of the full randomized sample[5].

School Attendance[6]. A child's attendance was represented as the total number of days attended during the respective school year and was determined by the number of

[5] All analyses of non-cognitive outcomes that are specific only to Cohort 1 of the full randomized sample should be considered preliminary. These results will be updated and will be more definitive as data become available to allow the inclusion of both cohorts.

[6] Tennessee's Consortium on Research, Evaluation, and Development provided invaluable assistance in obtaining attendance data and school calendars for these samples, as well as helping to validate the disciplinary action data.

instructional days the child was marked as present, summed across multiple schools if a child was enrolled at more than one during a school year.

Attendance data were available for the year after the pre-k year (the kindergarten year for most of the children) in both the ISS and full randomized samples. For attendance two years after the pre-k year (the first grade year for most of the children), data were available only for Cohort 1. Because these data were notably skewed, we analyzed both the original metric as described above and the log transformations of those values subtracted from one greater than the maximum value.

Disciplinary Action. Disciplinary actions were coded from the state education database as a binary variable indicating whether or not at least one event was recorded for a child in a given year. Though officially recorded disciplinary actions were rare occurrences in these early grades, we examined the frequency of disciplinary action in kindergarten for both the ISS and full samples and in first grade for Cohort 1 of the full sample.

Special Education Services. Special education designations were coded from the state education database. This outcome is complex for several reasons for younger children. Children who participate in TN-VPK are more likely to receive special education services in kindergarten and first grade simply because they have been in the school system longer and thus have had more opportunity to be identified as needing such services and, in kindergarten, have more likelihood of those services being carried over from the pre-k year. In addition, the large majority of special education designations for young children involve early speech/language issues that diminish rapidly as children mature given the developmental nature of those skills. The special education designations that are of primary interest as outcomes of pre-k after are those that indicate long-term difficulties, such as specific learning disorders. These occur some time after the initial services that may serve to prevent them and do not tend to emerge until later in elementary school.

Because of the complexity of this outcome, we looked at special education designations in several different ways. First, we coded whether each child was identified as receiving at least one special education service in each year (excluding the "Intellectually Gifted" designation). We then looked at whether that service was limited to speech/language needs and if the special education designation was a new one, meaning that the child either did not receive special education services the previous year or received services for a different identified need. In this report, we descriptively examined the frequency of reported designations for special education services in kindergarten for both the ISS and full samples, and in first grade for Cohort 1 of the full sample.

Analysis Procedures

Because different outcomes were available for different samples at varying time points, a list of each analysis presented in this report is included in Table A1 of Appendix A.

Statistical Approach

Except where indicated otherwise, the effects of the TN-VPK program on the outcome variables (other than special education services) were estimated using multilevel regression models with children nested within the schools to which their parents initially

applied for the TN-VPK program, and those schools nested within school district.[7] The treatment effects were estimated as constants (fixed effects) across districts and schools. The slopes for all other variables were fixed and a random intercept at each level was included.

To adjust for baseline differences in the ISS analysis sample, propensity scores were used that incorporated the following variables:

- Child age at pretest, gender (male yes/no), ethnicity (Black yes/no and Hispanic yes/no), and native language (English yes/no);
- Parent reports of home library card use, newspaper subscriptions, magazine subscriptions, maternal education, and number of working parents;
- Pretest W-scores for all six Woodcock Johnson achievement scales;
- Time lag from the beginning of the school year to pretest.

To account for any differences between cohorts in the variables that differentiated the TN-VPK participant and nonparticipant groups at baseline, separate propensity scores were created for each cohort. To create the propensity scores, the variables listed above were used in sample-weighted (described below) three-level logistic regressions (students nested in schools, and schools nested in districts) to predict participant vs. nonparticipant group membership, and the predicted values for the probability of being a participant were saved as propensity scores. The distributions of propensity scores for the two groups were examined for overlap and two children with propensity scores more than .25 standard deviation below the minimum or above the maximum of the other distribution were dropped from the analysis. The original ISS sample of 1078 was thus reduced to 1076, the total for the ISS analysis sample.

A further source of variation across the applicant lists and the TN-VPK participants and nonparticipants within each list in the ISS sample was the participation rate of each group in the analysis sample. Mainly as a result of the different parental consent rates, different proportions of the total number of TN-VPK participants and nonparticipants on the randomized applicant lists were represented in the overall ISS analysis sample. If the children of consenting and non-consenting parents differ in ways related to the outcomes, the varying rates of inclusion in the analysis sample for TN-VPK participants and nonparticipants across the applicant lists might inappropriately influence the estimates of the TN-VPK effects. We therefore created two *inclusion rate* variables for each applicant list that were used as Level 2 covariates in the analysis. These were defined as (a) the number of TN-VPK participants included in the analysis sample from a given applicant list divided by the total number of TN-VPK participants on that list, and (b) the number of TN-VPK nonparticipants included in the analysis sample from that list divided by the total number of nonparticipants on the list. Because the TN-VPK participant and nonparticipant inclusion rates typically differed for each list, we also included the interaction of these two inclusion rates at Level 2 in the analysis.

[7] If a school or district was represented in both cohorts, that school or district was treated as two unique entities in the analysis, which resulted in a multilevel model with 1076 children in 76 separately specified schools and 34 separately specified districts when the actual number of schools and districts was 58 and 21 respectively. Alternative nesting structures were also examined, but produced virtually identical results.

Because of the limited baseline information for the full randomized sample, which was restricted to the basic demographic information provided by the state database, propensity scores were not used in the analyses for that sample. However, those demographic variables that we did have access to were included as covariates in the analytic models to account for as many between-child differences as possible.

The proportion of children participating in TN-VPK relative to the proportion of nonparticipants varied considerably across the randomized applicant lists at the contributing schools. The uneven contributions of the associated schools to each of the comparison conditions was itself a possible source of differences between those conditions, including possible differences on variables that had not been measured at baseline. We therefore created weights (referred to as *sample weights*) to balance the representation of the respective schools in the two comparison groups. This was done by weighting the data from the TN-VPK participants and nonparticipants within each applicant list so that their proportionate contributions matched the proportions in the total sample. This was done separately for the ISS analysis sample and the full analysis sample, producing appropriate weights for each.

Attrition

Attrition from the full randomized sample was defined as any student who could not be located in the state database for a given year, though they might be found for a later year. Table 3 shows attrition during Year 2 (the kindergarten year for most children) for both cohorts of the full randomized sample. Table 4 shows attrition during Years 2 and 3 for Cohort 1 of the full randomized sample, the only cohort for which we have first grade data from the state data system. As both tables show, over 96% of the corresponding samples was located in each of the years following the intervention year.

Attrition from the ISS analysis sample was also minimal, as shown in Table 5. More than 95% of the original ISS analysis sample was assessed at the end of each year.

Missing Data

There were at least some missing values for most of the variables used in the analyses, and these were imputed so that all the cases that had been defined as eligible for each sample during the pre-k year could be used in the analyses of the kindergarten and first grade follow-up. The average missing value rate across all the variables in the ISS analysis sample was 5% with a range of 0 to 14%; in the full analysis sample (both cohorts) it was 1%, ranging from 0 to 3%. The proportion of cases with missing values for each of the relevant variables for each sample on each measurement wave is reported in Tables B1-B3 in Appendix B. Imputation was done using the multiple imputation procedure in SPSS, specifying 30 imputations and incorporating the sample weights described earlier. After imputation, the data were aggregated to the child level and all analyses were run on the aggregated file.

The propensity scores for the ISS sample described above were calculated from one specific imputed data file which included all data collected from the pre-k year only. After any missing data in that file were imputed using multiple imputation in 30 different

imputed datasets, those datasets were aggregated and the propensity scores were calculated.

Table 3. Attrition during Year 2 for Both Cohorts of the Full Randomized Sample

	Not Located in Year 2	Located in Year 2 (% of sample)
Nonparticipants (N=974)	19	955 (98.0%)
Participants (N=2051)	31	2020 (98.5%)
Total (N=3025)	50	2975 (98.3%)

Table 4. Attrition during Years 2 and 3 for Cohort 1 of the Full Randomized Sample

	Not Located in the Specified Year	Located in the Specified Year (% of sample)
Year 2 (Kindergarten)		
Nonparticipants (N=507)	13	494 (97.4%)
Participants (N=1257)	15	1242 (98.8%)
Total (N=1764)	28	1736 (98.4%)
Year 3 (First Grade)		
Nonparticipants (N=507)	11	496 (97.8%)
Participants (N=1257)	47	1210 (96.3%)
Total (N=1764)	58	1706 (96.7%)

Table 5. Attrition during Years 2 and 3 for the ISS Analysis Sample (Both Cohorts)

	Not Located in the Specified Year	Withdrew from Study	Assessed in the Specified Year (% of sample)
Year 2 (Kindergarten)			
Nonparticipants (N=303)	6	0	297 (98.0%)
Participants (N=773)	19	4	750 (97.0%)
Total (N=1076)	25	4	1047 (97.3%)
Year 3 (First Grade)			
Nonparticipants (N=303)	12	0	291 (96.0%)
Participants (N=773)	34	1	738 (95.5%)
Total (N=1076)	46	1	1029 (95.6%)

To preserve consistency between the imputation models and the analysis models used to estimate TN-VPK effects, the variables in the imputation function for the ISS sample included all those that were also to be used in the analysis models (Allison, 2002).

For the full randomized sample, the variables in each imputation included the relevant outcome variables, experimental condition, gender, ethnicity, age at the start of the pre-k school year, native English speaker status, and cohort. For the ISS sample, the variables included all the outcome variables in all the waves for which they were available plus experimental condition, child's age at pretest, pretest lag from school start date, test interval between pretest and each posttest, ethnicity, gender, native English speaker status, mother's education, library card use, newspaper subscriptions, magazine subscriptions, number of working parents, lag from kindergarten start date to time of kindergarten teacher rating, age at kindergarten and first grade teacher rating, and cohort.

Baseline Differences

Tables 6 & 7 show sample-weighted descriptive information on children's baseline characteristics by experimental condition for the ISS and full randomized samples. Statistical significance is reported from sample-weighted three-level regression models predicting each variable from TN-VPK participation with no covariates.

As Tables 6 and 7 show, the TN-VPK participants and nonparticipants were substantially similar at baseline in both the ISS sample and the full sample. There were statistically significant baseline differences in the ISS sample only on the WJ Letter-Word Identification scores (for which TN-VPK participants had a somewhat higher mean) and the interval between the start of the pre-k year and when a child was pretested. The latter difference was a result of the difficulty in locating nonparticipants, who of course were not in pre-k classrooms, for baseline assessments. On average, therefore, there was a greater lag to pretest for this group. In the full randomized sample, differences between participants and nonparticipants were found for the proportions of Black children and native English speakers, both of which were greater for the TN-VPK participants (though not significantly so for the Black children in the Cohort 1 sample).

The baseline differences in the ISS sample were dealt with in all the analyses of the effects of TN-VPK on the outcome variables through the use of propensity scores plus inclusion of the baseline variables as covariates. In the full randomized sample no attempt was made to create propensity scores based on the few baseline variables available, but all those baseline variables were included as covariates in all the analyses of the effects of TN-VPK on the outcomes.

TN-VPK Effects in Kindergarten and First Grade

TN-VPK Effects on Cognitive Achievement Outcomes

Achievement outcomes were available only for the ISS sample based on the direct assessments administered by the research team to children with parental consent. Annual state achievement testing in Tennessee begins in third grade, at which time achievement outcomes will be available for the full sample.

Table 6. Comparison of the TN-VPK Participants and Nonparticipants on Baseline Variables for the ISS Analysis Sample (Both Cohorts)

	TN-VPK Participants			Nonparticipants			*p*-value for Difference
	N	Mean	SD	N	Mean	SD	
Age at Pretest (months)	773	53.9	3.54	303	54.4	3.70	.248
Gender (0=F, 1=M)	773	.47	.50	303	.41	.49	.291
Black	773	.23	.42	303	.22	.41	.740
Hispanic	773	.18	.39	303	.18	.38	.920
WJ Letter-Word ID	773	319.8	27.6	303	315.3	26.1	.023*
WJ Spelling	773	351.3	28.5	303	349.0	28.4	.401
WJ Oral Comprehension	773	443.7	15.8	303	443.4	17.6	.864
WJ Picture Vocabulary	773	455.5	21.8	303	453.3	25.7	.169
WJ Applied Problems	773	390.9	27.4	303	390.9	27.4	.967
WJ Quantitative Concepts	773	407.5	14.0	303	406.8	13.6	.473
WJ Composite Score	773	394.8	17.9	303	393.1	17.8	.244
Pretest Lag (days)[a]	773	67.8	23.1	303	82.2	31.1	.000*
Pre-post Interval[b]	773	196.9	24.3	303	191.8	37.0	.143
Mother's Education[c]	773	2.13	.73	303	2.08	.68	.617
Native English Speaker (1=Yes)	773	.80	.40	303	.78	.41	.310
Library Card Use[d]	773	.94	.81	303	.85	.82	.203
Newspaper Subscriptions[e]	773	.37	.76	303	.32	.73	.510
Magazine Subscriptions[e]	773	.27	.50	303	.32	.56	.475
Number of Working Parents	773	1.26	.62	303	1.27	.59	.802

[a] Days to pretest from average schools start date [b] Days between the pretest and posttest. [c] 4-point scale from less than high school to more than associate's degree. [d] 3-point scale from never/almost never used to used more than once/month. [e] 3-point scale from 0 to 4 or more.

Note. Sample weighted values are reported to make these values comparable to the sample weighted outcomes and thus maintain consistency between the representation of baseline differences and the analysis of the outcome variables.

*p <.05

Table 7. Comparison of the TN-VPK Participants and Nonparticipants on Baseline Variables for the Full Analysis Sample

	TN-VPK Participants			Nonparticipants			*p*-value for Difference
	N	Mean	SD	N	Mean	SD	
Both Cohorts							
Age at Start of Pre-K Year (months)	2051	51.9	3.56	974	52.1	3.67	.317
Gender (0=F, 1=M)	2051	.49	.50	974	.50	.50	.934
Black	2051	.27	.45	974	.23	.42	.023*
Hispanic	2051	.22	.41	974	.24	.42	.133
Native English Speaker (1=Yes)	2051	.77	.42	974	.74	.44	.003*
Cohort 1 Only							
Age at Start of Pre-K Year (months)	1257	52.1	3.58	507	52.5	3.80	.162
Gender (0=F, 1=M)	1257	.50	.50	507	.51	.50	.798
Black	1257	.28	.45	507	.26	.44	.307
Hispanic	1257	.22	.42	507	.24	.43	.391
Native English Speaker (1=Yes)	1257	.76	.43	507	.73	.44	.044*

Note. Sample weighted values are reported to make these values comparable to the sample weighted outcomes and thus maintain consistency between the representation of baseline differences and the analysis of the outcome variables.

*p <.05

Kindergarten Achievement. To determine the impact of TN-VPK on the Woodcock Johnson achievement measures at the end of the kindergarten year in the ISS analysis sample, multilevel regressions as described earlier were conducted for the two WJ composite variables and each of the individual subscales. The propensity scores were included in the regression models as covariates, the approach that best balanced the baseline covariates when various ways of incorporating them were explored in the pre-k analysis (details are in the earlier end of pre-k report). As a further safeguard against bias, and to improve statistical power, all the variables used to create the propensity scores were also entered as individual covariates.

Table 8. Full Model Results for the Analysis of the Effect of TN-VPK on the Two WJ Composite Measure W-Scores at the End of the Kindergarten Year for the ISS Analysis Sample (Both Cohorts)

	WJ Composite (6 subscales)			WJ Composite (8 subscales)		
Variable	b	SE	*p*-value	b	SE	*p*-value
Intercept	184.9	17.5	.000	170.5	17.0	.000
Inclusion Rate: Nonparticipants	-2.61	1.63	.110	-3.40	1.51	.024
Inclusion Rate: TN-VPK Participants	-.83	1.97	.673	-.21	2.29	.928
Inclusion Rate: Interaction	-2.45	5.95	.681	-2.37	6.42	.713
Cohort (2=reference)	-.09	1.02	.927	-.68	1.11	.542
Black	.28	.70	.690	.68	.83	.414
Hispanic	3.50	1.28	.006	3.83	1.12	.001
Male	-.93	.67	.164	-1.40	.64	.029
Native English Speaker	-.64	1.25	.607	-2.51	1.11	.025
Library Card Use	-.33	.47	.478	-.39	.49	.423
Newspaper Subscriptions	-.11	.48	.826	-.20	.48	.685
Magazine Subscriptions	.60	.55	.277	.74	.58	.205
Mother's Education	-.18	.47	.711	.07	.51	.892
Number of Working Parents	.41	.48	.385	.39	.55	.477
Age at Pretest	-.21	.08	.010	-.15	.09	.088
Test Lag	-.01	.04	.818	.01	.04	.829
Test Interval (T1 to T3)	1.40	.73	.055	1.81	.70	.010
Pretest	.62	.02	.000	.62	.02	.000
Propensity Score	-2.22	3.81	.560	.07	3.54	.985
TN-VPK Participation	**.53**	**.70**	**.448**	**-.03**	**.64**	**.962**

Table 8 shows the full model results for the two WJ Composite measures, and Table 9 summarizes the results and reports the standardized mean difference effect sizes for the eight individual scales as well as the two WJ Composites. The full model results for the analysis of each of these outcome variables can be found in Table B4 in Appendix B.

As can be seen in these tables, the relatively large effects on WJ measures found at the end of the pre-k year were greatly diminished and the differences between TN-VPK participants

and nonparticipants were no longer statistically significant at the end of the kindergarten year. The only exception was a marginally significant negative effect on Passage Comprehension; nonparticipants had higher scores at the end of the kindergarten year than TN-VPK participants.

Table 9. TN-VPK Effect Estimates for the Woodcock Johnson Achievement Measures at the End of the Kindergarten Year for the ISS Analysis Sample (Both Cohorts)

Outcome	N for TN-VPK Participants	N for TN-VPK Non-participants	b[a]	*p*-value	Pooled Posttest Standard Deviation[b]	Effect Size
WJ Composite (6 subscales)	773	303	.53	.448	13.4	.04
WJ Composite (8 subscales)	773	303	-.03	.962	13.6	.00
Literacy Measures						
Letter-Word Identification	773	303	.95	.522	27.1	.04
Spelling	773	303	.18	.922	20.7	.01
Language Measures						
Oral Comprehension	773	303	1.38	.202	15.1	.09
Picture Vocabulary	773	303	.97	.179	11.6	.08
Passage Comprehension	773	303	-2.31†	.091	21.8	-.11
Math Measures						
Applied Problems	773	303	.36	.727	15.7	.02
Quantitative Concepts	773	303	-.92	.187	13.1	-.07
Calculation	773	303	-1.32	.266	18.4	-.07

[a] Estimates from the regression models of the TN-VPK effects in W-Score units. [b] Sample-weighted values that use the same sample weights as in the analysis that produces the effect estimates.
Notes: Pretest covariates for the WJ subscales added to the kindergarten and first grade battery were created for Passage Comprehension by averaging the two pretest language subscales (Oral Comprehension and Picture Vocabulary) and for Calculation by averaging the two math subscales(Applied Problems and Quantitative Concepts).
† $p < .10$

First Grade Achievement. To determine the impact of TN-VPK participation on the Woodcock Johnson achievement measures at the end of the first grade year, multilevel regressions analogous to those above were conducted for the two WJ Composite variables and each of the individual scales. Table 10 shows the full model results for the two WJ Composites, and Table 11 summarizes the results and reports the effect sizes for the individual scales as well as the two WJ Composites. The full model results for the analysis of each of these scales can be found in Table B5 in Appendix B.

Similar to effects at the end of kindergarten, there were no statistically significant differences between TN-VPK participants and nonparticipants on the WJ measures at the end of first grade with one exception. That exception was the Quantitative Concept subscale, for which there was a significant difference favoring the nonparticipant group; TN-VPK participants scored lower on that subscale than nonparticipants.

Table 10. Full Model Results for the Analysis of the Effect of TN-VPK on the Two WJ Composite Measure W-Scores at the End of the First Grade Year for the ISS Analysis Sample (Both Cohorts)

	WJ Composite (6 subscales)			WJ Composite (8 subscales)		
Variable	b	SE	*p*-value	b	SE	*p*-value
Intercept	235.0	21.5	.000	229.7	20.8	.000
Inclusion Rate: Nonparticipants	.77	2.25	.732	.67	2.12	.753
Inclusion Rate: TN-VPK Participants	-1.36	1.79	.450	-.75	1.96	.704
Inclusion Rate: Interaction	-16.7	9.08	.070	-17.0	10.1	.096
Cohort (2=reference)	.01	.81	.994	-.13	.82	.872
Black	-1.38	.77	.073	-1.01	.73	.163
Hispanic	1.94	1.27	.127	1.91	1.19	.110
Male	-1.01	.61	.097	-1.69	.66	.011
Native English Speaker	-1.68	1.29	.193	-2.96	1.19	.013
Library Card Use	-.90	.59	.126	-.83	.54	.121
Newspaper Subscriptions	.22	.43	.615	.10	.40	.809
Magazine Subscriptions	.98	.74	.189	1.11	.74	.135
Mother's Education	-.31	.44	.486	-.13	.47	.787
Number of Working Parents	.81	.31	.009	.81	.26	.003
Age at Pretest	-.22	.08	.008	-.20	.09	.031
Test Lag	-.01	.03	.740	.00	.03	.931
Test Interval	.51	.58	.382	.85	.55	.121
Pretest	.58	.03	.000	.56	.03	.000
Propensity Score	1.73	4.12	.674	1.55	4.39	.724
TN-VPK Participation	**-1.23**	**.78**	**.113**	**-1.19**	**.80**	**.136**

Table 11. TN-VPK Effect Estimates for the Woodcock Johnson Achievement Measures at the End of the First Grade Year for the ISS Analysis Sample (Both Cohorts)

Outcome	N for TN-VPK Participants	N for TN-VPK Non-participants	b[a]	*p*-value	Pooled Posttest Standard Deviation[b]	Effect Size
WJ Composite (6 subscales)	773	303	-1.23	.113	13.7	-.09
WJ Composite (8 subscales)	773	303	-1.19	.136	13.6	-.09
Literacy Measures						
Letter-Word Identification	773	303	-1.58	.399	28.2	-.06
Spelling	773	303	-1.79	.143	19.9	-.09
Language Measures						
Oral Comprehension	773	303	-.99	.257	13.7	-.07
Picture Vocabulary	773	303	.28	.688	11.4	.02
Passage Comprehension	773	303	-1.33	.209	18.7	-.07
Math Measures						
Applied Problems	773	303	-.77	.346	15.2	-.05
Quantitative Concepts	773	303	-2.81*	.004	13.2	-.21
Calculation	773	303	-.86	.455	14.9	-.06

[a] Estimates from the regression models of the TN-VPK effects in W-Score units. [b] Sample-weighted values that use the same sample weights as in the analysis that produces the effect estimates. Pretest covariates were created for Passage Comprehension by averaging the two pretest language subscales (Oral Comprehension, Picture Vocabulary) and for Calculation by averaging the two math subscales (Applied Problems Quantitative Concepts). *p<.01

TN-VPK Effects on Non-Cognitive Outcomes

Teacher-Rated Outcomes in First Grade. The first grade teachers rated the students in the ISS sample in the second semester of the first grade on the Cooper-Farran Social Skills and Work-Related Skills scales along with the four ACBR scales that asked for their perceptions of how well the children were prepared for first grade, the quality of their peer relations, any behavior problems they demonstrated, and their feelings about school. Note that there are no end-of-kindergarten measures on these scales. The kindergarten teachers were asked to rate the children in this sample at the beginning of kindergarten and those ratings were analyzed in our earlier end of pre-k report as pre-k outcomes.

