# Appendix D:
# Closing the Gap in the School Readiness of Low-Income Children

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## Introduction

This paper is intended to stimulate discussion of several important questions related to the problems faced by children from low-income families as they enter school: first, what is the size of the school readiness gap and what does it indicate about the school readiness of children from different socioeconomic backgrounds? Second, is it necessary to close the gap completely before children enter school in order to improve children's chances of school success; and finally, what are the implications of what we have learned about the school readiness gap for future program and research efforts?

This paper adds to the body of knowledge about the school readiness gap through secondary analyses of several data sets aimed at describing the size and nature of the school readiness gap as well as the developmental trajectories of children's school readiness skills. The paper begins by summarizing what we know about the gap in the school readiness of children from low-income families compared with their more advantaged peers, and its implications for later school achievement. As part of this discussion, we suggest one way in which the gap in achievement might be explained in a way that is easier to understand and that could be applied across a variety of different measures. The paper goes on to examine the question of whether the gap needs to be completely closed to reduce the likelihood of school failure. As part of this discussion, we look at children beginning school at varied levels of school readiness for differences in the rate of growth throughout the school years.

## 1. What is the nature of the gap in school readiness experienced by children from low-income families and how can it best be quantified?

The concept of "school readiness" is multi-faceted, encompassing the physical health, social-emotional, cognitive and linguistic status of children. There is abundant evidence that poor children lag behind their more advantaged counterparts on most if not all aspects of readiness. The effects of poverty manifest themselves early in a child's life. Children in low-income families have higher rates of asthma and dental disease, are more vulnerable to measles and other preventable illnesses, are more likely to have behavioral or developmental problems and less likely to see a pediatrician on a regular basis or live in a safe home environment that nurtures their development (Garbarino, 1990; Dryfoos, 1987; Rosenbaum, 1992; Gelles, 1992). At the end of preschool, they score up to one standard deviation below the norms on measures of language and early math (Lee & Burkham, 2002; U.S. DHHS, 2003). These problems are not readily overcome when children enter school; low-income children are more likely to perform poorly once in school (Dryfoos, 1987), to repeat grades and have frequent absences (Ravitch & Finn, 1987), fail to complete high school and lack basic literacy and numeracy skills (Gardner, 1990).

Ideally then, any consideration of the size of the gap in school readiness, its implications and the results of efforts to close it would consider all facets of the problem. In reality, there are difficulties in attempting this for several reasons: we have not specified and quantified the extent of the gap in several of these domains, in part because we lack good measures; we do not fully understand the implications of some early problems for school success; and there have been limited efforts to address problems in some domains. This paper confines discussion to the gap in cognitive (i.e., language) achievement for several reasons: early cognitive skills are foundational for later school performance and success (Whitehurst & Lonigan, 2001; Duncan et al., 2007) making the discussion substantively

important; characteristically (though not always) they are measured using standardized tests with norms that allow us to examine and describe the data in different ways; and, to date, most evaluations of early childhood interventions have measured effects in these areas.

Using several large national data sets, researchers have both identified the gap in school readiness in terms of pre-literacy skills (as well as math and cognitive skills) and quantified it. Lee and Burkham, in their analysis of data from the Early Childhood Longitudinal Study –Kindergarten cohort (ECLS-K), found that low-SES children scored almost half a standard deviation (.47) lower on the reading skills test at the start of kindergarten than their middle-class counterparts, and 1.17 standard deviations below high-SES children (Lee & Burkham, 2002). Analysis of data from the Family and Child Experiences Survey (FACES), administered when a child enters Head Start, found a gap of a standard deviation (1.0) in the pre-reading and math skills of Head Start children compared with national norms (U.S. DHHS, 2003).[1]

Why should we be concerned about this gap? As the earlier discussion showed, a number of researchers have demonstrated the implications of the gap for future school achievement. Recently, Duncan and his colleagues, analyzing data from more than 35,000 preschoolers in Canada and the United States, found that language and literacy skills at the start of school along with early math skills were the most important predictors of later school success (Duncan et al., 2007).[2] Children who enter school with many fewer of the necessary skills than their more advantaged counterparts do not catch up.

