



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

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 participate¹. 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 report² 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.