The first-grade teacher ratings were analyzed in multilevel regression models analogous to those reported above except that there were no pretest rating measures to include among the covariates (the pretest Woodcock Johnson Composite score from the beginning of pre-k was used in analyses to control for any differential baseline skills by condition). Table 12 presents a summary of the results. The full model results for the analysis of each of the individual rating scales can be found in Table B6 in Appendix B. As Table 12 reports, there were no statistically significant differences between the TN-VPK participants and nonparticipants on any of the first-grade teacher ratings.

The earlier end of pre-k report that described effects on kindergarten teacher ratings at the beginning of the kindergarten year used a reduced sample of 914 children in the analysis—all the children with valid teacher ratings at that time. For comparison purposes, the analysis of first grade teacher ratings were run on this same reduced sample and the results (not shown here) were virtually identical to those presented in Table 12.

Table 12. TN-VPK Effect Estimates for the Teacher Ratings in First Grade for the ISS Analysis Sample (Both Cohorts)

Outcome	N for TN-VPK Participants	N for TN-VPK Non-participants	b[a]	*p*-value	Pooled Posttest Standard Deviation[b]	Effect Size
CF Social Skills	773	303	.06	.573	.94	.06
CF Work-Related Skills	773	303	-.03	.803	1.16	-.03
ACBR Preparation for Grade	773	303	-.14	.193	1.39	-.10
ACBR Peer Relations	773	303	.08	.398	1.04	.08
ACBR Behavior Problems	773	303	-.06	.486	1.25	-.05
ACBR Feelings About School	773	303	-.02	.470	.34	-.06

[a] Estimates from the regression models of the TN-VPK effects in the units of the rating scales. [b] Sample-weighted values that use the same sample weights as in the analysis that produced the effect estimates.

Kindergarten Retention. To determine whether children were retained or promoted in kindergarten, we used their grade assignment in Year 3 as shown in the state education database (Cohort 1 of the full randomized sample) or as indicated by the reports of the members of the research team who assessed them in their schools near the end of Year 3 (ISS sample), which should have been 1st grade for any child not previously retained. For the ISS sample, 4.7% of the children were retained in kindergarten, with 4.1% of the TN-

VPK participants retained compared to 6.2% of the nonparticipants. This difference was investigated analytically with a fixed-effects sample-weighted three-level logistic regression. Retention was specified as having a Bernoulli, or discrete probability distribution (values of 0 and 1), and was analyzed with a unit-specific model with robust standard errors. Table 13 shows the full model results, which indicated that the difference in the retention rates for TN-VPK participants and nonparticipants was statistically significant with fewer participants retained in kindergarten than nonparticipants.

Table 13. Full Model Results for the Analysis of the Effect of TN-VPK on Kindergarten Retention for the ISS Analysis Sample (Both Cohorts)

Variable	b	SE	*p*-value
Intercept	36.2	4.36	.000
Inclusion Rate: Nonparticipants	.67	1.14	.558
Inclusion Rate: TN-VPK Participants	.24	1.26	.851
Inclusion Rate: Interaction	7.34	4.07	.075
Cohort (2=reference)	.88	.62	.164
Black	-1.12	.51	.029
Hispanic	.31	.76	.683
Male	1.22	.37	.001
Native English Speaker	1.44	.46	.002
Library Card Use	.53	.28	.055
Newspaper Subscriptions	-.28	.28	.327
Magazine Subscriptions	-.98	.40	.015
Mother's Education	-.03	.38	.936
Number of Working Parents	.28	.31	.366
Age at Pretest	-.33	.10	.001
Test Lag	.00	.02	.790
Pretest (WJ Composite)	-.06	.01	.000
Propensity Score	-1.74	1.28	.175
TN-VPK Participation	**-.82***	**.41**	**.044**

*p <.05

Kindergarten retention data were also available for Cohort 1 of the full analytic sample (n=1764). At the time of this report, we did not have data for Cohort 2 of the full sample[8]. According to the information in the state education database, 5.0% of the children in Cohort 1 of the full sample were retained in kindergarten, with 4.0% of the TN-VPK participants retained compared to 8.0% of the nonparticipants.

[8] For the full randomized sample, we relied solely on data from the state education database and the Year 3 state data with which we determine kindergarten retention were not yet available for Cohort 2 (those children had only completed Year 2 at the time of this report). However, we were able to obtain these data for Cohort 2 of the ISS sample because our research team identified the grade in which each child was found when they conducted the assessments at the end of the school year.

The analysis model to test the significance of this difference was analogous to the one above for the ISS sample, but the covariates were limited to the demographic variables available in the state education data. In addition, as noted earlier, for outcomes tested with the full randomized sample, both treatment on the treated (TOT) and intent to treat (ITT) estimates are possible and we have reported both, though our primary emphasis is on the TOT results. It is the TOT results that most directly assess the effects of TN-VPK on those children who actually participated in it. The ITT results are informative for comparison purposes nonetheless because they indicate whether any effects found in the TOT analysis are robust to the dilution caused by inclusion in the ITT participant condition of children who did not actually participate in TN-VPK. In addition, of course, the ITT analysis preserves the initial randomization and therefore is not as dependent on the ability of the covariates to statistically control for any initial baseline differences between the groups being compared.

Table 14 shows the full model results for both the TOT and ITT[9] versions of the TN-VPK participation variable. Results indicate that, as in the ISS sample, TN-VPK participants were significantly less likely to have been retained in kindergarten than nonparticipants, though the difference for the ITT analysis, while in the same direction, fell short of statistical significance.

Table 14. Full Model Results for the Analysis of the Effect of TN-VPK on Kindergarten Retention for Cohort 1 of the Full Randomized Sample

	TOT Analysis			ITT Analysis		
Variable	b	SE	*p*-value	b	SE	*p*-value
Intercept	9.54	1.83	.000	9.17	2.36	.000
Male	.32	.25	.201	.49	.26	.061
Black	-.54	.29	.060	-.47	.27	.080
Hispanic	-.51	.79	.520	-.50	.45	.270
Native English Speaker	.50	.42	.229	.50	.31	.106
Age at Start of Pre-K	-.25	.03	.000	-.25	.05	.000
TN-VPK Participation	**-.77***	**.27**	**.004**	**-.19**	**.22**	**.382**

*p <.05

Kindergarten Attendance. Kindergarten attendance data were available for all the children in the ISS analysis sample. However, for a small number of children (fewer than 20) who attended more than one school in the kindergarten year, the records showed overlapping enrollment periods. In those cases, we made the best estimates we could for attendance using the available data. The mean sample-weighted number of days attended for TN-VPK participants was 160.0 compared to 160.4 for nonparticipants. Differences between participants and nonparticipants were investigated analytically with a fixed-effects sample-weighted 3-level linear regression using log transformed values to adjust for

[9] Because of model convergence issues, the ITT analysis was conducted as a two-level regression with children nested within randomized lists, omitting the district level.

the skewed distributions[10]. Table 15 shows the full model results, which indicated that the difference between TN-VPK participants and nonparticipants were not statistically significant.

Table 15. Full Model Results for the Analysis of the Effect of TN-VPK on Kindergarten Attendance for the ISS Analysis Sample (Both Cohorts)

Variable	b	SE	*p*-value
Intercept	-1.57	.15	.000
Inclusion Rate: Nonparticipants	-.08	.05	.129
Inclusion Rate: TN-VPK Participants	-.03	.06	.625
Inclusion Rate: Interaction	.12	.20	.537
Cohort (2=reference)	-.14	.03	.000
Black	.01	.02	.666
Hispanic	-.02	.02	.520
Male	-.02	.01	.012
Native English Speaker	-.06	.02	.006
Library Card Use	-.02	.00	.001
Newspaper Subscriptions	.01	.01	.105
Magazine Subscriptions	-.00	.01	.685
Mother's Education	.02	.01	.006
Number of Working Parents	.02	.01	.024
Age at Pretest	-.00	.00	.915
Test Lag	-.00	.00	.942
Pretest (WJ Composite)	-.00	.00	.089
Propensity Score	-.04	.08	.647
TN-VPK Participation	**-.01**	**.02**	**.534**

Note. The transformation used to correct for the skewed outcome distribution reversed the direction of the coefficients, making negative coefficients represent benefits for TN-VPK participants. For ease of interpretation, the signs for all the coefficients in the table have been reversed so that positive coefficients represent greater attendance.
*p <.05

Kindergarten attendance information was also available for both cohorts of the full randomized sample. The mean sample-weighted number of days attended was 158.0 for the TN-VPK participants and 156.6 for the nonparticipants. The results of the regression models for this sample using the log transformed outcome variable are shown in Table 16 for both the TOT analysis and ITT analysis[11]. Though the difference is small, the TOT analysis showed a marginally significant effect on the number of days attended favoring the TN-VPK participants. The ITT analysis, however, showed no significant difference.

[10] Identical analyses were also run using the untransformed variable. The direction of the results was the same and also not statistically significant.

[11] Identical analyses were also run using the untransformed values, and the results were very similar to those presented here in both magnitude and direction.

Table 16. Full Model Results for the Analysis of the Effect of TN-VPK on Kindergarten Attendance for the Full Randomized Sample (Both Cohorts)

	TOT Analysis			ITT Analysis		
Variable	b	SE	*p*-value	b	SE	*p*-value
Intercept	-1.36	.06	.000	-1.33	.04	.000
Cohort	.14	.02	.000	-.14	.02	.000
Male	.01	.01	.620	-.01	.01	.411
Black	.05	.01	.000	.04	.00	.000
Hispanic	-.00	.01	.716	.01	.01	.455
Native English Speaker	-.06	.02	.000	-.06	.01	.000
Age at Start of Pre-K	-.00	.00	.002	.00	.00	.001
TN-VPK Participation	**.01†**	**.01**	**.084**	**.00**	**.01**	**.995**

Note. The transformation used to correct for the skewed outcome distribution reversed the direction of the coefficients, making negative coefficients represent benefits for TN-VPK participants. For ease of interpretation, the signs for all the coefficients in the table have been reversed so that positive coefficients represent greater attendance.
*p <.05, † p <.10

First Grade Attendance. Attendance data for two years after the intervention year (first grade for most of the children), were available for Cohort 1 of the full randomized sample. We will have more definitive results for this outcome when the Cohort 2 data are also available, but these data provide a preliminary look. The mean number of days attended in first grade was 164.0 for the TN-VPK participants and 160.6 for the nonparticipants. This difference was tested in a three-level regression model. The results using transformed values are presented in Tables 17 for both the TOT and ITT analyses. As was the case with kindergarten attendance for the full randomized sample, the TOT analyses show that TN-VPK participants attended significantly more days in first grade than did the nonparticipants. The direction of the ITT analysis was the same as that of the TOT results, but the difference was not statistically significant.

Table 17. Full Model Results for the Analysis of the Effect of TN-VPK on First Grade Attendance for Cohort 1 of the Full Randomized Sample

	TOT Analysis			ITT Analysis		
Variable	b	SE	*p*-value	b	SE	*p*-value
Intercept	-1.36	.07	.000	-1.34	.06	.000
Male	.01	.01	.305	.02	.01	.119
Black	.05	.01	.000	.05	.01	.000
Hispanic	-.00	.01	.615	.01	.02	.738
Native English Speaker	-.05	.02	.002	-.04	.02	.066
Age at Start of Pre-K	.01	.00	.272	.00	.00	.462
TN-VPK Participation	**.03***	**.01**	**.017**	**.01**	**.02**	**.650**

Note: Means are sample weighted. For ease of interpretation, the signs for all the coefficients in the table have been reversed so that positive coefficients represent greater attendance.
*p <.05

Kindergarten Disciplinary Action. Officially recorded disciplinary actions in the state database are rare outcomes for children as young as those in our current samples. Table 18 shows the percentages of TN-VPK participants and nonparticipants with at least one

disciplinary action in kindergarten for the ISS sample and the full randomized sample (both TOT and ITT analyses). Logistic regression analysis was used to test for differences between the groups. Because the children with disciplinary action were thinly distributed across schools, there was little to no nesting to account for and single level models were used for the analysis[12]. Child-level demographic characteristics and cohort were controlled for as they pertained to each sample[13]. Full results for the analytical models can be found in Tables B7-8 in Appendix B. The results showed no significant differences in the percentages of TN-VPK participants and nonparticipants with recorded disciplinary action in kindergarten in any of the analyses.

Table 18. Kindergarten Disciplinary Action for the ISS and Full Randomized Samples (Both Cohorts)

Sample & Analysis	TN-VPK Participants	Nonparticipants	*p*-value for Difference
ISS Sample	.9%	.8%	.252
Full Sample - TOT Analysis	1.1%	1.5%	.196
Full Sample - ITT Analysis	1.1%	.9%	.653

Note: Percentages are sample weighted.

First Grade Disciplinary Action. First grade disciplinary action data were also available for Cohort 1 of the full randomized sample. Table 19 shows the sample-weighted percentages of the TN-VPK participants and nonparticipants in Cohort 1 with at least one disciplinary action in first grade and the results of both the TOT and ITT analyses, again using single-level logistic regression. Full results of the statistical analysis are displayed in Table B9 in Appendix B. Though the TOT analyses did not reveal any significant difference in first grade disciplinary action by TN-VPK participation, the ITT analysis showed a significant difference with fewer nonparticipants having recorded disciplinary actions than participants. More complete results on this outcome for the full randomized sample will be provided when data for Cohort 2 are available.

Table 19. First Grade Disciplinary Action for Cohort 1 of the Full Randomized Sample

Analysis	TN-VPK Participants	Nonparticipants	*p*-value for Difference
TOT Analysis	2.6%	2.2%	.633
ITT Analysis	2.7%	.7%	.021

Kindergarten Special Education Services. We were able to obtain information from the state database about whether a child had any designations for special education services in

[12] Two-level regressions did not converge for the ISS sample but were run for the full randomized sample and the results were virtually equivalent to the single-level results.

[13] Hispanic and native English speaker were not included as covariates in the ISS analysis because there was no variation in those variables among children with disciplinary action in kindergarten; the same was true of the Hispanic variable in the full analysis sample for the kindergarten discipline analyses.

kindergarten for the ISS sample and both cohorts of the full randomized sample. These data for participants and nonparticipants were examined descriptively rather than tested for differences because of the uncertainty associated with the meaning of this outcome at this early grade level. The children who participated in TN-VPK had the opportunity to have their special needs recognized earlier than those who did not participate, and to have their special education services carry over into the kindergarten year, in a way that could not occur for nonparticipants. Moreover, early attention for special needs, especially the relatively common speech and language difficulties of young children, can be viewed as a positive feature of TN-VPK that could well reduce the need for later special education services. Our primary interest in special education services as an outcome variable, therefore, is their nature and frequency in later grades rather than in these early grades.

Table 20 shows the percentages of children in the ISS sample that were identified in the state data system as recipients of special education services in kindergarten. As expected, TN-VPK participants received more special education services in kindergarten than nonparticipants. However, the difference is reversed when only *new* special education designations are considered; that is, children receiving their first service or a service for a different need than their previous service. Also, when only special education services for needs other than speech/language are counted, both groups have considerably fewer IEPs and the differences in their percentages are smaller.

Table 20. Pre-K and Kindergarten Special Education Services for the ISS Analysis Sample (Both Cohorts)

Year and Type	TN-VPK Participants	Non-participants
Pre-K: Any service	7.9%	N/A
Pre-K: Service other than speech/language	1.0%	N/A
Kindergarten: Any service	11.6%	5.6%
Kindergarten: Service other than speech/language	1.8%	.7%
Kindergarten: New service	4.6%	5.6%
Kindergarten: New service other than speech/language	.9%	.7%

Notes: Percentages are sample weighted. No imputation for missing data was done for special education services.

Table 21. Pre-K and Kindergarten Special Education Services for the Full Randomized Sample (Both Cohorts)

Variable	TN-VPK Participants	Non-participants
Pre-K: Any service	9.1%	N/A
Pre-K: Service other than speech/language	1.1%	N/A
Kindergarten: Any service	12.6%	5.6%
Kindergarten: Service other than speech/language	1.7%	.7%
Kindergarten: New service	4.6%	5.6%
Kindergarten: New service other than speech/language	.8%	.7%

Notes: Percentages are sample weighted. No imputation for missing data was done for special education services.

Table 21 shows the analogous data for the full randomized sample with the TN-VPK participation variable representing actual participation (TOT comparison). The pattern of differences between TN-VPK participants and nonparticipants is similar to that found in the ISS sample, as described above.

First Grade Special Education Services. First grade special education data were available for Cohort 1 of the full randomized sample and are reported in Table 22. As with the kindergarten comparison above, they show a greater percentage of TN-VPK participants receiving special education services than nonparticipants, but with much smaller percentages for both when speech/language services are not counted. The difference between TN-VPK participants and nonparticipants are even smaller when only new services in first grade are considered; that is, children receiving a new or different service in first grade compared with services received in kindergarten.

Table 22. First Grade Special Education Services for Cohort 1 of the Full Randomized Sample

Variable	TN-VPK Participants	Non-participants
First Grade: Any service	13.9%	8.5%
First Grade: Service other than speech/language	2.8%	1.3%
First Grade: New service	3.6%	2.4%
First Grade: New service other than speech/language	1.7%	1.1%

Notes: Percentages are sample weighted. No imputation for missing data was done for special education services; the percentages are based on the number of cases with data.

Differential Effects for Student Subgroups

In addition to investigating the overall longitudinal effects of participation in TN-VPK, we were interested in whether the effects on the cognitive achievement outcomes and non-cognitive outcomes of retention and attendance were different depending on children's gender, age at pretest, and native language.

In the analysis of the TN-VPK effects on cognitive outcomes at the end of the pre-k year (reported in the earlier end of pre-k report), we found that the effects on achievement were similar for girls and boys, and for younger and older children. The effects for non-native English speakers, however, were greater than they were for native speakers.

Differential Effects on Kindergarten Achievement. For analyses investigating differential effects on kindergarten achievement in the ISS sample, the statistical models were identical to the ones described above for the main effects analysis except for the addition of a term in the multilevel regressions representing the interactions between TN-VPK participation and one of the moderator variables of interest (gender, age at pretest, or native language). Table 23 displays the coefficients for the respective interaction terms in these analysis models and their statistical significance. Table 24 shows the corresponding differential effects in the form of effect sizes for the respective subgroups (female, male;

Table 23. Interactions between TN-VPK Participation and Gender, Age, and English Speaker Subgroups on the Woodcock Johnson Achievement Measures at the End of Kindergarten for the ISS Analysis Sample (Both Cohorts)

	Gender		Age at Pretest		English Speaker	
Outcome	b	*p*-value	b	*p*-value	b	*p*-value
WJ Composite (6 subscales)	-.25	.871	-.34	.218	.39	.810
WJ Composite (8 subscales)	.05	.973	-.38	.193	.57	.696
Literacy Measures						
Letter-Word Identification	-4.92	.223	-.98†	.099	5.97*	.029
Spelling	-1.30	.597	-.68*	.032	1.68	.549
Language Measures						
Oral Comprehension	-1.61	.290	.19	.425	-4.23	.121
Picture Vocabulary	-.71	.606	-.07	.667	-.17	.931
Passage Comprehension	-.16	.957	-.31	.521	.77	.850
Math Measures						
Applied Problems	2.16	.203	-.44	.234	-1.72	.450
Quantitative Concepts	.26	.871	-.20	.461	-1.85	.396
Calculation	.42	.873	-.70*	.041	3.01	.109

*p <.05 , $^{\dagger}p$ <.10

Table 24. Effect Sizes for Gender, Age, and English Speaker Subgroups on the Woodcock Johnson Achievement Measures at the End of Kindergarten for the ISS Analysis Sample (Both Cohorts)

	Gender		Age at Pretest		English Speaker	
Outcome	Female	Male	Younger	Older	Native	Non-native
WJ Composite (6 subscales)	.05	.03	.19	-.10	.05	.02
WJ Composite (8 subscales)	.00	.00	.15	-.14	.01	-.03
Literacy Measures						
Letter-Word Identification	.11	-.07	**.20**	**-.11**	**.08**	**-.14**
Spelling	.04	-.03	**.17**	**-.15**	.03	-.05
Language Measures						
Oral Comprehension	.14	.03	.11	.05	.03	.31
Picture Vocabulary	.11	.05	.15	.05	.08	.10
Passage Comprehension	-.10	-.11	-.05	-.15	-.10	-.13
Math Measures						
Applied Problems	-.04	.10	.13	-.06	.00	.11
Quantitative Concepts	-.08	-.06	.09	-.25	-.10	.04
Calculation	-.08	-.06	**.08**	**-.22**	-.04	-.20

Note: Bolded effect sizes are those representing statistically significant interactions.

younger, older[14]; native English speaker, non-native English speaker); detailed results can be found in Tables B10-12 in Appendix B.

For gender, age, or native English speaker subgroups, no differential TN-VPK effects on either of the WJ composite achievement measures were found. Among the individual WJ scales, age at pretest was a significant moderator of the effect of TN-VPK on kindergarten Spelling and Calculation scores, and marginally significant for Letter-Word Identification. The direction of this effect indicated that the younger children attending TN-VPK benefitted more than the older children. In addition, native English speakers showed greater TN-VPK effects on Letter-Word identification at the end of kindergarten than non-native English speakers.

Differential Effects on First Grade Achievement. The analysis for investigating differential TN-VPK effects on achievement at the end of first grade for the gender, age, and English speaker subgroups of children was conducted in the same fashion as described above for kindergarten achievement outcomes.

Table 25 displays the coefficients from the regression models for the interaction terms and their statistical significance. Table 26 shows the differential effects for the different subgroups (female, male; younger, older[15]; native English speaker, non-native English speaker) in terms of their respective effect sizes. Detailed results can be found in Tables B13-15 in Appendix B.

There were no significant differential effects for any of the subgroups on either of the WJ composite achievement measures. Among the individual scales, the only differential TN-VPK effect for gender was for the Picture Vocabulary subscale. Girls showed greater effects from TN-VPK participation than boys. Age at pretest was a marginally significant moderator of the effects of TN-VPK participation on the Applied Problems and Calculation subscales. The younger children benefitted more from TN-VPK than their older counterparts. In addition the effects of TN-VPK on language outcomes (Picture Vocabulary and Passage Comprehension) were significantly smaller for non-native English speakers than for native English speakers. This pattern was reversed for Quantitative Concepts, where TN-VPK had larger effects for the non-native English speakers than for the native English speakers.

Though the moderator effects in kindergarten and first grade are not strong or extensive, there is some indication that the TN-VPK participants who are younger when they enter pre-k benefit more than those who are somewhat older. Differences in that direction appear for the literacy measures and one of the math measures in kindergarten and for two of the math measures in first grade. Similarly, there is some indication that non-native English speaking children experience less benefit from TN-VPK participation than the

[14] Though age at pretest was represented as a continuous variable in all analyses of moderator effects, the models were re-run using age at pretest dichotomized at the median into younger and older children only in order to provide an indication of the magnitude of any differences in effect size terms.

[15] See Footnote 14 above.