For this paper we used data from the ECLS-K to graphically illustrate the different trajectories traveled by the general population of children and those whose families lived in poverty at the time their children entered kindergarten and were in poverty at one or more measurement points before the end of fifth grade. Exhibit 1 shows, from the start of kindergarten through the spring of grade five, children demonstrate steady growth in their reading abilities. Children experiencing repeated poverty (i.e., children whose families are below the federal poverty line at baseline and at least one subsequent measurement point), however, follow a growth trajectory that is somewhat below the average trajectory for all children. That is, the difference in the reading scores increases over time, with children living in continued poverty falling farther and farther behind. These analyses suggest, consistent with previous studies, children living in continued poverty have a slightly slower rate of achievement in reading scores than the average of all children.

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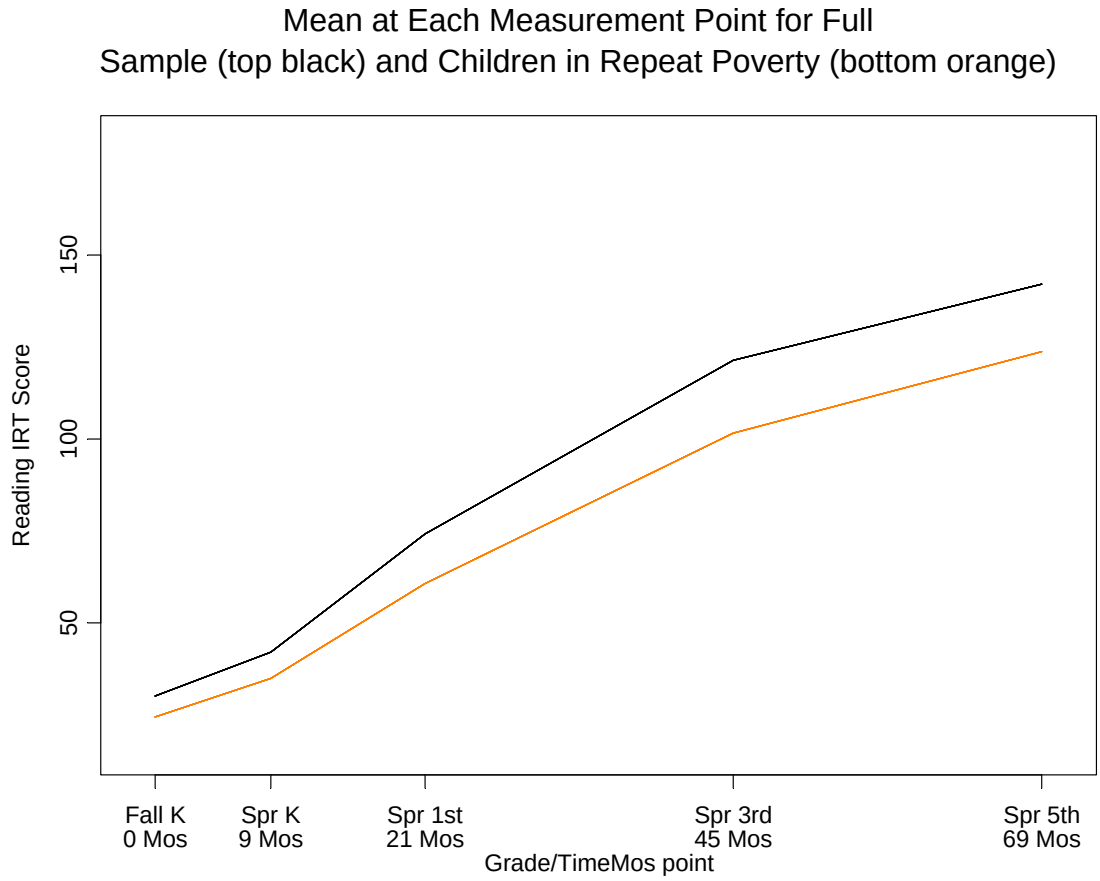
1 The ECLS-K, a longitudinal study of a nationally-representative sample of children beginning in kindergarten, used a set of measures developed for the study that borrowed subtests and items from existing tests to create a battery that could be applied from kindergarten through fifth grade. The FACES study used an extensive battery that included several subtests from standardized measures of language and preliteracy skills, as well as some measures developed for the study.