Table 25. Interactions between TN-VPK Participation and Gender, Age, and English Speaker Subgroups on the Woodcock Johnson Achievement Measures at the End of First Grade for the ISS Analysis Sample (Both Cohorts)

	Gender		Age at Pretest		English Speaker	
Outcome	b	*p*-value	b	*p*-value	b	*p*-value
WJ Composite (6 subscales)	-.14	.918	-.20	.273	-.20	.903
WJ Composite (8 subscales)	-.01	.998	-.26	.288	.57	.764
Literacy Measures						
Letter-Word Identification	-2.14	.534	-.41	.505	2.03	.623
Spelling	-1.09	.708	-.22	.318	-3.61	.219
Language Measures						
Oral Comprehension	-1.15	.418	-.25	.130	.61	.790
Picture Vocabulary	-2.23*	.047	-.03	.861	3.03*	.029
Passage Comprehension	-2.97	.276	-.30	.338	6.73*	.001
Math Measures						
Applied Problems	-.05	.974	-.52†	.091	-.22	.916
Quantitative Concepts	.25	.872	.06	.851	-5.18*	.006
Calculation	1.92	.491	-.63†	.093	1.00	.692

*p <.05, $^{\dagger}p$ <.10

Table 26. Effect Sizes for Gender, Age, and English Speaker Subgroups on the Woodcock Johnson Achievement Measures at the End of First Grade for the ISS Analysis Sample (Both Cohorts)

	Gender		Age at Pretest		English Speaker	
Outcome	Female	Male	Younger	Older	Native	Non-native
WJ Composite (6 subscales)	-.09	-.10	.07	-.16	-.09	-.08
WJ Composite (8 subscales)	-.09	-.09	.08	-.17	-.08	-.12
Literacy Measures						
Letter-Word Identification	-.02	-.10	.05	-.13	-.04	-.11
Spelling	-.07	-.12	.01	-.15	-.13	.05
Language Measures						
Oral Comprehension	-.04	-.12	.03	-.11	-.06	-.11
Picture Vocabulary	**.11**	**-.09**	.20	-.01	**.08**	**-.18**
Passage Comprehension	.00	-.16	.04	-.14	**.01**	**-.35**
Math Measures						
Applied Problems	-.05	-.05	**.14**	**-.12**	-.05	-.04
Quantitative Concepts	-.22	-.20	-.12	-.28	**-.30**	**.09**
Calculation	-.11	.02	**.10**	**-.18**	-.04	-.11

Note: Bolded effect sizes are those representing statistically significant interactions.

native English speaking children in kindergarten and first grade despite the fact that they experienced greater benefit during the pre-k year, as shown in the analysis presented in

the earlier end of pre-k report. This pattern appeared in the Letter-Word identification measure in kindergarten and more strongly in two of the language measures in first grade.

Differential Effects on First Grade Teacher Ratings. The analysis models for investigating differential TN-VPK effects on teacher ratings at the end of first grade for the different subgroups of children was conducted in the same fashion as described above for kindergarten and first grade achievement outcomes. Table 27 displays the coefficients from those analyses for the interaction terms and their statistical significance. Table 28 shows the differential effects for the different subgroups (female, male; younger, older[16]; native English speaker, non-native English speaker) in terms of their respective effect sizes. Detailed results can be found in Tables B16-18 of Appendix B.

Table 27. Interactions between TN-VPK Participation and Gender, Age, and English Speaker Subgroups on Teacher Ratings at the End of First Grade for the ISS Analysis Sample (Both Cohorts)

	Gender		Age at Pretest		English Speaker	
Outcome	b	*p*-value	b	*p*-value	b	*p*-value
CF Social Skills	-.06	.644	-.03†	.088	.04	.805
CF Work-Related Skills	-.01	.929	-.05*	.015	.14	.423
ACBR Preparation for Grade	.08	.650	.00	.872	.13	.503
ACBR Peer Relations	.06	.681	-.01	.530	.24	.153
ACBR Behavior Problems	-.13	.435	.01	.655	.11	.574
ACBR Feelings About School	-.01	.777	.00	.769	.10†	.058

*p <.05 , †p <.10

Table 28. Effect Sizes for Gender, Age, and English Speaker Subgroups on Teacher Ratings at the End of First Grade for the ISS Analysis Sample (Both Cohorts)

	Gender		Age at Pretest		English Speaker	
Outcome	Female	Male	Younger	Older	Native	Non-native
CF Social Skills	.08	.08	**.05**	**.07**	.07	.03
CF Work-Related Skills	-.02	-.02	**.12**	**-.17**	.00	-.12
ACBR Preparation for Grade	-.12	-.12	-.08	-.17	-.08	-.17
ACBR Peer Relations	.06	.06	.20	-.04	.13	-.10
ACBR Behavior Problems	.00	.00	-.02	-.09	-.03	-.11
ACBR Feelings About School	-.05	-.05	-.09	-.05	**.00**	**-.29**

Note: Bolded effect sizes are those representing statistically significant interactions.

There were no differential effects of gender on end of first grade teacher ratings. The only differential TN-VPK effects for age at pretest were for the two Cooper-Farran subscales. In terms of teacher-rated social skills, the somewhat older children benefitted more from TN-

[16] Though age at pretest was represented as a continuous variable in all analyses of moderator effects, the models were re-run using age at pretest dichotomized at the median into younger and older children only in order to provide an indication of the magnitude of any differences in effect size terms.

VPK than their somewhat younger counterparts. However, the younger children showed larger effects of TN-VPK on the ratings of work-related skills. In addition the effects of TN-VPK on children's feelings about school from the ACBR were moderated by language status at a marginally significant level. TN-VPK had less positive effects on feelings about school for the non-native English speakers than for the native English speakers.

Differential Effects on Kindergarten Retention. In the ISS sample there were no significant interactions between TN-VPK participation and the three moderators of interest (gender, age at pretest, and native English speaker) for kindergarten retention. The full model results can be found in Table B19 in Appendix B. With the full randomized sample, however, there were some significant interactions (full results from those models can be found in Table B20 in Appendix B). Table 29 below shows the interaction coefficients from the models predicting the likelihood of being retained in kindergarten for the different samples. The moderator effects were statistically significant for native English status in the TOT analysis of the full randomized sample and for gender and age in the ITT analysis of the full sample.

Table 29. Interactions between TN-VPK Participation and Gender, Age, and English Speaker Subgroups on Kindergarten Retention

	Gender		Age		English Speaker	
Sample and Analysis	b	*p*-value	b	*p*-value	b	*p*-value
ISS Sample (Both Cohorts)	.48	.588	.02	.889	-.51	.426
Full Sample (Cohort 1); TOT Analysis	.08	.890	.07	.406	-.81*	.005
Full Sample (Cohort 1); ITT Analysis	-.74†	.090	.21*	.033	-.01	.988

*p <.05 , †p <.10

Table 30 shows effect sizes for each of the subgroups. Because retention was a dichotomous outcome, effect sizes are represented as odds ratios. Odds ratios less than 1.0 indicate a benefit for TN-VPK participants; those greater than 1 indicate a benefit for nonparticipants. Within a given moderator category, the subgroup with the smaller odds ratio had the greater benefit. In the TOT analysis for the full randomized sample, TN-VPK had greater effects (less kindergarten retention) for native English speakers than non-native English speakers. Though this difference was not found in the ITT analysis, that analysis did show a greater effect of TN-VPK on kindergarten retention for males than for females, and for children who started pre-k at a younger age than their older counterparts.

Table 30. Effect Sizes (Odds Ratios) for Gender, Age, and English Speaker Subgroups on Kindergarten Retention

	Gender		Age		English Speaker	
Outcome	Female	Male	Younger	Older	Native	Non-native
ISS Sample (Both Cohorts)	.41	.67	.38	.88	.29	.49
Full Sample (Cohort 1); TOT	.46	.50	.43	.90	**.27**	**.61**
Full Sample (Cohort 1); ITT	**.89**	**.43**	**.76**	**1.25**	.82	.83

Note: Bolded effect sizes are those representing statistically significant interactions.

Differential Effects on Kindergarten Attendance. Table 31 shows the interaction coefficients from the models predicting kindergarten attendance for the different samples, and Table 32 shows the equivalent effect sizes by subgroup (full model effects in Tables B21-22 in Appendix B). The only significant moderator effect was a marginally significant interaction of TN-VPK participation and native English speaker status for the full randomized sample in the TOT analysis; native English speakers received a bigger benefit from TN-VPK and attended more days in kindergarten.

Table 31. Interactions between TN-VPK Participation and Gender, Age, and English Speaker Subgroups on Kindergarten Attendance

	Gender		Age		English Speaker	
Sample	b	*p*-value	b	*p*-value	b	*p*-value
ISS Sample (Both Cohorts)	.028	.315	-.003	.403	.011	.704
Full Sample (Both Cohorts); TOT Analysis	.007	.690	-.000	.822	.036†	.073
Full Sample (Both Cohorts); ITT Analysis	-.009	.663	-.000	.863	-.010	.589

*p <.05 , †p <.10

Table 32. Effect Sizes for Gender, Age, and English Speaker Subgroups on Kindergarten Attendance

	Gender		Age		English Speaker	
Outcome	Female	Male	Younger	Older	Native	Non-native
ISS Sample (Both Cohorts)	-.04	.09	-.05	-.05	-.02	-.07
Full Sample (Cohort 1); TOT	.06	.09	.14	.02	**.18**	**.01**
Full Sample (Cohort 1); ITT	-.00	-.04	.01	-.01	-.04	.01

Note: Bolded effect sizes are those representing statistically significant interactions.

Differential Effects on First Grade Attendance. Table 33 shows the interaction coefficients from the models predicting first grade attendance in Cohort 1 of the full randomized sample, and Table 34 shows the equivalent effect sizes by subgroup (full model results in Table B23 in Appendix B). The only significant interaction was a marginally significant effect of TN-VPK participation and native English speaker status for the full randomized sample in the TOT analysis. There was a greater effect of TN-VPK on first grade attendance for native English speakers than non-native English speakers.

Table 33. Interactions between TN-VPK Participation and Gender, Age, and English Speaker Subgroups on First Grade Attendance for Cohort 1 of the Full Randomized Sample

	Gender		Age		English Speaker	
Sample	b	*p*-value	b	*p*-value	b	*p*-value
Full Sample (Cohort 1); TOT Analysis	.005	.843	.005	.102	.039†	.071
Full Sample (Cohort 1); ITT Analysis	-.030	.225	.005	.122	-.051	.169

*p <.05 , †p <.10

Table 34. Effect Sizes for Gender, Age, and English Speaker Subgroups on First Grade Attendance for Cohort 1 of the Full Randomized Sample

	Gender		Age		English Speaker	
Outcome	Female	Male	Younger	Older	Native	Non-native
Full Sample (Cohort 1); TOT	.18	.20	.04	.30	**.34**	**.13**
Full Sample (Cohort 1); ITT	.04	-.12	-.11	.11	-.17	.11

Note: Bolded effect sizes are those representing statistically significant interactions.

Summary and Conclusions

The analyses and results presented in this report addressed the three questions we posed at the beginning about what effects of TN-VPK are evident one and two years after participation for the economically disadvantaged children eligible for the program. Below we restate those questions and summarize what was found in response to each of them.

Does participation in TN-VPK have effects on children's cognitive achievement outcomes that are evident at the end of the kindergarten and first grade years?

Cognitive achievement outcomes were measured near the end of the kindergarten and first grade years with Woodcock Johnson III scales selected to assess performance in the areas of literacy (Letter-Word Identification and Spelling), language (Oral Comprehension, Picture Vocabulary, and Passage Comprehension), and math (Applied Problems, Quantitative Concepts, and Calculation). Because administering these tests required parental consent and individual assessment of the children by the research team, data on these measures were available only for the Intensive Substudy sample.

The relatively large effects of TN-VPK on the Woodcock Johnson achievement measures found at the end of the pre-k year were greatly diminished and no longer statistically significant at the end of the kindergarten year. The only exception was a marginally significant negative effect on Passage Comprehension such that nonparticipants had higher scores at the end of the kindergarten year than TN-VPK participants.

Similarly, at the end of first grade, there were no statistically significant differences between TN-VPK participants and nonparticipants on the Woodcock Johnson achievement measures with one exception. There was a significant difference that favored the nonparticipant group on the Quantitative Concept subscale.

These diminished effects were not entirely unexpected in light of the findings in other longitudinal studies of the effects of early childhood programs on economically disadvantaged children. For preschool programs, a typical finding is that the cognitive effects are not sustained for very long after that initial year. Though none of those other studies investigated the effects of a single year of a scaled up state-funded public pre-k program, many involved even more intensive programs that nonetheless failed to show effects on cognitive achievement measures that were sustained for very long. Like TN-VPK, however, these programs did not involve any continuous, focused support in subsequent years for sustaining the gains made during the initial program year.

The especially rapid fall off of TN-VPK effects is somewhat surprising, nonetheless, and raises questions about why that drop off occurs that cannot be answered directly by the data available in the current study. There is reason to believe that early cognitive achievement gains achieved in pre-k can be sustained if they are large enough to begin with and/or are continuously supported with effective instruction in subsequent years.

Does participation in TN-VPK have effects on children's non-cognitive academic outcomes that are evident at the end of the kindergarten and first grade years?

First Grade Teachers' Ratings. One set of non-cognitive outcome measures came from ratings made by the first grade teachers near the end of the first grade year. There were no statistically significant differences between the TN-VPK participants and nonparticipants on any of these teacher ratings on scales for Social Skills, Work-related Skills, Preparation for Grade, Peer Relations, Behavior Problems, and Feelings About School.

A second set of measures of non-cognitive academic outcomes examined at the end of the kindergarten and first-grade years was drawn from the Tennessee state Education Information System and was available for both cohorts of the Intensive Substudy sample and at least Cohort 1 of the full randomized sample with some measures available for both cohorts of that sample. These outcomes included grade retention in kindergarten, attendance in kindergarten and first grade, officially recorded disciplinary actions in kindergarten and first grade, and identified special education needs and the associated services in kindergarten and first grade.

Expectations for TN-VPK effects on these non-cognitive outcomes were different than for the cognitive achievement outcomes. Whereas longitudinal research on other similar early education programs provides little evidence of sustained effects on achievement, they show more encouraging effects on non-cognitive outcomes. However, it is important to note that those effects are typically summarized for follow-up periods that include many years after the initial program concludes and relatively little is known about the effects in the early grades. Their effects thus may be more cumulative than immediate. The end of kindergarten and first grade measures of non-cognitive outcomes presented in this report come earlier than the late elementary and middle school grades where other research has typically identified effects on such outcomes. Nonetheless, our findings do show some promising indications that such effects of TN-VPK may be emerging.

Retention. For the Intensive Substudy sample, there was a statistically significant difference between the 4.1% of the TN-VPK participants who were retained in kindergarten compared to the 6.2% retention rate for the nonparticipants. This effect was confirmed in Cohort 1 of the full randomized sample, with retention data still unavailable for Cohort 2 of that sample. In Cohort 1, 4.0% of the TN-VPK participants were retained in kindergarten compared to 8.0% of the nonparticipants, also a statistically significant difference.

Attendance. Attendance in kindergarten and first grade was high for both TN-VPK participants and nonparticipants, so there was little room for large differences. For the Intensive Substudy sample the difference between participants and nonparticipants on the attendance measure was not statistically significant. But, in the full randomized sample there was a marginally significant effect on the number of days attended that favored the

TN-VPK participants. That difference was small, however—less than two days of attendance difference.

The attendance differences were larger in first grade. For Cohort 1 of the full randomized sample, the only group for which first grade attendance was available, the number of days attended were significantly greater for TN-VPK participants than nonparticipants. The average difference was about three and a half more days present in school during the year for the TN-VPK participants.

Disciplinary Actions. Officially recorded disciplinary actions were very infrequent during the kindergarten and first grade years and thus provided little scope for observing any differences between TN-VPK participants and nonparticipants. During kindergarten, there were no significant differences in the percentages of children with any recorded disciplinary action in the Intensive Substudy sample or the full randomized sample. For first grade, data on this outcome were available only for Cohort 1 of the full randomized sample but, for that sample, were a bit ambiguous. There was not a significant difference between TN-VPK participants and nonparticipants when they were compared directly in the treatment on the treated analysis.

Special Education Services. The final non-cognitive TN-VPK outcome examined in this report was recorded special education services. Only descriptive results were presented for that outcome because of the multiplicity of special education designations and, especially, because of ambiguity about how to interpret the identification of the children in our samples for special education services. TN-VPK participants have an opportunity to have their special needs identified and addressed with special education services during the pre-k year that is not afforded to the nonparticipants. Moreover, having that earlier year means those children are more likely to receive continued services in the kindergarten and first grade years. Arguably, this is a positive outcome—earlier identification and special education services for special needs for the TN-VPK participants should reduce the need for such services in later grades for these children. This might be especially true for what is by far the most common special need identified for very young children, speech and language difficulties. On the other hand, if TN-VPK participants should need and receive more special education services over a long term, that would be difficult to view as a positive outcome. The number of years that constitutes that long term is not clear, but we do not believe that two years after pre-k is sufficient to determine how special education needs and services will unfold as a result of participation in TN-VPK.

The findings so far, as expected, show that TN-VPK participants received more special education services in kindergarten than nonparticipants, though the difference was smaller when only services for needs other than speech/language were considered. However, the difference was reversed when only new special education designations were examined. Somewhat fewer TN-VPK participants had initial designations for special education services, or designations for a service for a different need than their previous service, in kindergarten than initial service designations for nonparticipants. This too is not surprising; kindergarten is the first opportunity for the special needs of nonparticipants to be identified and addressed.

First grade special education data were available only for Cohort 1 of the full randomized sample. As with the kindergarten comparison above, they showed a greater percentage of TN-VPK participants receiving special education services than nonparticipants, but with much smaller percentages for both when speech/language services are removed.

The non-cognitive effects of TN-VPK are important because of their potential long-term influence on children's academic careers and the findings in other studies of early childhood education that show this to be the domain in which the largest effects occur. Further, the literature identifies these non-cognitive outcomes as those with the biggest cost saving implications for schools and communities. It is too early to expect such effects to appear with any consequential magnitude for TN-VPK, but there are early promising signs in the positive findings so far for kindergarten grade retention and first grade attendance. The further follow-up waves planned for the current study extending through at least third grade will, in time, provide a fuller picture of TN-VPK effects on these non-cognitive academic outcomes.

What are the characteristics of the children who show the largest effects of participation in TN-VPK at the end of the kindergarten and first grade years?

No differential TN-VPK effects on either of the WJ composite achievement measures were found for gender, age, or native English speaker subgroups after either the kindergarten or first grade years. There thus were no strong overall effects of TN-VPK for any of these subgroups on the composite WJ score composed of all the achievement subtests given.

There were some indications, however, of differential TN-VPK effects in particular achievement domains. For participants who entered pre-k when they were younger, TN-VPK had greater effects on the literacy measures (Spelling and Letter-Word Identification) and one of the math measures (Calculation) in kindergarten and had similar differential effects for two of the math measures (Applied Problems and Calculation) in first grade. An age differential also was found for the first grade teachers' ratings. The younger children also benefitted more from TN-VPK than their older counterparts on teacher-rated work-related skills. In contrast, the older children showed larger effects of TN-VPK on the teachers' ratings of social skills.

Similarly, for native English speaking children the effects of TN-VPK on some of the measures of literacy and language achievement in kindergarten and first grade were stronger than for the non-native English speakers, though it is the latter that most need a boost in those skills. This pattern appeared in the Letter-Word identification measure in kindergarten and more strongly in two of the language measures (Picture Vocabulary and Passage Comprehension) in first grade. These findings are a reversal of the pattern of results found at the end of the pre-k year—the non-native English speaking children showed larger TN-VPK effects at that time on all the achievement measures than the native English speaking children. In light of this reversal, it may not be surprising that participation in TN-VPK had less positive effects on feelings about school, as rated by the first grade teachers, for the non-native English speakers than for the native English speakers.

There were also some indications of differential TN-VPK effects on kindergarten retention. TN-VPK had larger effects (less retention) for native English speaking children than for

non-native English speakers. This differential was statistically significant in the analysis with the full randomized sample and in the same direction, but not significant in the Intensive Substudy sample. A similar pattern was evident at a marginally significant level for TN-VPK effects on kindergarten attendance in the full randomized sample—native English speaking children showed larger effects than non-native English speaking children. Furthermore, the same pattern of differential effects appeared for first grade attendance but, again, was only marginally significant.

Concluding Note. The longitudinal effects found for TN-VPK so far are decidedly mixed. The encouraging achievement effects found at the end of the pre-k year were not sustained, but there are indications of possible effects on important non-cognitive academic outcomes. The kindergarten and first grade years are too early for any such effects to appear in anything but tentative form, however, so later waves of data will be required to paint the full picture of those effects. Also ahead are the state achievement tests that are administered in third grade with an open question of whether TN-VPK participation will have any effect on those critical performance measures.

Next Steps

The children in the Intensive Substudy sample are being followed with annual individual assessments at the end of each grade year that are planned to continue through the end of third grade. At the time this report was written, the children in Cohort 1 have completed second grade and the children in Cohort 2 have completed first grade. Analysis of the data collected from these two cohorts in the Intensive Substudy sample, in combination with data from the State Education Information System, will add further findings about the effects of TN-VPK in the years after kindergarten. Reports on those findings will be forthcoming.

In addition, data from the State Education Information System are being collected for all of the more than 3000 children in the original full randomizations of the two cohorts of children. The effects of TN-VPK on the non-cognitive academic outcomes available from that source for this larger sample will also be analyzed and reported for the years past kindergarten once sufficient data are available.

Finally, this evaluation project includes another parallel study that uses a regression-discontinuity design to assess TN-VPK effects at the end of the pre-k year for a representative sample of TN-VPK programs statewide. Data are being collected for that study on rolling basis through four regions across the state. Those data are complete for two of these regions and will soon be complete for a third. When sufficient data have accumulated, analyses will begin and those results will also be reported.

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APPENDIX A

Summaries

Executive Summary from the Initial Technical Report in this series: *Evaluation of the Tennessee Voluntary Prekindergarten Program: End of Pre-K Results from the Randomized Control Design*[1]

In 2009, Vanderbilt University's Peabody Research Institute, with the assistance of the Tennessee Department of Education's Division of Curriculum and Instruction, initiated a rigorous, independent evaluation of the state's Voluntary Prekindergarten program (TNVPK). TN-VPK is a full-day prekindergarten program for four-year-old children expected to enter kindergarten the following school year. The program in each participating school district must meet standards set by the State Board of Education that require each classroom to have a teacher with a license in early childhood development and education, an adult-student ratio of no less than 1:10, a maximum class size of 20, and an approved age-appropriate curriculum.

TN-VPK is an optional program that is focused on the neediest children in the state. It uses a tiered admission process with children from low-income families who apply to the program admitted first. If there are remaining seats in a given location, they are allocated to otherwise at-risk children including those with disabilities and limited English proficiency.

The evaluation was funded by a grant from the U. S. Department of Education's Institute of Education Sciences. It was designed to determine whether the children who participate in the TN-VPK program make greater academic and behavioral gains in areas that prepare them for later schooling than comparable children who do not participate in the program.

Research design. There are several different parts of the research design for this evaluation. The part reported here, and the one that provides the strongest test of the effects of TN-VPK, is a randomized control trial (RCT) in which children applying to TN-VPK are admitted to the program on a random basis. The TN-VPK programs that participated in the RCT were among those where more eligible children were expected to apply for the program than there were seats available. Under such circumstances, only some of the applicants can be admitted and, of necessity, some must be turned away. The participating programs agreed to make this decision on the basis of chance, a process rather like randomly selecting names out of a hat, to determine which children would be admitted. This procedure treats every applicant equally and, as a result, no differences are expected on average between the characteristics of those children admitted and those not admitted. Comparing their academic and behavioral outcomes at the end of the school year, then, provides a direct indication of the effects of the TN-VPK program on the children who were admitted.

To implement this procedure, TN-VPK programs across Tennessee that expected more applicants than they could accommodate and were willing to participate in the evaluation

[1] Available on the Peabody Research Institute Website: http://peabody.vanderbilt.edu/research/pri/projects/by_content_area/tennessee_state_pre-k_evaluation/TN_VPK_Evaluation_Technical_Report_Appendices_5_5_13.pdf

submitted lists of eligible applicants to the researchers at the Peabody Research Institute. The research team then shuffled each list into a random order and the TN-VPK program staff were asked to fill the available seats by first offering admission to the child at the top of the list and then going down the list in order until all the available seats were filled. Once a program had admitted enough children to fill its seats, any remaining children were put on a waiting list and were admitted, in order, if an additional seat became available. Those on the waiting list who were not admitted to TN-VPK became the control group for the study.

This procedure was used for two cohorts of children, TN-VPK applicants for the 2009-10 and 2010-11 school years, and resulted in more than 3000 randomly assigned children. Both the children who participated in TN-VPK and those who did not participate will be tracked through the state education database until their third grade year. Information from that database on attendance, disciplinary actions, special education placements, grade retention, and state standardized test scores is being collected each year to determine the long-term impact of the TN-VPK program. In addition, we obtained parental consent for a portion of this randomized sample, referred to as the Intensive Substudy. Children in the Intensive Substudy, including some who participated in TN-VPK and some who did not, are being directly assessed by the research team and rated by their teachers in each year of the study.

This report presents the findings from the Intensive Substudy portion of the randomized control design for the outcomes at the end of the prekindergarten year. The two cohorts of consented children in the Intensive Substudy provided a combined sample of more than 1,000 children who applied to 58 TN-VPK programs across 21 school districts in Tennessee. Though the consent procedures differed for the two cohorts and resulted in different participation rates in the Intensive Substudy, the two cohorts were similar in terms of demographic characteristics and initial academic skills. Likewise, although the consent rate for the children admitted to TN-VPK was higher than that for the children who were not admitted, there were few significant differences between them at the time of pretest. To ensure that no baseline differences between children who participated in TN-VPK and those who did not could bias the estimates of the effects of TN-VPK on the outcome measures, the baseline variables were used as statistical controls in the analyses. Using this large Intensive Substudy sample, two questions were investigated for this report:

1. Does participation in TN-VPK improve the school readiness of the economically disadvantaged children eligible for the program?
2. What are the characteristics of the children who benefit the most from TN-VPK?

Outcome measures. The academic gains of the children in the Intensive Substudy sample were measured with a selection of standardized tests from the Woodcock Johnson III Achievement Battery that were individually administered at the beginning and end of the school year. These tests assessed early literacy, language, and math skills:

Literacy

- *Letter-Word Identification*: Assesses the ability to identify and pronounce alphabet letters and read words.

- *Spelling:* Assesses prewriting skills, such as drawing lines and tracing, writing letters, and spelling orally presented words.

Language

- *Oral Comprehension*: Assesses listening ability and understanding by asking the child to complete analogies and provide words with similar or different meanings from key words.
- *Picture Vocabulary:* Assesses early language development and lexical knowledge by asking the child to name objects presented in pictures and point to the picture that goes with a word.

Math

- *Applied Problems*: Assesses the ability to solve small numerical and spatial problems presented verbally with accompanying pictures of objects.
- *Quantitative Concepts*: Assesses quantitative reasoning and math knowledge by asking the child to point to or state answers to questions on number identification, sequencing, shapes, symbols, and the like.

The scores on all of the above tests were summarized in a composite measure (WJ Composite) that averaged them together to create an overall measure representing children's combined achievement in literacy, language, and math.

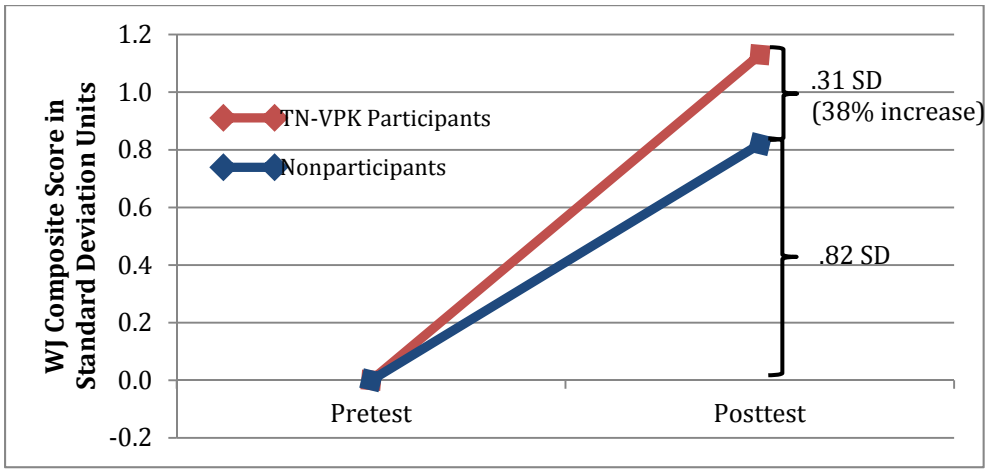
In addition, reports of the children's academic skills and behavior were collected from their kindergarten teachers early in the fall of the school year after pre-k. Two teacher rating instruments were used for this purpose:

- *Cooper-Farran Behavioral Rating Scales:* Teacher ratings for each child on two scales:
  - *Work-Related Skills:* The ability to work independently, listen to the teacher, remember and comply with instructions, complete tasks, function within designated time periods, and otherwise engage appropriately in classroom activities.
  - *Social Behavior:* Social interactions with peers including appropriate behavior while participating in group activities, play, and outdoor games; expression of feelings and ideas; and response to others' mistakes or misfortunes.
- *Academic Classroom and Behavior Record*: Teacher ratings for each child on three scales:
  - *Readiness for Kindergarten*: How well prepared the child is for kindergarten in literacy, language, and math skills, and social behavior.
  - *Liking for School*: The child's liking or disliking for school, having fun at school, enjoying and engaging in classroom activities, and seeming happy at school.
  - *Behavior Problems*: Whether the child has shown explosive or overactive behaviors, attention problems, physical or relational aggression, social withdrawal or anxiety, motor difficulties, and the like.

Findings. All the children included in the Intensive Substudy sample met the requirement that they qualify for the federal Free or Reduced Price Lunch programs. The children who participated in TN-VPK attended an average of 149 days during the school year. In contrast, more than half of the children who were not admitted to TNVPK stayed home with a parent or other guardian and only 27% were enrolled in Head Start or private center-based childcare.

During the course of the pre-k school year, the academic skills of all the children improved. However, the children who participated in TN-VPK gained significantly more on all the direct assessments of academic skills than the children who did not attend. In standard deviation units, the standardized mean difference effect size for the WJ Composite scale was .31, and the effect sizes for the individual literacy, language, and math scales ranged from .12 to .46. These standard deviation units allow the proportionately greater gain for TN-VPK participants relative to nonparticipants to be represented as a percentage increase. This is shown in the graph below for the WJ Composite outcome measure.

Gain from the Beginning to End of Pre-K on the Summary Achievement Measure for Children Who Participated in TN-VPK Compared to Children Who Did Not Participate



As shown in this graph, TN-VPK resulted in a gain on the WJ Composite measure that was 38% greater than the gain made by the children who did not attend TN-VPK. The analogous improvements for the TN-VPK participants relative to the nonparticipants on the individual academic achievement measures were as follows:

Literacy: *Letter-Word Identification*, 92%; *Spelling*, 32%.
Language: *Oral Comprehension*, 31%; *Picture Vocabulary*, 74%.
Math: *Applied Problems*, 21%; *Quantitative Concepts*, 50%.

Positive effects of TN-VPK were also found on the kindergarten teachers' ratings of children's preparedness for kindergarten and, to a lesser extent, on their ratings of the children's classroom work behavior and social behavior.

We also investigated whether the TN-VPK program was differentially effective for different subgroups of children. The program's positive effects were not different for boys compared to girls, but there were larger effects on the academic skills of children who were not native English speakers than for those who were. Most of these English Language Learners were Hispanic, so no separate analysis was done for differences among ethnic groups.

The findings described in this report show that the Tennessee Voluntary Prekindergarten program produces significant improvements in the academic skills generally regarded as important for school readiness compared to the gains made by comparable children who

did not participate in the program. These positive outcomes coincide with the main goal of the TN-VPK program, which is to increase the school readiness of the economically disadvantaged children it serves. The sample of children in the Intensive Substudy whose end of pre-k outcomes are examined here is being followed into subsequent grades in Tennessee public schools. Further assessments of the academic skills and classroom behavior of these children will be made each year until at least third grade to investigate the strength and longevity of these effects. The findings from those follow-ups, and from other components of the evaluation research design, will be the subject of later reports.

Table A1. Summary of Analytic Samples and Analyzed Effects in This Technical Report

	TOT Analysis				ITT Analysis	
Analysis	**ISS CH 1 (N=306)**	**ISS CH 2 (N=770)**	**FULL CH 1 (N=1764)**	**FULL CH 2 (N=1261)**	**FULL CH 1 (N=1764)**	**FULL CH 2 (N=1261)**
Effect on K WJ Scores	X	X				
Effect on G1 WJ Scores	X	X				
Effect on G1 Teacher Ratings	X	X				
Effect on K Retention	X	X	X		X	
Effect on K Attendance	X	X	X	X	X	X
Effect on G1 Attendance			X		X	
Effect on K Disciplinary Action	X	X	X	X	X	X
Effect on G1 Disciplinary Action			X		X	
Effect on K Special Ed Services	X	X	X	X	X	X
Effect on G1 Special Ed Services			X		X	
Moderators of Effects on Cognitive Outcomes	X	X				
Moderators of Effects on Non-Cognitive Outcomes	X	X				

Notes: ISS=Intensive Substudy; CH=Cohort; TOT=treatment on the treated; ITT=intent to treat; WJ=Woodcock Johnson III achievement measures; K=kindergarten; G=Grade.

APPENDIX B

Analysis Details

Table B1. Missing Data for Intensive Substudy Sample, Both Cohorts

Variable	Valid N	% Missing Data
TN-VPK Participation	1076	.00
Cohort	1076	.00
Black	1075	.09
Hispanic	1075	.09
Gender	1076	.00
Native English Speaker	1076	.00
Library Card Use	1017	5.48
Newspaper Subscriptions	1026	4.65
Magazine Subscriptions	1028	4.46
Mother's Education	1030	4.28
Number of Working Parents	1033	4.00
Test Lag (PK year start to WJ Pretest)	1043	3.07
Age at WJ Pretest	1043	3.07
T1 WJ Letter-Word Identification	1043	3.07
T1 WJ Spelling	1043	3.07
T1 WJ Applied Problems	1043	3.07
T1 WJ Picture Vocabulary	1043	3.07
T1 WJ Oral Comprehension	1043	3.07
T1 WJ Quantitative Concepts	1043	3.07
T1-T2 WJ Test Interval	1043	3.07
T2 WJ Letter-Word Identification	1076	.00
T2 WJ Spelling	1076	.00
T2 WJ Applied Problems	1076	.00
T2 WJ Picture Vocabulary	1076	.00
T2 WJ Oral Comprehension	1076	.00
T2 WJ Quantitative Concepts	1076	.00
T1-T3 WJ Test Interval	1015	5.67
T3 WJ Letter-Word Identification	1046	2.79
T3 WJ Spelling	1046	2.79
T3 WJ Oral Comprehension	1046	2.79
T3 WJ Quantitative Concepts	1046	2.79
T3 WJ Applied Problems	1046	2.79
T3 WJ Picture Vocabulary	1046	2.79
T3 WJ Passage Comprehension	1046	2.79
T3 WJ Calculation	1046	2.79
T1-T4 WJ Test Interval	997	7.34
T4 WJ Letter-Word Identification	1029	4.37
T4 WJ Spelling	1029	4.37
T4 WJ Applied Problems	1029	4.37
T4 WJ Picture Vocabulary	1029	4.37
T4 WJ Oral Comprehension	1029	4.37
T4 WJ Quantitative Concepts	1029	4.37
T4 WJ Calculation	1029	4.37
T4 WJ Passage Comprehension	1029	4.37
TCRF Test Lag (K year start to K Rating)	930	13.6
Age at K Teacher Rating	930	13.6

Variable	Valid N	% Missing Data
K CF Social Skills Scale	963	10.5
K CF Work-Related Skills Scale	963	10.5
K ACBR Preparedness Scale	962	10.6
K ACBR Peer Relationships Scale	962	10.6
K ACBR Behavior Problems Scale	963	10.5
K ACBR Feelings About School Scale	962	10.6
Age at G1 Teacher Rating	957	11.1
G1 CF Social Skills Scale	957	11.1
G1 CF Work-Related Skills Scale	957	11.1
G1 ACBR Preparedness Scale	955	11.3
G1 ACBR Peer Relationships Scale	955	11.3
G1 ACBR Behavior Problems Scale	956	11.2
G1 ACBR Feelings About School Scale	957	11.1
K Days Attended	1058	1.67
K Retention	1056	1.86
K Disciplinary Action	1065	1.02
K Special Education Services	1065	1.02

Notes: T1=Beginning of pre-k; T2=End of pre-k; T3=End of kindergarten; T4=end of first grade; WJ=Woodcock Johnson III achievement measures; K=kindergarten; G1=Grade.

Table B2. Missing Data for Full Randomized Sample, Both Cohorts

Variable	Valid N	% Missing Data
TN-VPK Participation	3025	.00
Cohort	3025	.00
Black	3025	.00
Hispanic	3025	.00
Gender	3025	.00
Native English Speaker	2992	1.09
Age at Start of PK School Year	3025	.00
K Days Attended	2934	3.01
K Disciplinary Action	2957	2.25
K Special Education Services	2957	2.25

Table B3. Missing Data for Full Randomized Sample, Cohort 1 Only

Variable	Valid N	% Missing Data
TN-VPK Participation	1764	.00%
Black	1764	.00%
Hispanic	1764	.00%
Gender	1764	.00%
Native English Speaker	1740	1.36%
Age at Start of PK School Year	1764	.00%
K Days Attended	1715	.00%
K Retention	1703	2.78%
K Disciplinary Action	1729	3.46%
K Special Education Services	1729	1.98%
G1 Days Attended	1673	1.98%
G1 Disciplinary Action	1706	5.16%
G1 Special Education Services	1706	3.29%

Table B4. Full Model Results for the Analysis of the Effect of TN-VPK on the End of Kindergarten WJ Subscales for the ISS Analysis Sample; Both Cohorts, Sample-Weighted Data

	WJ COMPOSITE (6)			WJ COMPOSITE (8)			LETTER-WORD ID			SPELLING		
Fixed Effect	**b**	**SE**	**p**	**b**	**SE**	**p**	**b**	**SE**	**p**	**b**	**SE**	**p**
Intercept	184.9	17.5	.000	170.5	17.0	.000	154.3	57.0	.011	291.8	31.1	.000
Cohort	-.09	1.02	.927	-.68	1.11	.542	-1.90	3.27	.561	2.02	1.67	.226
Inclusion Rate_Nonparticipants	-2.61	1.63	.110	-3.40	1.51	.024	-3.91	4.36	.371	-6.56	2.96	.027
Inclusion Rate_Participants	-.83	1.97	.673	-.21	2.29	.928	-3.46	4.89	.479	-2.78	2.88	.333
Inclusion Rate Interaction	-2.45	5.95	.681	-2.37	6.42	.713	-6.07	17.0	.721	-3.32	13.0	.799
Black	.28	.70	.690	.68	.83	.414	-.28	1.69	.867	4.86	1.51	.001
Hispanic	3.50	1.28	.006	3.83	1.12	.001	6.80	4.68	.147	1.87	2.53	.459
Male	-.93	.67	.164	-1.40	.64	.029	-2.08	1.48	.160	-4.26	1.20	.000
Native English Speaker	-.64	1.25	.607	-2.51	1.11	.025	2.61	2.98	.382	2.65	1.67	.113
Library Card Use	-.33	.47	.478	-.39	.49	.423	.07	1.06	.948	.99	.78	.202
Number Newspaper Subscriptions	-.11	.48	.826	-.20	.48	.685	.10	1.50	.949	-.67	.92	.465
Number Magazine Subscriptions	.60	.55	.277	.74	.58	.205	1.16	1.46	.427	1.05	1.56	.502
Mother's Education	-.18	.47	.711	.07	.51	.892	1.09	1.02	.284	1.25	.76	.101
Number Working Parents	.41	.48	.385	.39	.55	.477	.52	1.44	.719	.90	.67	.182
Test Lag	-.01	.04	.818	.01	.04	.829	-.01	.14	.944	-.04	.06	.520
Age at Pretest	-.21	.08	.010	-.15	.09	.088	.23	.19	.213	-.08	.20	.686
Pretest	.62	.02	.000	.62	.02	.000	.56	.04	.000	.33	.03	.000
Test Interval (T1 to T3)	1.40	.73	.055	1.81	.70	.010	2.95	2.68	.271	1.11	1.36	.417
Propensity Score	-2.22	3.81	.560	.07	3.54	.985	-6.90	10.9	.529	-2.74	8.77	.754
TN-VPK Participation	**.53**	**.70**	**.448**	**-.03**	**.64**	**.962**	**.95**	**1.49**	**.522**	**.18**	**1.79**	**.922**

Level 1 and Level 2 Variance Components

Random Effect	**SD**	**VC**	**p**	**SD**	**VC**	**p**	**SD**	**VC**	**p**	**SD**	**VC**	**p**
Intercept	1.28	1.65	.019	1.30	1.69	.032	3.02	9.13	.073	2.79	7.76	.008
Level 1 Residual	8.54	72.9		8.86	78.6		22.0	482.7		17.3	300.5	

Level 3 Variance Components

Random Effect	**SD**	**VC**	**p**	**SD**	**VC**	**p**	**SD**	**VC**	**p**	**SD**	**VC**	**p**
Intercept	.82	.67	.444	.98	.95	.265	3.73	13.9	.006	.18	.03	>.500

	ORAL COMPREHENSION			PICTURE VOCABULARY			PASSAGE COMPREHENSION		
Fixed Effect	**b**	**SE**	**p**	**b**	**SE**	**p**	**b**	**SE**	**p**
Intercept	196.9	22.3	.000	304.8	17.9	.000	93.8	40.4	.027
Cohort	-3.61	1.38	.009	.57	1.41	.686	-2.80	1.97	.155
Inclusion Rate_Nonparticipants	-1.36	2.05	.507	-.55	1.91	.773	-5.98	2.90	.040
Inclusion Rate_Participants	-2.20	2.43	.365	2.57	2.38	.280	3.43	3.96	.387
Inclusion Rate Interaction	11.1	11.2	.321	-7.56	6.65	.256	-7.27	12.6	.565
Black	-3.05	.87	.000	-.80	.83	.337	4.13	1.86	.027
Hispanic	-2.16	1.62	.182	1.75	.79	.027	4.57	2.29	.046
Male	.15	.49	.763	1.24	.55	.024	-6.11	1.13	<.001
Native English Speaker	3.04	1.38	.028	1.96	1.60	.222	-11.7	2.30	<.001
Library Card Use	.04	.51	.940	-.25	.36	.496	-.72	.87	.408
Number Newspaper Subscriptions	.01	.59	.985	-.45	.31	.155	-.65	.98	.508
Number Magazine Subscriptions	.68	.62	.270	.82	.43	.059	2.79	1.45	.055
Mother's Education	-.52	.66	.430	.37	.34	.277	1.79	.93	.056
Number Working Parents	.40	.46	.388	.50	.32	.119	-.77	.82	.350
Test Lag	.07	.03	.036	-.02	.02	.420	.17	.06	.008
Age at Pretest	-.02	.14	.895	.00	.07	.953	.51	.26	.047
Pretest	.55	.03	.000	.37	.03	.000	.55	.05	<.001
Test Interval (T1 to T3)	.34	.85	.687	-.18	.61	.772	1.36	1.37	.320
Propensity Score	15.2	4.54	.001	.32	2.31	.891	39.6	5.63	<.001
TN-VPK Participation	**1.38**	**1.08**	**.202**	**.97**	**.72**	**.179**	**-2.31**	**1.37**	**.091**

Level 1 and Level 2 Variance Components

Random Effect	**SD**	**VC**	**p**	**SD**	**VC**	**p**	**SD**	**VC**	**p**
Intercept	.30	.09	>.500	1.30	1.70	.026	2.02	4.07	.179
Level 1 Residual	10.6	111.3		7.28	53.0		19.1	365.0	

Level 3 Variance Components

Random Effect	**SD**	**VC**	**p**	**SD**	**VC**	**p**	**SD**	**VC**	**p**
Intercept	2.79	7.77	.000	2.34	5.46	.000	1.57	2.46	.333

	APPLIED PROBLEMS			QUANTITATIVE CONCEPTS			CALCULATION		
Fixed Effect	**b**	**SE**	**p**	**b**	**SE**	**p**	**b**	**SE**	**p**
Intercept	252.5	25.5	.000	212.4	12.8	.000	171.1	28.8	<.001
Cohort	-1.94	1.45	.180	1.31	1.34	.330	-4.73	2.66	.075
Inclusion Rate_Nonparticipants	-3.45	2.10	.100	-.52	2.19	.813	-4.58	3.71	.218
Inclusion Rate_Participants	.27	3.21	.932	-.26	2.65	.922	-2.21	6.05	.714
Inclusion Rate Interaction	-11.4	9.70	.242	-.42	6.90	.952	-4.35	12.4	.725
Black	-1.08	.77	.162	-.63	.72	.383	.35	1.63	.828
Hispanic	2.62	1.39	.060	.04	.96	.969	1.55	1.82	.393
Male	-3.44	1.10	.002	-2.69	.83	.001	-3.56	1.22	.004
Native English Speaker	-.88	1.49	.555	-.20	1.78	.911	-9.44	2.30	<.001
Library Card Use	-1.06	.53	.044	-.55	.57	.333	-.51	.68	.454
Number Newspaper Subscriptions	-.46	.53	.380	.51	.55	.356	-.64	.79	.420
Number Magazine Subscriptions	2.86	.94	.002	.78	1.00	.436	1.60	1.11	.152
Mother's Education	-.53	.58	.365	-.09	.45	.851	1.36	.93	.144
Number Working Parents	2.10	.85	.014	-.07	.83	.932	1.96	1.35	.148
Test Lag	.13	.05	.007	.00	.04	.980	.13	.06	.029
Age at Pretest	.14	.11	.206	-.06	.09	.464	.16	.20	.427
Pretest	.34	.02	.000	.56	.03	.000	.44	.03	<.001
Test Interval (T1 to T3)	1.17	1.11	.291	.49	.62	.437	3.90	1.39	.005
Propensity Score	21.5	5.35	.000	7.00	4.57	.126	11.0	4.08	.007
TN-VPK Participation	**.36**	**1.03**	**.727**	**-.92**	**.70**	**.187**	**-1.32**	**1.19**	**.266**