2 Children's attention-related skills and self-regulation were also important predictors; other social and emotional behaviors, such as aggression, disruptive behavior were not predictive for either gender or any social class.

**Exhibit 1: Growth Trajectories of Children in ECLS-K Full Sample and Children in Continuing Poverty***




*Children whose families are in repeated poverty (poverty at the time of the Fall K test and poverty at one or more subsequent measurement points).

### Ways to quantify the gap in readiness

Typically, as we have seen, achievement differences within a population and across populations are described in terms of the portion of a standard deviation (a measure of the variation in scores within a group) that the difference represents. Increasingly, the impacts of interventions designed to reduce those differences are expressed in effect sizes. Effect sizes are standardized measures of the magnitude (size) of treatment effects. For each measure, the effect size is equal to the estimated impact of the treatment, divided by the control group standard deviation. The standardization makes possible a comparison of the size of treatment effects across studies and, within limits, across outcome measures.[3] For example, if the effect sizes of a treatment on outcome measures A and B are 0.50, and 0.25, respectively, then the size of the treatment impact on A is considered to be twice the

[3] Comparisons across studies must be approached cautiously. Even if the same outcome measure is used, the comparison assumes that the two study samples have similar standard deviations. Comparison of effect sizes for very different outcome measures may be misleading.

size of the impact on B.[4] This strategy also allows us to estimate how much of a gap in achievement has been narrowed by an intervention. For example, if the initial gap is 0.5 of a standard deviation, then an intervention that has an impact of 0.25 (to use the example given above) has succeeded in halving the gap. This is an important aid to our understanding of the effectiveness of an intervention.

However, for policymakers and other members of the interested public, standard deviations and effect sizes are quite abstract measures and offer no guidance about the educational or developmental meaning of the gap (or of the impact of an intervention). To try to address this problem, we developed a different metric for the school readiness gap, one that might help policymakers understand both the magnitude of the gap and the effectiveness of efforts to close it.

To do this, we identified some large data sets that included low-income preschoolers assessed with nationally-normed language/pre-reading tests. The first data set came from two evaluations of the Comprehensive Child Development Program (CCDP), in which almost 8,000 low-income children below the age of five were assessed repeatedly using the Peabody Picture Vocabulary Test (PPVT-R) and its Spanish equivalent (TVIP). The second data set came from the first evaluation of Even Start, in which more than 6,000 low-income preschool children were assessed using the PPVT-R and TVIP at several points in time.[5] Since both evaluations showed that the programs had no effects on any of the outcomes measured, we used scores from both treatment and control group children. The readily available data are in the form of standard score equivalents. These were converted to raw scores using Table 1 of the PPVT-R Manual. We then converted the raw scores into age-equivalent scores for both the study samples and the norming samples, and assessed the difference in months of development between the low-income samples and the norming sample (which, of course, included some low-income children). Exhibit 2 presents the findings of those assessments.

For the CCDP sample of children, whose family incomes were substantially below the Federal Poverty Level (FPL) when they entered the study and moved only slightly upward over time, three-year-olds in the study sample lagged behind the norms by almost nine months. The gap continued to widen with age: the gap at four years of age was almost 14 months and before six years of age, the gap was almost 15 months. Findings from the analysis of data from the Even Start evaluation showed a similar gap in achievement – 8 months for three-year-olds, increasing to 12 months for four-year-olds. The income criteria for participation in Even Start were not as uniform as those used in CCDP, so the income range is probably slightly wider. However, when we looked at scores for children in the lowest income group (less than 50% of the FPL), these showed an even wider gap in achievement as the children prepared to enter kindergarten—almost 18 months.[6]

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[4] With the caveat expressed in the last footnote, that the outcome measures must be comparable. If the effect size of 0.50 represented program impact on children's behavior measured by parent report, it would not be appropriate to compare that impact with a smaller impact on a standardized measure of children's behavior, because of differences in the reliability and other psychometric characteristics of the two measures.