Level 1 and Level 2 Variance Components

Random Effect	**SD**	**VC**	**p**	**SD**	**VC**	**p**	**SD**	**VC**	**p**
Intercept	2.57	6.59	.008	.21	.04	>.500	2.13	4.52	.078
Level 1 Residual	12.0	144.8		10.5	109.6		15.3	233.7	

Level 3 Variance Components

Random Effect	**SD**	**VC**	**p**	**SD**	**VC**	**p**	**SD**	**VC**	**p**
Intercept	.72	.51	>.500	1.28	1.64	.033	3.82	14.6	<.001

Table B5. Full Model Results for the Analysis of the Effect of TN-VPK on the End of First Grade WJ Subscales for the ISS Analysis Sample; Both Cohorts, Sample-Weighted Data

	WJ COMPOSITE (6)			WJ COMPOSITE (8)			LETTER-WORD ID			SPELLING		
Fixed Effect	**b**	**SE**	**p**	**b**	**SE**	**p**	**b**	**SE**	**p**	**b**	**SE**	**p**
Intercept	235.0	21.5	.000	229.7	20.8	.000	268.6	51.7	.000	334.8	39.3	.000
Cohort	.01	.81	.994	-.13	.82	.872	1.83	2.16	.401	-2.39	2.10	.259
Inclusion Rate_Nonparticipants	.77	2.25	.732	.67	2.12	.753	2.76	4.66	.555	1.74	2.94	.555
Inclusion Rate_Participants	-1.36	1.79	.450	-.75	1.96	.704	-4.24	4.36	.335	-3.46	2.85	.230
Inclusion Rate Interaction	-16.7	9.08	.070	-17.0	10.1	.096	-46.9	24.0	.054	-19.3	11.8	.106
Black	-1.38	.77	.073	-1.01	.73	.163	-4.06	1.76	.021	.62	1.56	.692
Hispanic	1.94	1.27	.127	1.91	1.19	.110	3.40	3.01	.259	.07	2.02	.974
Male	-1.01	.61	.097	-1.69	.66	.011	-4.78	1.31	.001	-4.92	1.05	.000
Native English Speaker	-1.68	1.29	.193	-2.96	1.19	.013	.75	3.28	.819	3.33	2.07	.108
Library Card Use	-.90	.59	.126	-.83	.54	.121	-.90	1.28	.483	-.29	1.12	.799
Number Newspaper Subscriptions	.22	.43	.615	.10	.40	.809	1.22	1.26	.333	.14	.87	.877
Number Magazine Subscriptions	.98	.74	.189	1.11	.74	.135	2.66	1.61	.100	2.86	1.39	.040
Mother's Education	-.31	.44	.486	-.13	.47	.787	.84	.78	.281	-.66	1.00	.509
Number Working Parents	.81	.31	.009	.81	.26	.003	2.48	.72	.001	1.67	.56	.004
Test Lag	-.01	.03	.740	.00	.03	.931	-.07	.09	.447	.07	.05	.201
Age at Pretest	-.22	.08	.008	-.20	.09	.031	.35	.22	.107	-.05	.15	.726
Pretest	.58	.03	.000	.56	.03	.000	.49	.06	.000	.27	.03	.000
Test Interval (T1 to T4)	.51	.58	.382	.85	.55	.121	.36	1.40	.797	.57	1.22	.642
Propensity Score	1.73	4.12	.674	1.55	4.39	.724	-5.97	12.0	.619	16.5	7.02	.019
TN-VPK Participation	**-1.23**	**.78**	**.113**	**-1.19**	**.80**	**.136**	**-1.58**	**1.87**	**.399**	**-1.79**	**1.22**	**.143**

Level 1 and Level 2 Variance Components

Random Effect	**SD**	**VC**	**p**	**SD**	**VC**	**p**	**SD**	**VC**	**p**	**SD**	**VC**	**p**
Intercept	1.94	3.76	.002	2.02	4.09	.001	3.36	11.3	.037	3.58	12.8	.003
Level 1 Residual	9.58	91.9		9.68	93.7		24.3	589.6		17.2	295.6	

Level 3 Variance Components

Random Effect	**SD**	**VC**	**p**	**SD**	**VC**	**p**	**SD**	**VC**	**p**	**SD**	**VC**	**p**
Intercept	.50	.25	.363	.72	.52	.311	2.24	5.01	.185	1.46	2.12	.120

	ORAL COMPREHENSION			PICTURE VOCABULARY			PASSAGE COMPREHENSION		
Fixed Effect	**b**	**SE**	**p**	**b**	**SE**	**p**	**b**	**SE**	**p**
Intercept	237.3	29.1	.000	302.8	21.3	.000	136.7	33.7	.001
Cohort	-1.53	.75	.045	-.31	.59	.600	-1.80	1.89	.345
Inclusion Rate_Nonparticipants	2.88	2.08	.171	.66	1.69	.698	-.50	3.54	.889
Inclusion Rate_Participants	-3.26	2.69	.230	-.42	2.12	.843	.78	3.76	.835
Inclusion Rate Interaction	-5.42	8.65	.532	-9.12	5.83	.122	-32.4	16.2	.049
Black	-1.82	.65	.006	-1.79	.78	.022	.62	1.17	.597
Hispanic	.39	.87	.659	-1.25	.87	.152	2.01	1.90	.290
Male	.23	.52	.665	1.97	.70	.005	-5.95	1.13	.000
Native English Speaker	1.97	1.02	.052	-.17	1.99	.933	-12.8	1.50	.000
Library Card Use	-.86	.28	.003	-.36	.32	.266	-.84	.62	.178
Number Newspaper Subscriptions	-.55	.43	.194	-.52	.39	.187	.31	.79	.698
Number Magazine Subscriptions	1.10	.78	.159	.87	.60	.148	2.37	.92	.011
Mother's Education	-.35	.32	.271	.95	.38	.013	1.58	.81	.052
Number Working Parents	.42	.35	.228	.44	.32	.169	1.32	.74	.073
Test Lag	.04	.03	.237	.05	.03	.157	.13	.04	.001
Age at Pretest	.04	.09	.661	.09	.09	.347	.24	.18	.194
Pretest	.51	.03	.000	.33	.04	.000	.57	.05	.000
Test Interval (T1 to T4)	.02	.80	.984	.33	.69	.633	1.32	.72	.066
Propensity Score	11.6	3.35	.001	8.69	2.48	.001	20.0	5.55	.001
TN-VPK Participation	**-.99**	**.87**	**.257**	**.28**	**.70**	**.688**	**-1.33**	**1.06**	**.209**

Level 1 and Level 2 Variance Components

Random Effect	**SD**	**VC**	**p**	**SD**	**VC**	**p**	**SD**	**VC**	**p**
Intercept	2.26	5.10	.001	1.23	1.51	.036	2.95	8.70	.002
Level 1 Residual	9.98	99.7		7.86	61.8		15.9	252.7	

Level 3 Variance Components

Random Effect	**SD**	**VC**	**p**	**SD**	**VC**	**p**	**SD**	**VC**	**p**
Intercept	1.84	3.37	.011	1.24	1.53	.006	1.18	1.40	.424

	APPLIED PROBLEMS			QUANTITATIVE CONCEPTS			CALCULATION		
Fixed Effect	**b**	**SE**	**p**	**b**	**SE**	**p**	**b**	**SE**	**p**
Intercept	297.8	14.7	.000	236.6	29.3	.000	258.0	34.7	.000
Cohort	-1.16	.70	.101	.69	.51	.182	-2.02	1.22	.100
Inclusion Rate_Nonparticipants	-3.93	1.05	.001	-1.07	1.9	.575	1.97	2.49	.431
Inclusion Rate_Participants	3.11	1.79	.086	-1.14	2.44	.642	-.11	2.89	.971
Inclusion Rate Interaction	-9.44	10.1	.354	-24.5	9.56	.013	-16.0	13.1	.227
Black	-1.89	.78	.016	-2.18	.49	.000	-.01	.90	.994
Hispanic	.49	1.35	.719	-2.11	.83	.011	-.68	1.16	.558
Male	-1.69	1.27	.182	-2.78	.95	.004	-4.77	1.31	.000
Native English Speaker	-2.13	1.19	.073	-1.27	1.62	.432	-6.71	1.97	.001
Library Card Use	-1.13	.66	.088	-.42	.47	.370	-.69	.61	.256
Number Newspaper Subscriptions	-.01	.43	.981	.67	.45	.136	-1.11	.39	.005
Number Magazine Subscriptions	1.09	1.08	.314	1.14	1.30	.378	2.03	.92	.026
Mother's Education	.86	.70	.216	-.37	.57	.517	.66	.79	.409
Number Working Parents	1.16	.76	.127	.57	.61	.353	.48	.43	.266
Test Lag	.11	.04	.002	.02	.04	.646	.13	.04	.001
Age at Pretest	.03	.14	.817	-.15	.08	.071	-.01	.16	.942
Pretest	.31	.02	.000	.49	.02	.000	.31	.03	.000
Test Interval (T1 to T4)	.48	.49	.324	1.15	.95	.229	2.46	1.05	.019
Propensity Score	21.0	5.39	.000	10.0	5.51	.069	12.3	6.56	.060
TN-VPK Participation	**-.77**	**.81**	**.346**	**-2.81**	**.97**	**.004**	**-.86**	**1.15**	**.455**

Level 1 and Level 2 Variance Components

Random Effect	**SD**	**VC**	**p**	**SD**	**VC**	**p**	**SD**	**VC**	**p**
Intercept	1.48	2.18	.016	.65	.42	.135	2.16	4.68	.004
Level 1 Residual	12.2	149.2		11.0	120.8		13.1	172.1	

Level 3 Variance Components

Random Effect	**SD**	**VC**	**p**	**SD**	**VC**	**p**	**SD**	**VC**	**p**
Intercept	.14	.02	>.500	1.05	1.10	.021	2.24	5.03	.001

Table B6. Full Model Results for the Analysis of the Effect of TN-VPK on the End of First Grade Teacher Ratings for the ISS Analysis Sample; Both Cohorts, Sample-Weighted Data

	CF SOCIAL SKILLS			CF WORK-RELATED SKILLS		
Fixed Effect	**b**	**SE**	**p**	**b**	**SE**	**p**
Intercept	4.45	1.01	.000	-2.74	1.95	.176
Cohort	.06	.09	.498	.38	.16	.021
Inclusion Rate_Nonparticipants	-.26	.17	.136	-.16	.22	.472
Inclusion Rate_Participants	.09	.25	.734	.12	.27	.655
Inclusion Rate Interaction	.24	.43	.574	-.74	.66	.268
Black	-.22	.08	.004	-.02	.09	.857
Hispanic	.40	.15	.008	.36	.16	.029
Male	-.34	.08	.000	-.50	.10	.000
Native English Speaker	-.22	.10	.031	-.51	.13	.000
Library Card Use	.06	.05	.163	.03	.06	.665
Number Newspaper Subscriptions	.00	.05	.927	.00	.04	.964
Number Magazine Subscriptions	.00	.08	.966	.05	.07	.476
Mother's Education	-.04	.03	.097	-.12	.04	.004
Number Working Parents	.04	.08	.606	.12	.07	.101
Test Lag	-.01	.00	.021	-.01	.00	.025
Age at Pretest	.05	.03	.086	.06	.03	.077
Pretest	.01	.00	.000	.03	.00	.000
Age at Rating	-.05	.03	.084	-.05	.04	.140
Propensity Score	-.32	.35	.368	-.27	.34	.424
TN-VPK Participation	**.06**	**.10**	**.573**	**-.03**	**.12**	**.803**
Level 1 and Level 2 Variance Components						
Random Effect	**SD**	**VC**	**p**	**SD**	**VC**	**p**
Intercept	.12	.02	.059	.24	.06	.000
Level 1 Residual	.86	.74		1.00	.99	
Level 3 Variance Components						
Random Effect	**SD**	**VC**	**p**	**SD**	**VC**	**p**
Intercept	.12	.02	.022	.01	.00	>.500

	ACBR PREPARATION			ACBR PEER RELATIONS			ACBR BEHAVIOR PROBLEMS			ACBR FEELINGS ABOUT SCHOOL		
Fixed Effect	**b**	**SE**	**p**	**b**	**SE**	**p**	**b**	**SE**	**p**	**b**	**SE**	**p**
Intercept	-10.7	2.57	.001	1.37	1.74	.441	4.74	1.61	.009	.44	.47	.358
Cohort	.33	.17	.051	.35	.12	.007	-.11	.13	.369	.06	.04	.161
Inclusion Rate_Nonparticipants	.04	.27	.877	-.38	.18	.034	.45	.19	.018	-.11	.04	.016
Inclusion Rate_Participants	-.22	.30	.468	.41	.25	.104	-.28	.26	.271	.03	.06	.589
Inclusion Rate Interaction	-.43	1.02	.673	.22	.72	.760	-.46	.91	.618	-.11	.25	.641
Black	-.02	.08	.778	-.04	.05	.414	.07	.11	.527	.00	.02	.856
Hispanic	.50	.14	.001	.30	.11	.008	-.44	.19	.021	.08	.04	.022
Male	-.16	.11	.140	-.22	.11	.042	.56	.07	.000	-.12	.02	.000
Native English Speaker	-.28	.11	.011	-.15	.09	.076	.42	.15	.007	-.08	.03	.003
Library Card Use	.01	.09	.939	-.02	.05	.650	-.02	.05	.658	-.03	.02	.094
Number Newspaper Subscriptions	-.05	.04	.210	-.03	.04	.423	-.03	.06	.621	-.03	.02	.142
Number Magazine Subscriptions	-.01	.07	.861	-.10	.07	.125	.05	.09	.593	.00	.03	.879
Mother's Education	-.08	.05	.130	.07	.04	.102	.01	.06	.880	-.04	.01	.004
Number Working Parents	.08	.07	.275	.04	.07	.605	-.12	.05	.023	.03	.03	.316
Test Lag	-.01	.00	.001	-.01	.00	.001	.00	.00	.061	.00	.00	.158
Age at Pretest	.02	.04	.586	.00	.02	.994	-.04	.02	.071	.01	.01	.569
Pretest	.04	.00	.000	.02	.00	.000	-.01	.00	.000	.01	.00	.000
Age at Rating	-.03	.04	.406	-.02	.02	.435	.03	.03	.191	-.01	.01	.378
Propensity Score	-.10	.34	.770	-.74	.16	.000	.34	.30	.254	-.09	.10	.402
TN-VPK Participation	**-.14**	**.10**	**.193**	**.08**	**.10**	**.398**	**-.06**	**.08**	**.486**	**-.02**	**.03**	**.470**

Level 1 and Level 2 Variance Components

Random Effect	**SD**	**VC**	**p**	**SD**	**VC**	**p**	**SD**	**VC**	**p**	**SD**	**VC**	**p**
Intercept	.14	.02	.031	.18	.03	.000	.20	.04	.008	.06	.00	.000
Level 1 Residual	1.18	1.39		.97	.95		1.15	1.32		.32	.10	

Level 3 Variance Components

Random Effect	**SD**	**VC**	**p**	**SD**	**VC**	**p**	**SD**	**VC**	**p**	**SD**	**VC**	**p**
Intercept	.01	.00	>.500	.01	.00	>.500	.01	.00	>.500	.00	.00	>.500

Table B7. Full Model Results for the Analysis of the Effect of TN-VPK on Kindergarten Disciplinary Action for ISS Sample; Both Cohorts, Sample-Weighted Data

Effect	Logit	S.E.	Wald	df	p-value	Odds Ratio
Intercept	4.43	9.74	.207	1	.649	84.0
Cohort	-1.70	1.41	1.45	1	.229	.183
Black	.751	.806	.867	1	.352	2.12
Male	1.10	.812	1.82	1	.177	2.99
Library Card use	.077	.480	.026	1	.872	1.08
Newspaper Subscriptions	-.160	.487	.108	1	.743	.852
Magazine Subscriptions	1.02	.577	3.10	1	.078	2.76
Mother Education	-.149	.576	.067	1	.796	.861
Number of Working Parents	.797	.725	1.21	1	.271	2.22
Test Lag from Pretest	-.029	.029	.965	1	.326	.972
Age at Pretest	-.043	.119	.133	1	.715	.957
WJ Composite Pretest Score	-.006	.027	.056	1	.814	.994
Propensity Score	-7.76	4.34	3.20	1	.074	.000
TN-VPK Participation	**1.15**	**1.00**	**1.31**	**1**	**.252**	**3.15**

Table B8. Full Model Results for the Analysis of the Effect of TN-VPK on Kindergarten Disciplinary Action for Full Randomized Sample; Both Cohorts, Sample-Weighted Data

Effect	Logit	S.E.	Wald	df	p-value	Odds Ratio
TOT Analysis						
Intercept	-6.94	2.44	8.11	1	.004	.001
Cohort	.226	.355	.404	1	.525	1.25
Black	1.49	.362	17.0	1	.000	4.44
Hispanic	-1.93	1.20	2.59	1	.107	.145
Male	1.01	.370	7.45	1	.006	2.75
Age at Start of Pre-K	.030	.046	.433	1	.510	1.03
TN-VPK Participation	**-.445**	**.344**	**1.68**	**1**	**.196**	**.641**
ITT Analysis						
Intercept	-6.82	2.68	6.47	1	.011	.001
Cohort	.019	.375	.003	1	.959	1.02
Black	1.28	.380	11.3	1	.001	3.58
Hispanic	-1.93	1.20	2.58	1	.108	.145
Male	1.34	.437	9.40	1	.002	3.81
Age at Start of Pre-K	.017	.050	.117	1	.732	1.02
TN-VPK Participation	**.181**	**.403**	**.203**	**1**	**.653**	**1.20**

Table B9. Full Model Results for the Analysis of the Effect of TN-VPK on First Grade Disciplinary Action for Full Randomized Sample; Cohort 1, Sample-Weighted Data

Effect	Logit	S.E.	Wald	df	p-value	Odds Ratio
TOT Analysis						
Intercept	-8.32	2.42	11.8	1	.001	.000
Black	.109	.325	.112	1	.738	1.12
Hispanic	-.943	1.09	.744	1	.388	.390
Male	1.46	.384	14.4	1	.000	4.29
Age at Start of Pre-K	.041	.040	1.06	1	.304	1.04
Native English Speaker	1.67	1.10	2.30	1	.129	5.29
TN-VPK Participation	**.170**	**.356**	**.227**	**1**	**.633**	**1.19**
ITT Analysis						
Intercept	-7.63	2.74	7.74	1	.005	.000
Black	.342	.342	1.00	1	.317	1.41
Hispanic	-.775	1.18	.434	1	.510	.461
Male	1.25	.392	10.21	1	.001	3.50
Age at Start of Pre-K	.012	.046	.064	1	.800	1.01
Native English Speaker	1.50	1.17	1.64	1	.201	4.47
TN-VPK Participation	**1.29**	**.558**	**5.37**	**1**	**.021**	**3.64**

Table B10. Full Model Results for the Analysis of Interactions between TN-VPK Participation and Gender on the WJ Achievement Measures at the End of Kindergarten for ISS Sample; Both Cohorts, Sample-Weighted Data

	WJ COMPOSITE (6)			WJ COMPOSITE (8)			LETTER-WORD ID			SPELLING		
Fixed Effect	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**
Intercept	185.0	17.4	<.001	170.5	16.9	<.001	154.1	56.1	.010	291.9	31.0	<.001
Cohort	-.09	1.02	.931	-.68	1.11	.542	-1.81	3.27	.581	2.04	1.67	.220
Inclusion Rate_Nonparticipants	-2.64	1.58	.095	-3.39	1.47	.021	-4.58	4.31	.289	-6.73	3.00	.025
Inclusion Rate_Participants	-.81	1.97	.680	-.21	2.28	.926	-2.92	4.92	.552	-2.66	2.92	.362
Inclusion Rate Interaction	-2.39	5.99	.690	-2.38	6.55	.717	-4.54	16.9	.788	-3.03	12.9	.814
Black	.27	.69	.692	.68	.83	.413	-.30	1.67	.859	4.84	1.50	.001
Hispanic	3.52	1.23	.004	3.82	1.09	<.001	7.08	4.55	.120	1.95	2.48	.431
Male	-.74	1.42	.601	-1.44	1.51	.341	1.52	3.25	.640	-3.31	2.36	.161
Native English Speaker	-.62	1.29	.631	-2.51	1.17	.032	2.98	3.09	.335	2.76	1.61	.088
Library Card Use	-.33	.46	.478	-.39	.48	.417	.12	1.06	.911	1.00	.77	.196
Number Newspaper Subscriptions	-.11	.49	.823	-.19	.49	.690	.03	1.54	.984	-.69	.93	.460
Number Magazine Subscriptions	.60	.55	.278	.74	.58	.204	1.14	1.45	.432	1.04	1.57	.507
Mother's Education	-.17	.46	.711	.07	.50	.890	1.14	1.02	.262	1.27	.76	.095
Number Working Parents	.42	.47	.379	.39	.55	.473	.55	1.45	.702	.90	.66	.173
Test Lag	-.01	.04	.816	.01	.04	.829	-.01	.14	.943	-.04	.06	.512
Age at Pretest	-.21	.08	.011	-.15	.09	.092	.22	.19	.247	-.08	.20	.676
Pretest	.62	.02	<.001	.62	.02	<.001	.56	.04	<.001	.33	.03	<.001
Test Interval (T1 to T3)	1.40	.73	.055	1.81	.70	.010	2.93	2.63	.267	1.10	1.36	.420
Propensity Score	-2.24	3.78	.555	.07	3.51	.984	-7.07	10.7	.510	-2.82	8.73	.747
TN-VPK Participation	.64	.68	.348	-.05	.60	.929	3.07	2.03	.130	.73	1.84	.691
TN-VPK Participation * Gender	**-.25**	**1.54**	**.871**	**.05**	**1.60**	**.973**	**-4.92**	**4.03**	**.223**	**-1.30**	**2.46**	**.597**

Level 1 and Level 2 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	1.28	1.64	.020	1.30	1.70	.032	2.98	8.86	.091	2.77	7.68	.009
Level 1 Residual	8.54	72.9		8.86	78.6		21.9	481.5		17.3	300.5	

Level 3 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	.82	.67	.444	.98	.95	.265	3.79	14.3	.005	.17	.03	>.500

	ORAL COMPREHENSION			PICTURE VOCABULARY			PASSAGE COMPREHENSION		
Fixed Effect	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**
Intercept	196.8	22.4	<.001	304.8	17.9	<.001	93.8	40.5	.027
Cohort	-3.56	1.38	.010	.59	1.43	.679	-2.80	1.97	.155
Inclusion Rate_Nonparticipants	-1.59	2.04	.437	-.65	1.91	.731	-6.00	3.04	.049
Inclusion Rate_Participants	-1.98	2.44	.416	2.63	2.40	.272	3.45	3.91	.378
Inclusion Rate Interaction	11.7	11.1	.296	-7.38	6.92	.287	-7.23	12.8	.573
Black	-3.05	.86	<.001	-.81	.84	.338	4.12	1.87	.028
Hispanic	-2.06	1.65	.211	1.80	.78	.020	4.58	2.20	.038
Male	1.33	1.33	.316	1.77	1.32	.180	-5.99	2.51	.017
Native English Speaker	3.15	1.42	.026	2.01	1.57	.199	-11.7	2.28	<.001
Library Card Use	.06	.50	.908	-.24	.36	.510	-.72	.86	.403
Number Newspaper Subscriptions	-.01	.59	.990	-.46	.31	.139	-.65	.99	.511
Number Magazine Subscriptions	.67	.62	.281	.81	.43	.062	2.78	1.44	.054
Mother's Education	-.51	.66	.443	.38	.34	.266	1.79	.92	.052
Number Working Parents	.41	.47	.375	.51	.32	.118	-.77	.81	.345
Test Lag	.07	.03	.038	-.02	.02	.416	.17	.06	.007
Age at Pretest	-.02	.14	.863	.00	.07	.982	.51	.25	.044
Pretest	.55	.03	<.001	.37	.03	<.001	.55	.05	<.001
Test Interval (T1 to T3)	.33	.86	.698	-.18	.61	.768	1.36	1.36	.317
Propensity Score	15.0	4.50	<.001	.25	2.32	.913	39.6	5.46	<.001
TN-VPK Participation	2.07	1.32	.118	1.28	1.07	.230	-2.24	1.64	.172
TN-VPK Participation * Gender	**-1.61**	**1.52**	**.290**	**-.71**	**1.38**	**.606**	**-.16**	**2.99**	**.957**

Level 1 and Level 2 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	.27	.07	>.500	1.33	1.76	.023	2.02	4.08	.179
Level 1 Residual	10.6	111.3		7.28	53.0		19.1	365.0	

Level 3 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	2.74	7.51	<.001	2.31	5.35	<.001	1.56	2.45	.334

	APPLIED PROBLEMS			QUANTITATIVE CONCEPTS			CALCULATION		
Fixed Effect	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**
Intercept	251.9	25.3	<.001	212.3	12.8	<.001	170.9	29.4	<.001
Cohort	-2.01	1.47	.171	1.30	1.34	.332	-4.75	2.65	.073
Inclusion Rate_Nonparticipants	-3.13	2.04	.125	-.48	2.15	.824	-4.53	3.57	.205
Inclusion Rate_Participants	.11	3.21	.973	-.29	2.67	.913	-2.25	5.93	.704
Inclusion Rate Interaction	-11.9	9.82	.225	-.49	6.95	.944	-4.46	12.4	.720
Black	-1.06	.78	.173	-.63	.72	.383	.36	1.63	.827
Hispanic	2.51	1.40	.073	.02	.98	.982	1.53	1.85	.409
Male	-5.03	1.99	.012	-2.88	1.39	.039	-3.87	2.63	.141
Native English Speaker	-1.07	1.59	.502	-.22	1.79	.902	-9.47	2.39	<.001
Library Card Use	-1.09	.52	.036	-.56	.57	.333	-.51	.68	.451
Number Newspaper Subscriptions	-.44	.53	.405	.52	.56	.356	-.63	.80	.432
Number Magazine Subscriptions	2.87	.93	.002	.78	1.00	.436	1.60	1.11	.152
Mother's Education	-.56	.58	.333	-.09	.45	.843	1.35	.93	.146
Number Working Parents	2.08	.85	.014	-.07	.83	.930	1.96	1.35	.148
Test Lag	.13	.05	.007	.00	.04	.979	.13	.06	.029
Age at Pretest	.14	.11	.184	-.06	.09	.465	.16	.20	.428
Pretest	.34	.02	<.001	.56	.03	<.001	.44	.03	<.001
Test Interval (T1 to T3)	1.19	1.10	.279	.49	.63	.437	3.90	1.40	.005
Propensity Score	21.7	5.33	<.001	7.01	4.57	.126	11.0	4.10	.007
TN-VPK Participation	-.57	1.18	.633	-1.03	.98	.292	-1.50	1.63	.356
TN-VPK Participation * Gender	**2.16**	**1.69**	**.203**	**.26**	**1.58**	**.871**	**.42**	**2.62**	**.873**

Level 1 and Level 2 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	2.57	6.60	.008	.22	.05	>.500	2.14	4.57	.076
Level 1 Residual	12.0	144.5		10.5	109.6		15.3	233.6	

Level 3 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	.84	.70	.445	1.29	1.65	.032	3.82	14.6	<.001

Table B11. Full Model Results for the Analysis of Interactions between TN-VPK Participation and Age at Pretest on the WJ Achievement Measures at the End of Kindergarten for ISS Sample; Both Cohorts, Sample-Weighted Data

	WJ COMPOSITE (6)			WJ COMPOSITE (8)			LETTER-WORD ID			SPELLING		
Fixed Effect	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**
Intercept	174.2	16.9	<.001	163.2	16.0	<.001	168.9	52.3	.003	288.8	31.4	<.001
Cohort	-.13	1.02	.897	-.72	1.10	.511	-2.10	3.26	.521	1.93	1.68	.251
Inclusion Rate_Nonparticipants	-2.71	1.61	.092	-3.54	1.48	.017	-4.25	4.36	.330	-6.74	2.90	.020
Inclusion Rate_Participants	-.81	1.92	.675	-.17	2.26	.941	-3.50	4.85	.471	-2.67	2.77	.336
Inclusion Rate Interaction	-2.29	5.98	.702	-2.11	6.55	.747	-5.65	17.1	.742	-2.97	13.2	.822
Black	.32	.70	.645	.73	.82	.370	-.13	1.71	.939	4.94	1.50	.001
Hispanic	3.59	1.28	.005	3.92	1.12	<.001	7.02	4.61	.128	2.05	2.48	.409
Male	-.98	.65	.135	-1.45	.62	.020	-2.24	1.49	.133	-4.37	1.15	<.001
Native English Speaker	-.60	1.33	.655	-2.47	1.19	.039	2.70	3.10	.384	2.76	1.73	.110
Library Card Use	-.32	.46	.481	-.38	.48	.426	.09	1.07	.930	.99	.78	.202
Number Newspaper Subscriptions	-.08	.48	.871	-.16	.48	.730	.17	1.49	.907	-.62	.92	.502
Number Magazine Subscriptions	.70	.57	.219	.85	.62	.169	1.45	1.55	.348	1.25	1.58	.427
Mother's Education	-.16	.46	.735	.09	.49	.854	1.15	1.01	.255	1.29	.75	.085
Number Working Parents	.39	.49	.426	.37	.57	.518	.45	1.47	.759	.85	.70	.221
Test Lag	-.01	.04	.750	.00	.03	.888	-.02	.14	.900	-.04	.06	.459
Age at Pretest	.03	.22	.884	.12	.23	.603	.94	.50	.063	.41	.33	.211
Pretest	.62	.02	<.001	.62	.02	<.001	.56	.04	<.001	.32	.03	<.001
Test Interval (T1 to T4)	1.36	.70	.052	1.77	.67	.009	2.86	2.60	.271	1.04	1.33	.434
Propensity Score	-2.03	3.92	.605	.29	3.63	.937	-6.21	11.2	.578	-2.23	8.98	.804
TN-VPK Participation	.53	.69	.440	-.03	.63	.961	.95	1.50	.527	.18	1.77	.919
TN-VPK Participation * Age	**-.34**	**.28**	**.218**	**-.38**	**.29**	**.193**	**-.98**	**.59**	**.099**	**-.68**	**.32**	**.032**

Level 1 and Level 2 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	1.30	1.68	.016	1.32	1.75	.026	3.02	9.15	.059	2.79	7.80	.006
Level 1 Residual	8.52	72.6		8.84	78.2		21.9	480.4		17.3	299.3	

Level 3 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	.77	.60	>.500	.92	.84	.321	3.65	13.3	.008	.20	.04	>.500

	ORAL COMPREHENSION			PICTURE VOCABULARY			PASSAGE COMPREHENSION		
Fixed Effect	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**
Intercept	195.9	22.6	<.001	305.2	17.0	<.001	121.9	36.0	.002
Cohort	-3.56	1.38	.010	.56	1.40	.690	-2.86	1.99	.152
Inclusion Rate_Nonparticipants	-1.28	2.08	.538	-.57	1.88	.763	-6.10	2.96	.040
Inclusion Rate_Participants	-2.18	2.42	.367	2.57	2.38	.281	3.49	3.98	.380
Inclusion Rate Interaction	11.0	11.1	.323	-7.48	6.62	.259	-6.90	13.0	.594
Black	-3.08	.87	<.001	-.79	.85	.353	4.17	1.84	.024
Hispanic	-2.21	1.62	.173	1.77	.77	.022	4.63	2.27	.041
Male	.18	.52	.733	1.23	.56	.029	-6.15	1.13	<.001
Native English Speaker	3.03	1.37	.027	1.97	1.59	.215	-11.7	2.29	<.001
Library Card Use	.03	.52	.946	-.24	.36	.498	-.72	.87	.405
Number Newspaper Subscriptions	.00	.58	.997	-.44	.31	.157	-.62	.97	.519
Number Magazine Subscriptions	.63	.62	.308	.84	.41	.041	2.89	1.54	.061
Mother's Education	-.53	.65	.416	.38	.34	.270	1.80	.91	.048
Number Working Parents	.42	.47	.370	.50	.32	.119	-.78	.83	.346
Test Lag	.07	.03	.032	-.02	.02	.422	.17	.06	.006
Age at Pretest	-.16	.22	.474	.05	.14	.715	.74	.47	.122
Pretest	.55	.03	<.001	.37	.03	<.001	.55	.05	<.001
Test Interval (T1 to T4)	.36	.85	.675	-.18	.61	.769	1.34	1.35	.321
Propensity Score	15.1	4.67	.001	.35	2.32	.879	39.8	5.73	<.001
TN-VPK Participation	1.38	1.06	.195	.98	.72	.174	-2.30	1.37	.094
TN-VPK Participation * Age	**.19**	**.24**	**.425**	**-.07**	**.16**	**.667**	**-.31**	**.49**	**.521**

Level 1 and Level 2 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	.03	.00	>.500	1.29	1.65	.028	2.15	4.61	.156
Level 1 Residual	10.6	111.3		7.28	53.0		19.1	364.4	

Level 3 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	2.78	7.71	<.001	2.34	5.49	<.001	1.54	2.37	.346

	APPLIED PROBLEMS			QUANTITATIVE CONCEPTS			CALCULATION		
Fixed Effect	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**
Intercept	260.4	23.2	<.001	209.8	12.2	<.001	180.3	26.6	<.001
Cohort	-1.99	1.44	.167	1.27	1.34	.343	-4.89	2.58	.058
Inclusion Rate_Nonparticipants	-3.65	2.02	.071	-.60	2.14	.778	-4.80	3.62	.185
Inclusion Rate_Participants	.35	3.19	.913	-.22	2.63	.932	-2.31	6.11	.705
Inclusion Rate Interaction	-10.9	9.63	.258	-.34	6.84	.960	-4.17	12.3	.734
Black	-1.01	.78	.195	-.60	.72	.401	.47	1.63	.774
Hispanic	2.75	1.36	.044	.08	1.00	.936	1.72	1.79	.337
Male	-3.49	1.09	.001	-2.72	.82	<.001	-3.66	1.19	.002
Native English Speaker	-.87	1.58	.584	-.17	1.83	.927	-9.39	2.27	<.001
Library Card Use	-1.05	.53	.047	-.55	.56	.332	-.49	.68	.470
Number Newspaper Subscriptions	-.43	.52	.410	.53	.55	.340	-.57	.79	.466
Number Magazine Subscriptions	2.98	.96	.002	.84	1.03	.417	1.78	1.15	.121
Mother's Education	-.51	.56	.368	-.07	.45	.878	1.41	.90	.119
Number Working Parents	2.06	.86	.017	-.08	.83	.921	1.91	1.37	.164
Test Lag	.13	.05	.008	.00	.04	.989	.12	.06	.035
Age at Pretest	.45	.32	.154	.08	.24	.733	.66	.29	.022
Pretest	.34	.02	<.001	.56	.03	<.001	.44	.03	<.001
Test Interval (T1 to T4)	1.13	1.10	.303	.46	.60	.442	3.85	1.37	.005
Propensity Score	21.7	5.44	<.001	7.14	4.62	.123	11.2	4.03	.005
TN-VPK Participation	.36	.98	.714	-.92	.69	.182	-1.32	1.23	.281
TN-VPK Participation * Age	**-.44**	**.37**	**.234**	**-.20**	**.27**	**.461**	**-.70**	**.34**	**.041**

Level 1 and Level 2 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	2.60	6.78	.007	.01	.00	>.500	2.01	4.04	.085
Level 1 Residual	12.0	144.3		10.5	109.5		15.3	232.9	

Level 3 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	.56	.32	>.500	1.26	1.59	.036	3.73	13.9	<.001

Table B12. Full Model Results for the Analysis of Interactions between TN-VPK Participation and Native English Speaker Status on the WJ Achievement Measures at the End of Kindergarten for ISS Sample; Both Cohorts, Sample-Weighted Data

	WJ COMPOSITE (6)			WJ COMPOSITE (8)			LETTER-WORD ID			SPELLING		
Fixed Effect	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**
Intercept	185.3	16.7	<.001	171.0	16.1	<.001	160.5	54.2	.006	293.6	30.2	<.001
Cohort	-.11	1.02	.916	-.70	1.11	.529	-2.13	3.18	.504	1.96	1.67	.241
Inclusion Rate_Nonparticipants	-2.64	1.61	.102	-3.44	1.51	.023	-4.39	4.37	.315	-6.70	2.92	.022
Inclusion Rate_Participants	-.85	1.99	.669	-.23	2.29	.921	-3.67	4.76	.440	-2.85	2.87	.322
Inclusion Rate Interaction	-2.40	5.99	.689	-2.30	6.50	.724	-5.26	16.8	.755	-3.08	13.0	.813
Black	.27	.70	.697	.67	.83	.423	-.36	1.69	.829	4.82	1.53	.002
Hispanic	3.51	1.25	.005	3.84	1.10	<.001	6.96	4.68	.137	1.91	2.51	.446
Male	-.93	.66	.158	-1.41	.64	.027	-2.17	1.46	.138	-4.29	1.18	<.001
Native English Speaker	-.91	1.54	.556	-2.90	1.43	.044	-1.49	3.23	.645	1.51	2.35	.520
Library Card Use	-.33	.47	.479	-.39	.49	.425	.08	1.08	.938	.99	.78	.203
Number Newspaper Subscriptions	-.10	.48	.833	-.19	.48	.694	.17	1.49	.909	-.65	.92	.482
Number Magazine Subscriptions	.61	.55	.270	.75	.58	.197	1.29	1.46	.376	1.09	1.55	.484
Mother's Education	-.18	.48	.705	.06	.51	.908	.99	1.00	.325	1.23	.77	.112
Number Working Parents	.41	.48	.391	.39	.56	.484	.49	1.47	.740	.89	.67	.186
Test Lag	-.01	.04	.804	.01	.04	.838	-.02	.14	.901	-.04	.06	.497
Age at Pretest	-.22	.08	.011	-.15	.09	.088	.22	.19	.245	-.08	.20	.676
Pretest	.62	.02	<.001	.62	.02	<.001	.56	.04	<.001	.33	.03	<.001
Test Interval (T1 to T4)	1.40	.72	.053	1.80	.70	.010	2.90	2.64	.271	1.09	1.36	.421
Propensity Score	-2.28	3.75	.542	-.02	3.48	.994	-7.77	10.6	.464	-2.94	8.80	.738
TN-VPK Participation	.23	1.51	.879	-.47	1.37	.730	-3.70	2.58	.152	-1.14	1.67	.496
TN-VPK Participation * Native English	**.39**	**1.61**	**.810**	**.57**	**1.45**	**.696**	**5.97**	**2.73**	**.029**	**1.68**	**2.81**	**.549**
Level 1 and Level 2 Variance Components												
Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	1.28	1.64	.020	1.29	1.67	.034	2.99	8.93	.073	2.75	7.54	.009
Level 1 Residual	8.54	72.9		8.86	78.6		22.0	481.7		17.3	300.6	
Level 3 Variance Components												
Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	.82	.67	.443	.97	.95	.262	3.68	13.6	.007	.16	.02	>.500

	ORAL COMPREHENSION			PICTURE VOCABULARY			PASSAGE COMPREHENSION		
Fixed Effect	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**
Intercept	193.1	22.4	<.001	304.7	17.6	<.001	94.2	40.5	.026
Cohort	-3.45	1.36	.011	.58	1.42	.683	-2.83	1.96	.149
Inclusion Rate_Nonparticipants	-1.01	2.00	.615	-.54	1.84	.771	-6.04	3.03	.046
Inclusion Rate_Participants	-2.11	2.44	.388	2.57	2.39	.283	3.41	3.95	.388
Inclusion Rate Interaction	10.4	11.1	.345	-7.58	6.60	.251	-7.16	12.8	.575
Black	-3.00	.88	<.001	-.80	.84	.342	4.12	1.89	.029
Hispanic	-2.28	1.66	.170	1.75	.79	.028	4.59	2.22	.039
Male	.21	.50	.680	1.24	.54	.022	-6.12	1.14	<.001
Native English Speaker	5.99	2.56	.020	2.08	2.45	.395	-12.3	4.05	.003
Library Card Use	.03	.52	.948	-.25	.36	.496	-.72	.87	.409
Number Newspaper Subscriptions	-.04	.60	.946	-.45	.32	.163	-.64	.99	.520
Number Magazine Subscriptions	.60	.61	.327	.81	.43	.061	2.80	1.44	.052
Mother's Education	-.44	.61	.472	.38	.34	.272	1.77	.95	.062
Number Working Parents	.43	.46	.357	.50	.32	.120	-.77	.83	.351
Test Lag	.08	.04	.029	-.02	.02	.417	.17	.06	.007
Age at Pretest	-.01	.14	.963	.00	.07	.947	.51	.25	.043
Pretest	.55	.03	<.001	.37	.03	<.001	.55	.05	<.001
Test Interval (T1 to T4)	.38	.83	.648	-.17	.60	.772	1.36	1.36	.319
Propensity Score	15.8	4.71	<.001	.35	2.43	.886	39.5	5.70	<.001
TN-VPK Participation	4.67	2.33	.046	1.11	1.70	.514	-2.91	3.34	.383
TN-VPK Participation * Native English	**-4.23**	**2.72**	**.121**	**-.17**	**2.00**	**.931**	**.77**	**4.10**	**.850**

Level 1 and Level 2 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	.21	.05	>.500	1.30	1.69	.026	2.02	4.07	.180
Level 1 Residual	10.5	110.8		7.28	53.0		19.1	365.0	

Level 3 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	2.78	7.70	<.001	2.33	5.45	<.001	1.57	2.47	.329

	APPLIED PROBLEMS			QUANTITATIVE CONCEPTS			CALCULATION		
Fixed Effect	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**
Intercept	251.0	25.0	<.001	210.4	12.8	<.001	173.8	27.9	<.001
Cohort	-1.88	1.47	.201	1.38	1.40	.325	-4.84	2.61	.064
Inclusion Rate_Nonparticipants	-3.32	2.04	.104	-.35	2.17	.873	-4.81	3.77	.202
Inclusion Rate_Participants	.32	3.27	.921	-.23	2.67	.931	-2.30	5.98	.700
Inclusion Rate Interaction	-11.6	9.69	.232	-.74	6.91	.915	-3.98	12.5	.750
Black	-1.07	.79	.174	-.61	.73	.402	.32	1.63	.845
Hispanic	2.57	1.34	.055	-.01	.93	.987	1.64	1.85	.377
Male	-3.41	1.10	.002	-2.66	.84	.002	-3.60	1.22	.003
Native English Speaker	.31	2.17	.886	1.07	1.41	.449	-11.5	2.16	<.001
Library Card Use	-1.06	.52	.042	-.56	.57	.326	-.50	.68	.461
Number Newspaper Subscriptions	-.49	.53	.359	.49	.54	.369	-.60	.79	.446
Number Magazine Subscriptions	2.82	.94	.003	.74	1.04	.475	1.66	1.09	.130
Mother's Education	-.50	.61	.411	-.05	.47	.910	1.30	.91	.154
Number Working Parents	2.10	.84	.013	-.06	.83	.940	1.94	1.36	.153
Test Lag	.13	.05	.006	.00	.04	.938	.12	.06	.034
Age at Pretest	.14	.11	.197	-.06	.09	.512	.15	.20	.456
Pretest	.34	.02	<.001	.56	.03	<.001	.44	.03	<.001
Test Interval (T1 to T4)	1.18	1.11	.285	.50	.62	.423	3.87	1.37	.005
Propensity Score	21.7	5.29	<.001	7.26	4.43	.101	10.5	4.24	.014
TN-VPK Participation	1.70	2.27	.455	.52	1.99	.794	-3.67	1.31	.005
TN-VPK Participation * Native English	**-1.72**	**2.27**	**.450**	**-1.85**	**2.18**	**.396**	**3.01**	**1.87**	**.109**

Level 1 and Level 2 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	2.58	6.64	.007	.22	.05	>.500	2.10	4.41	.087
Level 1 Residual	12.0	144.7		10.5	109.4		15.3	233.4	

Level 3 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	.72	.52	>.500	1.31	1.70	.029	3.81	14.5	<.001

Table B13. Full Model Results for the Analysis of Interactions between TN-VPK Participation and Gender on the WJ Achievement Measures at the End of First Grade for ISS Sample; Both Cohorts, Sample-Weighted Data

	WJ COMPOSITE (6)			WJ COMPOSITE (8)			LETTER-WORD ID			SPELLING		
Fixed Effect	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**
Intercept	235.0	22.0	.000	229.7	20.8	.000	268.0	52.8	.000	334.3	39.6	.000
Cohort	.01	1.09	.993	-.13	.82	.873	1.87	2.55	.467	-2.37	2.10	.263
Inclusion Rate_Nonparticipants	.75	2.20	.733	.67	2.16	.757	2.46	5.25	.641	1.60	3.04	.599
Inclusion Rate_Participants	-1.34	2.46	.587	-.75	1.98	.707	-3.96	5.90	.504	-3.35	2.90	.253
Inclusion Rate Interaction	-16.7	9.43	.080	-17.0	10.2	.098	-46.3	22.2	.040	-19.1	11.7	.106
Black	-1.38	.80	.086	-1.01	.74	.168	-4.07	2.03	.044	.59	1.56	.703
Hispanic	1.95	1.25	.120	1.91	1.13	.090	3.52	3.15	.266	.12	1.95	.949
Male	-.91	1.18	.443	-1.68	1.56	.281	-3.22	2.98	.281	-4.13	2.37	.082
Native English Speaker	-1.66	1.22	.173	-2.96	1.24	.017	.92	3.02	.760	3.41	2.09	.102
Library Card Use	-.90	.39	.022	-.83	.53	.118	-.88	.99	.375	-.27	1.11	.806
Number Newspaper Subscriptions	.22	.42	.610	.10	.41	.815	1.19	1.07	.266	.12	.89	.892
Number Magazine Subscriptions	.98	.67	.143	1.11	.74	.135	2.65	1.69	.117	2.85	1.39	.041
Mother's Education	-.31	.45	.490	-.13	.46	.785	.87	1.12	.441	-.64	.98	.513
Number Working Parents	.82	.51	.111	.81	.26	.003	2.49	1.29	.053	1.68	.56	.003
Test Lag	-.01	.03	.705	.00	.03	.931	-.07	.07	.359	.07	.06	.202
Age at Pretest	-.22	.09	.016	-.20	.09	.034	.35	.22	.121	-.05	.15	.717
Pretest	.58	.02	.000	.56	.03	.000	.49	.03	.000	.27	.03	.000
Test Interval (T1 to T4)	.51	.63	.415	.85	.55	.122	.37	1.56	.814	.58	1.23	.638
Propensity Score	1.73	3.35	.607	1.55	4.34	.720	-6.08	8.92	.496	16.5	7.01	.019
TN-VPK Participation	-1.17	.92	.203	-1.18	.85	.164	-.66	2.32	.775	-1.32	1.86	.477
TN-VPK Participation * Gender	**-.14**	**1.37**	**.918**	**-.01**	**1.97**	**.998**	**-2.14**	**3.44**	**.534**	**-1.09**	**2.92**	**.708**