[5] For complete information on the programs and their evaluations, see St. Pierre et al., 1994 and St. Pierre et al., 1995.

[6] Data from the second evaluation of Even Start could not be used in this way because the measures used were the Preschool Inventory, which has not been normed, and the Preschool Language Series (PSL-3), in which the norms span such wide age ranges (6 months) that they are not sufficiently precise for measuring developmental gaps. In a third study of Even Start (again with no positive findings), the PPVT was administered to several hundred low-income children at up to three points in time. Here the developmental

**Exhibit 2: Size of the Language Achievement Gap in Two Samples of Low-Income Preschool-age Children**

| Age span of children | Median deficit | Sample size |
|---|---|---|
| **CCDP** | | |
| 3 years to 3 years,11 months | 8.7 months | 2541 |
| 4 years to 4 years,11 months | 13.8 months | 2360 |
| 5 years to 5 years, 9 months | 14.8 months | 2878 |
| **Even Start** | | |
| 3 years to 3 years,11 months | 8 months | 2187 |
| 4 years to 4 years,11 months | 12 months | 2805 |

While both of these were large samples of low-income children drawn from many different parts of the country, neither is representative of children from low-income families nationally. The same analysis could be performed with data from the ECLS-K, for a nationally-representative sample. However, because the ECLS-K chose to use a compendium of subtests drawn from several existing measures rather than a single standardized test, standardization of the measure and creation of age-based norms would be a time-consuming undertaking that is beyond the scope of this project.

These analyses and descriptions assume that the gap to be closed is between the achievement of children from low-income families and the average child as they enter kindergarten. Although it may not have been quantified in these terms before, the gap in school readiness associated with socioeconomic status has certainly been recognized by policymakers at all levels of government for many decades. Considering it here in terms of children's months of development gives new perspective to the weight and scale of the problem, the need for effective solutions, and the tremendous challenge these disparities pose for schools and social programs serving low-income families.

## 2. Do we have to close the gap all the way?

As the previous discussion made clear, progress in narrowing the school readiness gap is generally measured in terms of how close children are to national norms. Closing the school readiness gap refers to bringing children to national norms on a specific outcome measure, such as a standardized literacy or math assessment. Using this yardstick, numerous studies have demonstrated that school readiness interventions make progress toward narrowing the gap but generally do not close the gap entirely.[7] Some researchers have asked whether it is necessary to close the gap all the way before children begin school. Can disadvantaged children be kept "in the running" to participate in school even if they do not catch up to national norms? It is a tempting thought because, as we saw earlier, the size of the gap as children enter school is large and may be hard to close in one year before

gaps were much larger, probably because of the inclusion of many children for whom English was a second language. More than two-thirds of the children tested at 36 to 47 months had raw scores below 22, for which the age equivalent is 21 months.

[7] A detailed discussion of the progress that has been made by high quality early childhood interventions in narrowing the school readiness gap is the subject of other papers in the series. See Caswell and He, 2008; Ginsburg and Clements, 2008; Goodson, 2008; Raver, 2008.

school. The question here is: Can school readiness research help identify a point that is sufficient to enable children to benefit fully from kindergarten and not continue to lose ground?

To investigate this question, we used longitudinal data from the ECLS-K, namely the scores on the reading test used from the fall of the kindergarten year through fifth grade (35,468 observations) to construct growth trajectories for children beginning kindergarten at varied literacy levels. If it were true that children entering school with scores at some point below the average score managed to catch up, we hypothesized that we would expect to see a different (i.e., slightly accelerated) growth trajectory for those children. In other words, we investigated the question of whether, at the start of kindergarten, children with lower than average literacy levels had faster rates of growth than children at higher literacy levels, moving their scores up to the average score. This would manifest itself as a steeper growth trajectory than the ones for both higher- and lower-performing peers. If this were the case, then helping to move children at least to this specified level before school might mean they could make somewhat greater gains than their peers in the early grades, and that the school experience itself would be instrumental in closing the gap.