Level 1 and Level 2 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	1.94	3.75	.002	2.02	4.09	.001	3.33	11.07	.041	3.54	12.5	.003
Level 1 Residual	9.58	91.9		9.68	93.7		24.3	589.4		17.2	295.7	

Level 3 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	.50	.25	.359	.72	.52	.311	2.29	5.25	.168	1.49	2.22	.108

	ORAL COMPREHENSION			PICTURE VOCABULARY			PASSAGE COMPREHENSION		
Fixed Effect	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**
Intercept	236.8	29.5	.000	302.1	21.1	.000	135.6	33.1	.001
Cohort	-1.51	.75	.048	-.27	.60	.653	-1.74	1.89	.362
Inclusion Rate_Nonparticipants	2.73	2.06	.189	.37	1.74	.832	-.87	3.60	.809
Inclusion Rate_Participants	-3.17	2.70	.245	-.22	2.15	.920	1.09	3.91	.781
Inclusion Rate Interaction	-5.10	8.80	.563	-8.46	6.07	.168	-31.8	16.1	.052
Black	-1.83	.65	.005	-1.81	.79	.022	.59	1.15	.610
Hispanic	.46	.89	.602	-1.12	.88	.203	2.21	1.95	.257
Male	1.08	1.37	.433	3.61	1.33	.007	-3.76	2.27	.098
Native English Speaker	2.06	1.08	.055	-.01	1.91	.995	-12.5	1.58	.000
Library Card Use	-.85	.27	.002	-.34	.33	.300	-.81	.63	.198
Number Newspaper Subscriptions	-.57	.44	.193	-.54	.38	.156	.27	.81	.739
Number Magazine Subscriptions	1.09	.78	.163	.86	.60	.154	2.35	.94	.012
Mother's Education	-.34	.32	.288	.97	.38	.010	1.61	.80	.045
Number Working Parents	.43	.35	.222	.45	.33	.165	1.34	.74	.069
Test Lag	.04	.03	.232	.05	.03	.156	.13	.04	.001
Age at Pretest	.04	.09	.692	.08	.09	.390	.23	.19	.232
Pretest	.51	.03	.000	.33	.04	.000	.57	.05	.000
Test Interval (T1 to T4)	.02	.81	.977	.34	.69	.623	1.33	.71	.059
Propensity Score	11.5	3.32	.001	8.50	2.41	.001	19.7	5.34	.000
TN-VPK Participation	-.49	1.29	.702	1.24	.90	.170	-.05	.87	.953
TN-VPK Participation * Gender	**-1.15**	**1.42**	**.418**	**-2.23**	**1.12**	**.047**	**-2.97**	**2.72**	**.276**

Level 1 and Level 2 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	2.26	5.12	.001	1.17	1.37	.045	2.94	8.66	.003
Level 1 Residual	9.98	99.6		7.85	61.7		15.9	252.2	

Level 3 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	1.82	3.33	.012	1.25	1.57	.005	1.22	1.50	.387

	APPLIED PROBLEMS			QUANTITATIVE CONCEPTS			CALCULATION		
Fixed Effect	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**
Intercept	297.8	14.8	.000	236.5	29.3	.000	257.9	34.7	.000
Cohort	-1.16	.70	.104	.69	.52	.186	-2.05	1.23	.099
Inclusion Rate_Nonparticipants	-3.93	1.07	.001	-1.04	1.98	.602	2.21	2.70	.416
Inclusion Rate_Participants	3.12	1.81	.089	-1.16	2.51	.645	-.26	2.95	.932
Inclusion Rate Interaction	-9.43	10.1	.353	-24.5	9.69	.014	-16.4	13.4	.226
Black	-1.89	.78	.016	-2.17	.49	.000	.01	.92	.987
Hispanic	.49	1.29	.705	-2.13	.81	.009	-.79	1.13	.487
Male	-1.65	1.92	.391	-2.96	1.21	.015	-6.18	2.63	.019
Native English Speaker	-2.13	1.22	.081	-1.29	1.57	.411	-6.90	2.11	.002
Library Card Use	-1.13	.66	.086	-.43	.47	.367	-.72	.60	.236
Number Newspaper Subscriptions	-.01	.43	.980	.68	.46	.139	-1.09	.39	.006
Number Magazine Subscriptions	1.09	1.08	.315	1.14	1.29	.378	2.04	.91	.024
Mother's Education	.87	.69	.212	-.37	.57	.514	.63	.78	.421
Number Working Parents	1.16	.76	.126	.57	.62	.358	.47	.42	.271
Test Lag	.11	.04	.002	.02	.04	.648	.13	.04	.001
Age at Pretest	.03	.14	.817	-.15	.08	.069	-.01	.15	.953
Pretest	.31	.02	.000	.49	.02	.000	.31	.03	.000
Test Interval (T1 to T4)	.48	.49	.325	1.15	.95	.229	2.45	1.05	.019
Propensity Score	21.0	5.35	.000	10.0	5.51	.068	12.4	6.56	.058
TN-VPK Participation	-.74	.86	.386	-2.92	1.52	.055	-1.68	.87	.054
TN-VPK Participation * Gender	**-.05**	**1.65**	**.974**	**.25**	**1.55**	**.872**	**1.92**	**2.79**	**.491**

Level 1 and Level 2 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	1.48	2.18	.016	.66	.43	.136	2.17	4.72	.004
Level 1 Residual	12.2	149.2		11.0	120.8		13.1	171.9	

Level 3 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	.14	.02	>.500	1.04	1.09	.022	2.24	5.03	.001

Table B14. Full Model Results for the Analysis of Interactions between TN-VPK Participation and Age at Pretest on the WJ Achievement Measures at the End of First Grade for ISS Sample; Both Cohorts, Sample-Weighted Data

	WJ COMPOSITE (6)			WJ COMPOSITE (8)			LETTER-WORD ID			SPELLING		
Fixed Effect	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**
Intercept	222.2	21.8	.000	217.9	19.5	.000	285.6	46.6	.000	331.1	39.7	.000
Cohort	-.02	1.09	.985	-.17	.83	.837	1.76	2.22	.430	-2.44	2.13	.255
Inclusion Rate_Nonparticipants	.71	2.20	.747	.60	2.11	.778	2.62	4.69	.577	1.68	2.94	.568
Inclusion Rate_Participants	-1.31	2.46	.595	-.71	1.95	.718	-4.14	4.36	.346	-3.47	2.84	.227
Inclusion Rate Interaction	-16.6	9.43	.082	-16.9	10.2	.102	-46.7	24.2	.057	-19.2	11.9	.110
Black	-1.35	.80	.093	-.98	.70	.160	-3.99	1.76	.024	.65	1.53	.673
Hispanic	2.00	1.25	.109	1.99	1.20	.096	3.52	2.98	.238	.14	2.02	.946
Male	-1.04	.63	.097	-1.72	.67	.010	-4.85	1.36	.001	-4.96	1.04	.000
Native English Speaker	-1.64	1.21	.178	-2.91	1.24	.019	.83	3.37	.806	3.36	2.10	.110
Library Card Use	-.90	.39	.022	-.83	.53	.119	-.90	1.28	.484	-.28	1.12	.799
Number Newspaper Subscriptions	.24	.42	.576	.12	.40	.762	1.26	1.25	.314	.16	.87	.857
Number Magazine Subscriptions	1.04	.67	.120	1.18	.76	.120	2.78	1.61	.083	2.92	1.39	.036
Mother's Education	-.30	.45	.505	-.11	.45	.807	.87	.78	.270	-.65	1.00	.516
Number Working Parents	.80	.51	.116	.79	.27	.004	2.45	.73	.001	1.65	.57	.004
Test Lag	-.01	.03	.705	.00	.03	.930	-.07	.09	.444	.07	.05	.201
Age at Pretest	-.07	.16	.648	-.01	.22	.967	.65	.53	.218	.11	.23	.645
Pretest	.58	.02	.000	.56	.03	.000	.49	.06	.000	.27	.03	.000
Test Interval (T1 to T4)	.54	.63	.391	.88	.55	.107	.42	1.39	.762	.60	1.21	.621
Propensity Score	1.85	3.35	.580	1.70	4.56	.709	-5.71	12.4	.646	16.7	7.19	.021
TN-VPK Participation	-1.22	.71	.085	-1.16	.77	.132	-1.55	1.82	.396	-1.78	1.21	.143
TN-VPK Participation * Age	**-.20**	**.19**	**.273**	**-.26**	**.24**	**.288**	**-.41**	**.62**	**.505**	**-.22**	**.22**	**.318**

Level 1 and Level 2 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	1.94	3.78	.002	2.03	4.12	.001	3.40	11.6	.033	3.61	13.0	.003
Level 1 Residual	9.58	91.7		9.67	93.5		24.3	588.9		17.2	295.4	

Level 3 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	.52	.28	.361	.74	.54	.318	2.27	5.17	.188	1.41	1.98	.126

	ORAL COMPREHENSION			PICTURE VOCABULARY			PASSAGE COMPREHENSION		
Fixed Effect	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**
Intercept	237.9	29.7	.000	307.4	18.2	.000	148.3	38.0	.001
Cohort	-1.56	.74	.039	-.31	.87	.720	-1.85	1.77	.302
Inclusion Rate_Nonparticipants	2.82	2.06	.176	.65	1.86	.729	-.58	3.63	.873
Inclusion Rate_Participants	-3.25	2.75	.242	-.42	2.06	.838	.83	4.06	.838
Inclusion Rate Interaction	-5.28	8.63	.542	-9.10	7.55	.232	-32.2	15.4	.040
Black	-1.79	.66	.008	-1.79	.66	.007	.66	1.33	.620
Hispanic	.47	.86	.583	-1.25	1.03	.226	2.11	2.07	.308
Male	.20	.52	.701	1.97	.51	.000	-5.99	1.03	.000
Native English Speaker	2.00	1.01	.049	-.16	1.07	.881	-12.7	2.16	.000
Library Card Use	-.86	.27	.002	-.36	.32	.264	-.83	.65	.201
Number Newspaper Subscriptions	-.53	.43	.215	-.51	.35	.139	.34	.70	.632
Number Magazine Subscriptions	1.17	.79	.139	.88	.55	.108	2.46	1.11	.026
Mother's Education	-.34	.32	.288	.95	.36	.009	1.60	.73	.029
Number Working Parents	.40	.34	.242	.44	.42	.296	1.31	.85	.123
Test Lag	.04	.03	.223	.05	.02	.051	.13	.05	.005
Age at Pretest	.22	.10	.027	.11	.13	.418	.45	.27	.089
Pretest	.51	.03	.000	.33	.02	.000	.57	.04	.000
Test Interval (T1 to T4)	.05	.80	.948	.34	.52	.520	1.36	1.04	.193
Propensity Score	11.7	3.23	.001	8.70	2.68	.002	20.2	5.33	.000
TN-VPK Participation	-.97	.88	.272	.28	.58	.624	-1.31	1.17	.266
TN-VPK Participation * Age	**-.25**	**.16**	**.130**	**-.03**	**.15**	**.861**	**-.30**	**.31**	**.338**

Level 1 and Level 2 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	2.24	5.02	.001	1.23	1.51	.036	3.00	8.98	.002
Level 1 Residual	9.98	99.5		7.86	61.8		15.9	252.3	

Level 3 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	1.86	3.45	.009	1.24	1.54	.006	1.20	1.45	.430

	APPLIED PROBLEMS			QUANTITATIVE CONCEPTS			CALCULATION		
Fixed Effect	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**
Intercept	296.5	15.7	.000	228.5	28.9	.00	254.4	33.4	.000
Cohort	-1.23	.70	.084	.70	.53	.19	-2.13	1.16	.070
Inclusion Rate_Nonparticipants	-4.06	.98	.000	-1.05	1.89	.58	1.76	2.43	.471
Inclusion Rate_Participants	3.21	1.77	.074	-1.14	2.44	.64	-.11	2.93	.970
Inclusion Rate Interaction	-9.19	10.1	.366	-24.5	9.57	.01	-15.5	13.3	.250
Black	-1.82	.79	.022	-2.18	.50	.00	.09	.88	.917
Hispanic	.64	1.35	.633	-2.13	.78	.01	-.49	1.07	.645
Male	-1.76	1.28	.169	-2.77	.97	.01	-4.85	1.29	.000
Native English Speaker	-2.05	1.25	.100	-1.29	1.60	.42	-6.62	1.91	.001
Library Card Use	-1.13	.66	.086	-.42	.47	.37	-.68	.60	.264
Number Newspaper Subscriptions	.03	.44	.941	.67	.44	.13	-1.05	.39	.007
Number Magazine Subscriptions	1.25	1.13	.272	1.12	1.36	.41	2.20	.95	.021
Mother's Education	.88	.67	.187	-.38	.56	.50	.69	.77	.369
Number Working Parents	1.13	.77	.142	.57	.61	.35	.44	.45	.331
Test Lag	.11	.03	.001	.02	.04	.65	.13	.04	.001
Age at Pretest	.40	.33	.215	-.20	.25	.43	.44	.37	.238
Pretest	.31	.02	.000	.49	.02	.00	.31	.03	.000
Test Interval (T1 to T4)	.56	.47	.233	1.14	.93	.22	2.55	1.07	.017
Propensity Score	21.3	5.52	.000	9.98	5.69	.08	12.6	6.73	.061
TN-VPK Participation	-.72	.80	.368	-2.82	.97	.00	-.81	1.10	.459
TN-VPK Participation * Age	**-.52**	**.31**	**.091**	**.06**	**.33**	**.85**	**-.63**	**.38**	**.093**

Level 1 and Level 2 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	1.52	2.32	.016	.65	.43	.13	2.16	4.66	.004
Level 1 Residual	12.2	148.4		11.0	120.8		13.1	171.1	

Level 3 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	.12	.01	>.500	1.04	1.09	.02	2.18	4.75	.002

Table B15. Full Model Results for the Analysis of Interactions between TN-VPK Participation and English Speaker Subgroups on the WJ Achievement Measures at the End of First Grade for ISS Sample; Both Cohorts, Sample-Weighted Data

	WJ COMPOSITE (6)			WJ COMPOSITE (8)			LETTER-WORD ID			SPELLING		
Fixed Effect	b	SE	p-value	b	SE	p-value	b	SE	p-value	b	SE	p-value
Intercept	235.0	22.0	.000	229.9	21.0	.000	269.7	52.8	.000	332.9	38.5	.000
Cohort	.01	1.09	.990	-.15	.82	.854	1.75	2.56	.496	-2.25	2.00	.264
Inclusion Rate_Nonparticipants	.79	2.20	.720	.63	2.13	.769	2.62	5.23	.617	2.01	4.10	.625
Inclusion Rate_Participants	-1.35	2.45	.583	-.76	1.96	.698	-4.33	5.88	.464	-3.31	4.56	.470
Inclusion Rate Interaction	-16.7	9.43	.080	-17.0	10.2	.099	-46.6	22.2	.039	-19.8	17.3	.257
Black	-1.37	.80	.087	-1.02	.74	.166	-4.09	2.03	.044	.68	1.45	.639
Hispanic	1.93	1.25	.122	1.93	1.15	.094	3.46	3.15	.273	-.02	2.22	.992
Male	-1.01	.63	.108	-1.69	.65	.010	-4.81	1.59	.003	-4.9	1.14	.000
Native English Speaker	-1.54	1.65	.350	-3.35	1.50	.025	-.62	4.11	.880	5.77	2.94	.049
Library Card Use	-.90	.39	.022	-.83	.54	.123	-.90	.99	.364	-.29	.70	.679
Number Newspaper Subscriptions	.22	.42	.611	.10	.40	.795	1.25	1.07	.244	.09	.76	.906
Number Magazine Subscriptions	.98	.67	.145	1.12	.73	.125	2.70	1.69	.110	2.8	1.19	.020
Mother's Education	-.31	.45	.493	-.14	.48	.777	.80	1.12	.475	-.61	.80	.450
Number Working Parents	.82	.51	.111	.80	.26	.003	2.47	1.29	.055	1.68	.92	.067
Test Lag	-.01	.03	.706	.00	.03	.937	-.07	.07	.349	.07	.05	.175
Age at Pretest	-.22	.09	.016	-.20	.09	.035	.35	.22	.121	-.05	.16	.778
Pretest	.58	.02	.000	.56	.03	.000	.49	.03	.000	.27	.02	.000
Test Interval (T1 to T4)	.51	.63	.419	.85	.56	.125	.38	1.56	.808	.52	1.14	.646
Propensity Score	1.76	3.36	.600	1.46	4.24	.730	-6.25	8.94	.484	17.0	6.03	.005
TN-VPK Participation	-1.08	1.46	.459	-1.63	2.04	.426	-3.16	3.68	.391	1.02	2.61	.697
TN-VPK Participation * Native English	**-.20**	**1.64**	**.903**	**.57**	**1.89**	**.764**	**2.03**	**4.13**	**.623**	**-3.61**	**2.93**	**.219**
Level 1 and Level 2 Variance Components												
Random Effect	SD	VC	p-value	SD	VC	p-value	SD	VC	p-value	SD	VC	p-value
Intercept	1.94	3.77	.002	2.01	4.06	.001	3.35	11.2	.037	3.60	13.0	.003
Level 1 Residual	9.58	91.9		9.68	93.7		24.3	589.5		17.2	295.1	
Level 3 Variance Components												
Random Effect	SD	VC	p-value	SD	VC	p-value	SD	VC	p-value	SD	VC	p-value
Intercept	.49	.24	.363	.73	.53	.309	2.23	4.98	.189	1.48	2.20	.114

	ORAL COMPREHENSION			PICTURE VOCABULARY			PASSAGE COMPREHENSION		
Fixed Effect	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**
Intercept	237.5	29.0	.000	303.1	21.6	.000	137.0	33.9	.001
Cohort	-1.54	.73	.037	-.41	.55	.463	-2.00	1.81	.273
Inclusion Rate_Nonparticipants	2.84	2.03	.166	.44	1.68	.795	-.97	3.60	.788
Inclusion Rate_Participants	-3.28	2.68	.226	-.52	2.09	.805	.69	3.62	.849
Inclusion Rate Interaction	-5.36	8.64	.537	-8.76	5.92	.143	-31.9	16.1	.052
Black	-1.83	.65	.006	-1.84	.77	.017	.52	1.15	.651
Hispanic	.41	.89	.649	-1.13	.91	.214	2.25	2.00	.262
Male	.22	.51	.669	1.93	.71	.007	-6.05	1.09	.000
Native English Speaker	1.55	2.08	.455	-2.31	2.29	.314	-17.5	1.85	.000
Library Card Use	-.86	.28	.003	-.36	.33	.274	-.84	.66	.203
Number Newspaper Subscriptions	-.55	.43	.205	-.48	.39	.229	.39	.79	.620
Number Magazine Subscriptions	1.11	.77	.148	.93	.61	.127	2.49	.92	.007
Mother's Education	-.36	.32	.261	.89	.34	.010	1.47	.75	.051
Number Working Parents	.42	.35	.230	.42	.32	.188	1.28	.73	.077
Test Lag	.04	.03	.233	.05	.03	.182	.13	.04	.001
Age at Pretest	.04	.09	.675	.08	.09	.393	.22	.19	.236
Pretest	.51	.03	.000	.33	.04	.000	.57	.05	.000
Test Interval (T1 to T4)	.02	.81	.978	.36	.70	.605	1.40	.71	.049
Propensity Score	11.5	3.33	.001	8.16	2.47	.001	19.0	5.48	.001
TN-VPK Participation	-1.47	1.97	.456	-2.08	1.17	.075	-6.56	1.46	.000
TN-VPK Participation * Native English	**.61**	**2.28**	**.790**	**3.03**	**1.39**	**.029**	**6.73**	**1.96**	**.001**

Level 1 and Level 2 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	2.26	5.09	.001	1.22	1.49	.041	2.80	7.84	.004
Level 1 Residual	9.98	99.7		7.84	61.5		15.9	251.6	

Level 3 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	1.84	3.38	.010	1.27	1.60	.005	1.29	1.65	.355

	APPLIED PROBLEMS			QUANTITATIVE CONCEPTS			CALCULATION		
Fixed Effect	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**
Intercept	297.7	25.8	.000	233.6	25.0	.000	258.4	35.1	.000
Cohort	-1.15	1.20	.343	.86	1.06	.421	-2.05	1.21	.093
Inclusion Rate_Nonparticipants	-3.91	2.40	.108	-.72	2.18	.744	1.90	2.55	.457
Inclusion Rate_Participants	3.12	2.73	.258	-.92	2.48	.713	-.14	2.89	.961
Inclusion Rate Interaction	-9.47	10.7	.378	-24.7	9.37	.011	-15.9	13.3	.236
Black	-1.89	1.00	.060	-2.09	.89	.019	-.02	.91	.982
Hispanic	.48	1.55	.758	-2.27	1.39	.101	-.65	1.13	.568
Male	-1.69	.78	.031	-2.71	.70	.000	-4.79	1.31	.001
Native English Speaker	-1.98	2.09	.344	2.23	1.84	.225	-7.40	2.78	.008
Library Card Use	-1.13	.50	.023	-.43	.44	.331	-.69	.61	.257
Number Newspaper Subscriptions	-.01	.54	.981	.61	.48	.206	-1.10	.40	.006
Number Magazine Subscriptions	1.09	.84	.196	1.03	.76	.175	2.05	.90	.023
Mother's Education	.87	.56	.120	-.29	.50	.570	.64	.81	.434
Number Working Parents	1.16	.65	.072	.59	.58	.308	.48	.44	.273
Test Lag	.11	.03	.001	.02	.03	.511	.13	.04	.001
Age at Pretest	.03	.11	.764	-.14	.10	.164	-.01	.16	.928
Pretest	.31	.02	.000	.49	.03	.000	.31	.03	.000
Test Interval (T1 to T4)	.48	.76	.526	1.10	.68	.108	2.47	1.05	.019
Propensity Score	21.1	4.00	.000	10.7	3.75	.005	12.2	6.39	.057
TN-VPK Participation	-.59	1.85	.748	1.21	1.65	.463	-1.64	2.76	.552
TN-VPK Participation * Native English	**-.22**	**2.08**	**.916**	**-5.18**	**1.85**	**.006**	**1.00**	**2.54**	**.692**

Level 1 and Level 2 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	1.48	2.20	.016	.87	.75	.094	2.16	4.66	.004
Level 1 Residual	12.2	149.2		10.9	119.8		13.1	172.0	

Level 3 Variance Components

Random Effect	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**	**SD**	**VC**	**p-value**
Intercept	.14	.02	>.500	.96	.93	.036	2.24	5.03	.001

Table B16. Full Model Results for the Analysis of Interactions between TN-VPK Participation and Gender on Teacher Ratings at the End of First Grade for ISS Sample; Both Cohorts, Sample-Weighted Data