Fall kindergarten Item Response Theory (IRT) scaled scores were used to sort children into deciles and then IRT scaled scores at four subsequent time-points were used to construct linear growth models for each decile. Exhibit 3 shows the mean growth trajectories for children from each of the ten deciles. For example, the curve at the bottom of the exhibit shows the mean Reading IRT scores over several time points, for the children whose scores taken in the fall of kindergarten were in the lowest 10 percent of the score distribution. The mean scores of these children were below the means of children from the higher deciles, as they progressed from kindergarten to first grade, on to grades 3 and 5. On average, the deciles move along nearly parallel tracks – there is no group that breaks away and moves closer to another. In addition to the plots shown in Exhibit 3, we fitted linear growth curve models to the data. Consistent with the results shown in the plots, these models indicated that children's scores from the fall kindergarten are highly predictive ($p = <.0001$) of their scores on the test in fifth grade. Furthermore, analysis of the ECLS-K data did not indicate that children's rate of growth in literacy over the elementary school years was related to their literacy level at the start of kindergarten. Children's average rate of growth in literacy through elementary school was effectively the same regardless of their fall kindergarten score. Children with high, moderate, and low literacy scores at the start of kindergarten all grew at the same rate, on average. At no level along the continuum of kindergarten starting points did the gap narrow over time between any deciles.

Of course, one possible reason why children in the lowest deciles do not catch up to others as a result of the school experience is that these predominantly low-income children may enter schools that are of lower quality than the schools their more advantaged peers enter. If it were true that low-income children could depend on having a high-quality kindergarten experience that supported the gains made as a result of an effective preschool intervention, the results might be different.

Looking at the ECLS-K data from a different perspective offers some additional insights into the reasons why children do not catch up. The reading test used for the ECLS-K actually was a composite of nine subtests drawn from existing tests. An examination of the decile growth curves for each of the subtests provides interesting insights and helps explain the overall growth pattern. Exhibits 4-11 show the decile growth curves for each of the subtests. As some have suggested, there are foundational skills (letter recognition, beginning sounds, ending sounds, sight words) that most children (except those in the lowest decile) have acquired by third grade, even if they lagged behind badly on entry to kindergarten. As the skill tested becomes more complex (understanding words in

context), the time taken to catch up increases, and some of the deciles have not caught up by the end of fifth grade. Exhibits 7-10 show that, for the skills that are needed to interpret and understand what is read, which for most children do not manifest themselves at all until the end of the kindergarten year, the gaps between the deciles actually widen over time – we are no longer looking at the parallel tracks that the overall reading score produces. Although children in the lower deciles do catch up to others on some skills, the delay may cost them the opportunity to develop adequately the skills that are important for school success.

These analyses demonstrate the relationship between early and later achievement scores and suggest ways in which early skills may be foundational for later skills. Findings also raise additional questions about whether it is adequate to narrow the school readiness gap or if the gap needs to be closed completely in order for children to benefit from later schooling. That is, it is clear that early delays in literacy skills can result in delays in the acquisition of more complex skills and leaves underperforming children at risk for school failure. The next step in exploring how to put children "in the running" for school success may be to identify the specific skills children need to benefit from learning opportunities in kindergarten (and later schooling) and the early childhood experiences that get them there.