	CF SOCIAL SKILLS			CF WORK-RELATED SKILLS		
Fixed Effect	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**
Intercept	4.46	1.03	.000	-2.74	1.20	.033
Cohort	.06	.10	.528	.38	.12	.004
Inclusion Rate_Nonparticipants	-.27	.20	.177	-.16	.24	.505
Inclusion Rate_Participants	.09	.22	.680	.12	.27	.643
Inclusion Rate Interaction	.26	.81	.749	-.73	1.03	.478
Black	-.22	.07	.003	-.02	.08	.844
Hispanic	.41	.11	.000	.36	.13	.006
Male	-.29	.11	.006	-.49	.12	.000
Native English Speaker	-.22	.11	.044	-.51	.13	.000
Library Card Use	.06	.04	.068	.03	.04	.501
Number Newspaper Subscriptions	-.01	.04	.889	.00	.04	.960
Number Magazine Subscriptions	.00	.06	.959	.05	.07	.494
Mother's Education	-.04	.04	.305	-.12	.05	.008
Number Working Parents	.04	.05	.333	.12	.05	.025
Test Lag	-.01	.00	.019	-.01	.00	.007
Age at Pretest	.05	.03	.066	.06	.03	.064
Pretest	.01	.00	.000	.03	.00	.000
Age at Rating	-.05	.02	.055	-.05	.03	.062
Propensity Score	-.32	.30	.288	-.27	.35	.442
TN-VPK Participation	.08	.08	.333	-.03	.10	.788
TN-VPK Participation * Gender	**-.06**	**.12**	**.644**	**-.01**	**.14**	**.929**

	ACBR PREPARATION			ACBR PEER RELATIONS			ACBR BEHAVIOR PROBLEMS			ACBR FEELINGS ABOUT SCHOOL		
Fixed Effect	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**
Intercept	-10.7	1.39	.000	1.36	1.16	.254	4.74	1.37	.003	.44	.38	.252
Cohort	.33	.12	.009	.35	.11	.003	-.11	.13	.391	.06	.04	.113
Inclusion Rate_Nonparticipants	.05	.23	.825	-.37	.21	.084	.44	.25	.082	-.11	.07	.126
Inclusion Rate_Participants	-.23	.26	.385	.40	.24	.094	-.27	.28	.327	.03	.08	.686
Inclusion Rate Interaction	-.45	1.02	.663	.21	.92	.823	-.43	1.08	.691	-.11	.31	.716
Black	-.02	.10	.828	-.04	.08	.612	.07	.10	.494	.00	.03	.892
Hispanic	.50	.15	.001	.30	.13	.018	-.44	.15	.004	.08	.04	.042
Male	-.22	.14	.130	-.26	.12	.029	.65	.14	.000	-.11	.04	.004
Native English Speaker	-.29	.15	.046	-.16	.12	.196	.43	.14	.003	-.08	.04	.057
Library Card Use	.01	.05	.894	-.02	.04	.553	-.02	.05	.648	-.03	.01	.016
Number Newspaper Subscriptions	-.05	.05	.299	-.03	.04	.461	-.03	.05	.543	-.03	.01	.034
Number Magazine Subscriptions	-.01	.08	.881	-.10	.07	.137	.05	.08	.558	.00	.02	.863
Mother's Education	-.08	.05	.140	.07	.05	.112	.01	.05	.842	-.04	.01	.007
Number Working Parents	.08	.06	.198	.04	.05	.490	-.12	.06	.050	.03	.02	.120
Test Lag	-.01	.00	.001	-.01	.00	.008	.00	.00	.116	.00	.00	.068
Age at Pretest	.02	.04	.576	.00	.03	.998	-.04	.03	.242	.01	.01	.503
Pretest	.04	.00	.000	.02	.00	.000	-.01	.00	.000	.01	.00	.000
Age at Rating	-.03	.03	.360	-.02	.03	.559	.03	.03	.305	-.01	.01	.263
Propensity Score	-.10	.40	.809	-.74	.34	.029	.33	.40	.402	-.09	.11	.426
TN-VPK Participation	-.17	.11	.137	.06	.09	.527	.00	.11	.981	-.02	.03	.595
TN-VPK Participation * Gender	**.08**	**.17**	**.650**	**.06**	**.14**	**.681**	**-.13**	**.16**	**.435**	**-.01**	**.04**	**.777**

Table B17. Full Model Results for the Analysis of Interactions between TN-VPK Participation and Age at Pretest on Teacher Ratings at the End of First Grade for ISS Sample; Both Cohorts, Sample-Weighted Data

	CF SOCIAL SKILLS			CF WORK-RELATED SKILLS		
Fixed Effect	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**
Intercept	7.08	2.19	.005	.37	2.57	.888
Cohort	.06	.10	.560	.37	.12	.004
Inclusion Rate_Nonparticipants	-.27	.20	.175	-.17	.24	.472
Inclusion Rate_Participants	.09	.22	.692	.13	.26	.628
Inclusion Rate Interaction	.26	.81	.753	-.71	1.02	.490
Black	-.22	.07	.003	-.01	.08	.905
Hispanic	.41	.11	.000	.37	.13	.005
Male	-.34	.06	.000	-.50	.07	.000
Native English Speaker	-.22	.11	.042	-.50	.13	.000
Library Card Use	.06	.04	.067	.03	.04	.494
Number Newspaper Subscriptions	.00	.04	.953	.00	.04	.965
Number Magazine Subscriptions	.01	.06	.851	.06	.07	.380
Mother's Education	-.04	.04	.317	-.12	.05	.009
Number Working Parents	.04	.05	.359	.12	.05	.029
Test Lag	-.01	.00	.015	-.01	.00	.005
Age at Pretest	.07	.03	.017	.09	.03	.007
Pretest	.01	.00	.000	.03	.00	.000
Age at Rating	-.05	.02	.053	-.06	.03	.059
Propensity Score	-.30	.30	.314	-.24	.35	.492
TN-VPK Participation	.06	.06	.365	-.03	.07	.699
TN-VPK Participation * Age	**-.03**	**.02**	**.088**	**-.05**	**.02**	**.015**

	ACBR PREPARATION			ACBR PEER RELATIONS			ACBR BEHAVIOR PROBLEMS			ACBR FEELINGS ABOUT SCHOOL		
Fixed Effect	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**
Intercept	-9.70	2.97	.004	1.36	2.49	.589	2.57	2.93	.391	.79	.81	.339
Cohort	.33	.12	.008	.35	.11	.003	-.11	.13	.393	.06	.04	.113
Inclusion Rate_Nonparticipants	.04	.23	.854	-.38	.21	.075	.45	.25	.069	-.11	.07	.133
Inclusion Rate_Participants	-.22	.26	.398	.41	.24	.088	-.29	.28	.305	.03	.08	.699
Inclusion Rate Interaction	-.44	1.02	.671	.23	.92	.807	-.46	1.08	.668	-.12	.31	.708
Black	-.02	.10	.819	-.04	.08	.620	.07	.10	.494	.00	.03	.890
Hispanic	.50	.15	.001	.30	.13	.016	-.45	.15	.003	.08	.04	.044
Male	-.16	.08	.034	-.22	.06	.001	.56	.07	.000	-.12	.02	.000
Native English Speaker	-.28	.15	.050	-.15	.12	.215	.42	.14	.004	-.08	.04	.051
Library Card Use	.01	.05	.881	-.02	.04	.563	-.02	.05	.629	-.03	.01	.015
Number Newspaper Subscriptions	-.06	.05	.287	-.03	.04	.464	-.03	.05	.555	-.03	.01	.035
Number Magazine Subscriptions	-.01	.08	.869	-.10	.07	.152	.04	.08	.581	.00	.02	.880
Mother's Education	-.08	.05	.143	.07	.05	.105	.01	.05	.872	-.04	.01	.007
Number Working Parents	.08	.06	.194	.04	.05	.494	-.12	.06	.049	.03	.02	.120
Test Lag	-.01	.00	.001	-.01	.00	.008	.00	.00	.115	.00	.00	.070
Age at Pretest	.02	.04	.668	.01	.03	.797	-.05	.04	.219	.01	.01	.625
Pretest	.04	.00	.000	.02	.00	.000	-.01	.00	.000	.01	.00	.000
Age at Rating	-.03	.03	.365	-.02	.03	.561	.03	.03	.310	-.01	.01	.262
Propensity Score	-.10	.40	.798	-.73	.34	.030	.33	.40	.403	-.09	.11	.424
TN-VPK Participation	-.14	.09	.119	.08	.07	.241	-.06	.08	.492	-.02	.02	.352
TN-VPK Participation * Age	**.00**	**.02**	**.872**	**-.01**	**.02**	**.530**	**.01**	**.02**	**.655**	**.00**	**.01**	**.769**

Table B18. Full Model Results for the Analysis of Interactions between TN-VPK Participation and English Speaker Subgroups on Teacher Ratings at the End of First Grade for ISS Sample; Both Cohorts, Sample-Weighted Data

	CF SOCIAL SKILLS			CF WORK-RELATED SKILLS		
Fixed Effect	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**
Intercept	4.48	1.03	.000	-2.63	1.21	.041
Cohort	.06	.10	.543	.37	.13	.004
Inclusion Rate_Nonparticipants	-.27	.20	.185	-.17	.24	.483
Inclusion Rate_Participants	.09	.22	.698	.12	.27	.657
Inclusion Rate Interaction	.24	.81	.764	-.72	1.03	.488
Black	-.22	.07	.003	-.02	.08	.827
Hispanic	.41	.11	.000	.36	.13	.006
Male	-.34	.06	.000	-.50	.07	.000
Native English Speaker	-.25	.15	.091	-.60	.17	.001
Library Card Use	.06	.04	.071	.03	.04	.501
Number Newspaper Subscriptions	.00	.04	.914	.00	.04	.993
Number Magazine Subscriptions	.00	.06	.947	.05	.07	.470
Mother's Education	-.04	.04	.290	-.13	.05	.007
Number Working Parents	.04	.05	.341	.12	.05	.026
Test Lag	-.01	.00	.018	-.01	.00	.006
Age at Pretest	.05	.03	.065	.06	.03	.065
Pretest	.01	.00	.000	.03	.00	.000
Age at Rating	-.05	.02	.055	-.05	.03	.061
Propensity Score	-.33	.30	.283	-.29	.35	.409
TN-VPK Participation	.03	.13	.834	-.14	.15	.365
TN-VPK Participation * Native English	**.04**	**.15**	**.805**	**.14**	**.17**	**.423**

	ACBR PREPARATION			ACBR PEER RELATIONS			ACBR BEHAVIOR PROBLEMS			ACBR FEELINGS ABOUT SCHOOL		
Fixed Effect	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**
Intercept	-10.6	1.40	.000	1.55	1.17	.199	4.82	1.37	.003	.52	.38	.181
Cohort	.33	.12	.010	.34	.11	.004	-.12	.13	.370	.06	.04	.138
Inclusion Rate_Nonparticipants	.03	.23	.892	-.40	.21	.065	.44	.25	.076	-.12	.07	.107
Inclusion Rate_Participants	-.23	.26	.391	.40	.24	.095	-.29	.28	.301	.03	.08	.728
Inclusion Rate Interaction	-.41	1.02	.690	.25	.92	.784	-.44	1.07	.683	-.10	.31	.744
Black	-.02	.10	.809	-.04	.08	.579	.07	.10	.494	.00	.03	.855
Hispanic	.51	.15	.001	.31	.13	.015	-.44	.15	.003	.09	.04	.036
Male	-.16	.08	.032	-.22	.06	.001	.55	.07	.000	-.12	.02	.000
Native English Speaker	-.38	.20	.060	-.32	.17	.058	.34	.20	.079	-.15	.05	.007
Library Card Use	.01	.05	.881	-.02	.04	.565	-.02	.05	.630	-.03	.01	.015
Number Newspaper Subscriptions	-.05	.05	.305	-.03	.04	.491	-.03	.05	.584	-.03	.01	.044
Number Magazine Subscriptions	-.01	.08	.905	-.10	.07	.156	.05	.08	.537	.01	.02	.788
Mother's Education	-.08	.05	.132	.07	.05	.132	.01	.05	.894	-.04	.01	.005
Number Working Parents	.08	.06	.198	.04	.05	.498	-.12	.06	.047	.03	.02	.128
Test Lag	-.01	.00	.001	-.01	.00	.006	.00	.00	.127	.00	.00	.052
Age at Pretest	.02	.04	.588	.00	.03	.985	-.04	.03	.248	.01	.01	.509
Pretest	.04	.00	.000	.02	.00	.000	-.01	.00	.000	.01	.00	.000
Age at Rating	-.03	.03	.362	-.02	.03	.556	.03	.03	.313	-.01	.01	.255
Propensity Score	-.12	.40	.765	-.78	.34	.022	.32	.40	.418	-.10	.11	.353
TN-VPK Participation	-.24	.18	.180	-.10	.15	.494	-.14	.17	.412	-.10	.05	.035
TN-VPK Participation * Native English	**.13**	**.20**	**.503**	**.24**	**.17**	**.153**	**.11**	**.20**	**.574**	**.10**	**.05**	**.058**

Table B19. Full Model Results for the Analysis of Interactions between TN-VPK Participation and Gender, Age at Pretest, and Native English Speaker Subgroups on Grade Retention in Kindergarten for the ISS Sample; Both Cohorts, Sample-Weighted Data

	Moderator: Gender			Moderator: Age			Moderator: Native English		
Fixed Effect	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**
Intercept	36.6	4.34	.000	18.0	4.70	.001	36.6	4.34	.000
Cohort	.81	.61	.186	.82	.60	.177	.84	.60	.164
Inclusion Rate_Nonparticipants	.61	1.12	.587	.56	1.07	.602	.60	1.09	.582
Inclusion Rate_Participants	.31	1.26	.808	.38	1.22	.754	.34	1.20	.775
Inclusion Rate Interaction	6.83	4.00	.091	6.81	4.00	.092	6.78	3.99	.094
Black	-1.12	.51	.028	-1.11	.50	.026	-1.10	.50	.029
Hispanic	.21	.76	.776	.27	.77	.727	.19	.75	.801
Male	.93	.72	.195	1.23	.37	.001	1.23	.37	.001
Native English Speaker	1.30	.48	.007	1.35	.47	.004	1.62	.62	.010
Library Card Use	.54	.28	.049	.55	.28	.049	.55	.28	.048
Number Newspaper Subscriptions	-.30	.27	.273	-.30	.28	.279	-.31	.27	.248
Number Magazine Subscriptions	-.96	.40	.016	-.96	.39	.013	-.97	.39	.014
Mother's Education	-.01	.37	.976	.00	.36	.996	.00	.37	1.000
Number Working Parents	.29	.30	.342	.29	.30	.343	.30	.30	.323
Test Lag	.00	.01	.908	.00	.02	.872	.00	.02	.900
Age at Pretest	-.33	.09	.001	-.34	.13	.008	-.33	.09	.001
Pretest	-.06	.01	.000	-.06	.01	.000	-.06	.01	.000
Propensity Score	-1.33	1.14	.244	-1.48	1.19	.214	-1.22	1.15	.290
TN-VPK Participation	-.88	.41	.030	-.74	.53	.168	-.72	.46	.121
TN-VPK Participation * Moderator	**.48**	**.88**	**.588**	**.02**	**.17**	**.889**	**-.51**	**.64**	**.426**

Table B20. Full Model Results for the Analysis of Interactions between TN-VPK Participation and Gender, Age at Start of Pre-K, and Native English Speaker Subgroups on Grade Retention in Kindergarten for Cohort 1 of the Full Randomized Sample; Sample-Weighted Data

	Moderator: Gender			Moderator: Age			Moderator: Native English		
Effect	**b**	**S.E.**	**p-value**	**b**	**S.E.**	**p-value**	**b**	**S.E.**	**p-value**
TOT Analysis									
Intercept	9.70	1.84	.000	-3.33	.56	.000	9.70	1.81	.000
Male	.27	.54	.614	.33	.25	.197	.33	.25	.193
Black	-.54	.29	.063	-.56	.30	.062	-.56	.28	.050
Hispanic	-.52	.79	.509	-.53	.80	.504	-.58	.75	.439
Native English Speaker	.49	.41	.242	.48	.42	.251	.94	.48	.047
Age at Start of Pre-K	-.24	.03	.000	-.28	.07	.000	-.25	.04	.000
TN-VPK Participation	-.77	.26	.004	-.62	.37	.093	-.50	.24	.039
TN-VPK Participation * Moderator	**.08**	**.58**	**.890**	**.07**	**.08**	**.406**	**-.81**	**.29**	**.005**
ITT Analysis									
Intercept	9.37	2.37	.000	-4.05	.41	.000	9.42	2.33	.000
Male	1.00	.39	.010	.49	.26	.055	.49	.25	.056
Black	-.48	.27	.077	-.49	.27	.075	-.46	.27	.080
Hispanic	-.53	.44	.237	-.58	.44	.192	-.50	.45	.268
Native English Speaker	.51	.31	.101	.42	.31	.172	.51	.59	.388
Age at Start of Pre-K	-.25	.05	.000	-.41	.09	.000	-.25	.05	.000
TN-VPK Participation	-.12	.22	.602	.40	.38	.283	-.19	.26	.458
TN-VPK Participation * Moderator	**-.74**	**.44**	**.090**	**.21**	**.10**	**.033**	**-.01**	**.63**	**.988**

Table B21. Full Model Results for the Analysis of Interactions between TN-VPK Participation and Gender, Age at Pretest, and Native English Speaker Subgroups on Days Attended in Kindergarten for the ISS Sample; Both Cohorts, Sample-Weighted Data

	Moderator: Gender			Moderator: Age			Moderator: Native English		
Effect	**b**	**S.E.**	**p-value**	**b**	**S.E.**	**p-value**	**b**	**S.E.**	**p-value**
Intercept	-1.59	.15	.000	-1.58	.16	.000	-1.60	.15	.000
Cohort	-.14	.03	.000	-.14	.03	.000	-.14	.03	.000
Inclusion Rate_Nonparticipants	-.07	.05	.155	-.08	.06	.192	-.08	.05	.130
Inclusion Rate_Participants	-.03	.06	.608	-.03	.06	.627	-.03	.06	.622
Inclusion Rate Interaction	.12	.20	.571	.13	.22	.569	.12	.20	.537
Black	.01	.02	.654	.01	.02	.659	.01	.02	.673
Hispanic	-.02	.02	.477	-.01	.02	.555	-.02	.02	.529
Male	-.04	.03	.118	-.02	.01	.073	-.02	.01	.013
Native English Speaker	-.07	.02	.007	-.06	.02	.009	-.07	.02	.003
Library Card Use	-.02	.00	.001	-.01	.01	.052	-.02	.00	.001
Number Newspaper Subscriptions	.01	.01	.087	.01	.01	.078	.01	.01	.101
Number Magazine Subscriptions	-.00	.01	.691	-.00	.01	.811	-.00	.01	.701
Mother's Education	.02	.01	.008	.02	.01	.015	.02	.01	.007
Number Working Parents	.02	.01	.022	.02	.01	.024	.02	.01	.025
Test Lag	-.00	.00	.933	-.00	.00	.899	-.00	.00	.927
Age at Pretest	-.00	.00	.941	-.00	.00	.522	-.00	.00	.900
Pretest	-.00	.00	.084	-.00	.00	.027	-.00	.00	.086
Propensity Score	-.04	.08	.655	-.04	.07	.585	-.04	.08	.627
TN-VPK Participation	-.01	.02	.629	-.01	.01	.430	-.01	.02	.375
TN-VPK Participation * Moderator	**.03**	**.03**	**.315**	**-.00**	**.00**	**.403**	**.01**	**.03**	**.704**

Table B22. Full Model Results for the Analysis of Interactions between TN-VPK Participation and Gender, Age at Pretest, and Native English Speaker Subgroups on Days Attended in Kindergarten for the Full Randomized Sample; Both Cohorts, Sample-Weighted Data

	Moderator: Gender			Moderator: Age			Moderator: Native English		
Fixed Effect	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**	**b**	**SE**	**p-value**
TOT Analysis									
Intercept	-1.37	.05	.000	-1.20	.03	.000	-1.39	.06	.000
Cohort	-.14	.02	.000	-.14	.02	.000	-.14	.02	.000
Male	-.01	.02	.634	-.00	.01	.613	-.00	.01	.617
Black	.05	.01	.000	.05	.01	.000	.05	.01	.000
Hispanic	-.00	.01	.729	-.00	.01	.716	-.00	.01	.731
Age at Start of Pre-K	-.00	.00	.002	-.00	.00	.083	-.00	.00	.002
Native English Speaker	-.06	.02	.000	-.06	.02	.000	-.08	.02	.001
TN-VPK Participation	.01	.01	.083	.01	.01	.086	-.00	.01	.667
TN-VPK Participation * Moderator	**.01**	**.02**	**.690**	**-.00**	**.00**	**.822**	**.04**	**.02**	**.073**
ITT Analysis									
Intercept	-1.34	.04	.000	-1.19	.03	.000	-1.36	.04	.000
Cohort	-.14	.02	.000	-.14	.02	.000	-.14	.02	.000
Male	-.00	.02	.925	-.01	.01	.411	-.01	.01	.410
Black	.04	.01	.000	.04	.01	.000	.04	.01	.000
Hispanic	.01	.01	.463	.01	.01	.451	.01	.01	.452
Age at Start of Pre-K	-.00	.00	.001	-.00	.00	.063	-.00	.00	.001
Native English Speaker	-.06	.01	.000	-.06	.01	.000	-.05	.02	.017
TN-VPK Participation	-.00	.01	.998	-.00	.01	.993	-.00	.01	.729
TN-VPK Participation * Moderator	**-.01**	**.02**	**.663**	**-.00**	**.00**	**.863**	**-.01**	**.02**	**.589**

Table B23. Full Model Results for the Analysis of Interactions between TN-VPK Participation and Gender, Age at Pretest, and Native English Speaker Subgroups on Days Attended in First Grade for Cohort 1 of the Full Randomized Sample; Sample-Weighted Data

	Moderator: Gender			Moderator: Age			Moderator: Native English		
Fixed Effect	**b**	**S.E.**	**p-value**	**b**	**S.E.**	**p-value**	**b**	**S.E.**	**p-value**
TOT Analysis									
Intercept	-1.36	.07	.000	-1.28	.03	.000	-1.39	.07	.000
Male	.01	.02	.784	.01	.01	.263	.01	.01	.315
Black	.05	.01	.000	.05	.01	.000	.05	.01	.000
Hispanic	-.00	.01	.617	-.00	.01	.614	-.00	.01	.563
Age at Start of Pre-K	-.00	.00	.253	-.00	.00	.511	-.00	.00	.242
Native English Speaker	-.05	.02	.002	-.05	.02	.002	-.08	.03	.003
TN-VPK Participation	.03	.01	.017	.03	.01	.017	.02	.01	.035
TN-VPK Participation * Moderator	**-.00**	**.02**	**.843**	**-.00**	**.00**	**.102**	**.04**	**.02**	**.071**
ITT Analysis									
Intercept	-1.33	.06	.000	-1.28	.03	.000	-1.36	.06	.000
Male	.04	.02	.101	.02	.01	.112	.02	.01	.102
Black	.05	.01	.000	.05	.01	.000	.05	.01	.000
Hispanic	.01	.02	.755	-.00	.02	.804	-.00	.02	.772
Age at Start of Pre-K	-.00	.00	.455	-.00	.00	.484	-.00	.00	.451
Native English Speaker	-.03	.02	.065	-.04	.02	.046	-.00	.04	.986
TN-VPK Participation	.01	.02	.667	.01	.02	.661	.02	.02	.360
TN-VPK Participation * Moderator	**-.03**	**.02**	**.225**	**-.00**	**.00**	**.122**	**-.05**	**.04**	**.169**