## 3. Discussion

When we describe the gap that exists in terms that policymakers and the general public can easily comprehend, we get a sense of the size and scale of the school readiness gap in terms of the number of months of development that low-income children lag behind their more affluent peers. Is it realistic to expect a single year of early childhood intervention before the start of kindergarten to make up for nine months to a year of development (i.e., to greatly accelerate the rate at which disadvantaged children develop and learn)? The good news from the most recent reviews of early childhood research (e.g., Caswell & He, 2008; Ginsburg & Clements, 2008; Goodson, 2008; Raver, 2008) is that some interventions have been successful in moving children closer to this goal; the bad new is that none succeeded in accomplishing it completely (i.e., closing the gap). As Hart and Risley (1995) pointed out, longer and more focused interventions are needed to help children acquire the language and vocabulary skills that will be essential to develop the more complex skills of comprehension and interpretation. Beginning a year earlier or continuing the intervention into kindergarten might magnify the impact of effective interventions sufficiently to accomplish that goal. At the same time, it is important that we continue to work on improving the quality of interventions and curricula for preschool-aged children.

Many other questions about effective strategies for preparing low-income children for school and reducing the school readiness gap remain to be answered. Although everyone recognizes that parents are essential agents in supporting children's development, we have been almost completely ineffective in marshalling this resource. Are we to give up on parents or are there ways they could be enlisted to help magnify the effect of direct services to children? Another question has to do with the utility of continued experimental testing in single sites of different curricular or teacher training approaches, in the absence of a comprehensive theoretical framework for the research. Is Head Start, with its commitment to continuous quality improvement, and its ability to move a very large number of programs in a desired direction, a better laboratory for the many aspects of early childhood education that need to be tested? What if any evidence about the effectiveness of different strategies and approaches will be gained as states invest more resources in universal prekindergarten? These and other questions are topics for later discussion.

**Exhibit 3:**

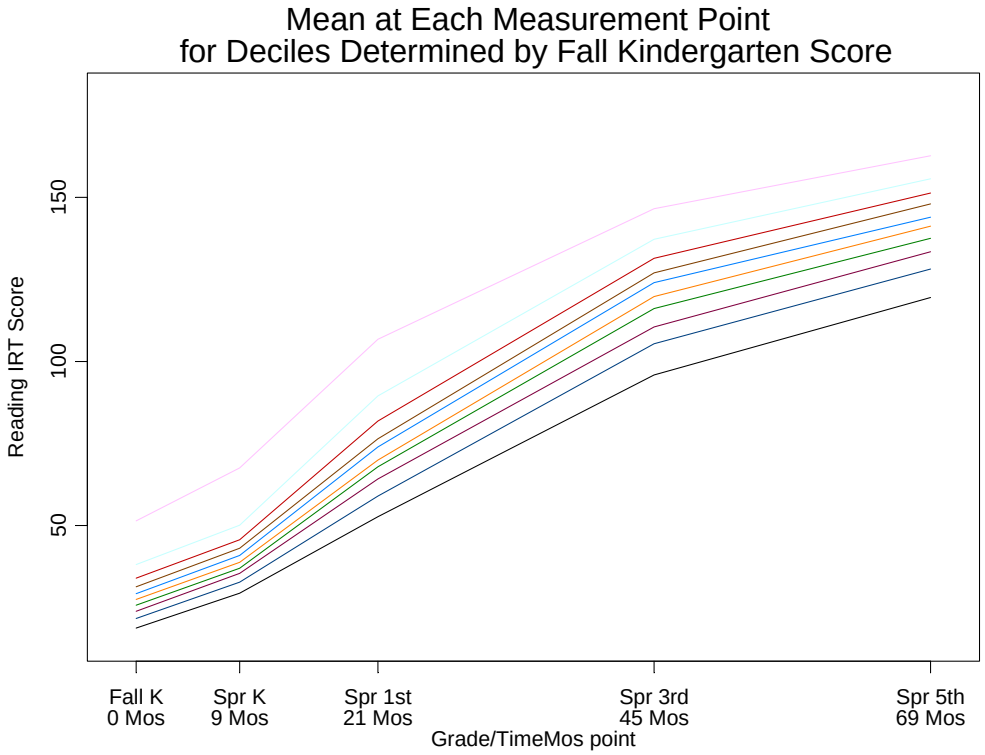

Mean at Each Measurement Point
for Deciles Determined by Fall Kindergarten Score
Reading IRT Score
50
100
150
Fall K
0 Mos
Spr K
9 Mos
Spr 1st
21 Mos
Spr 3rd
45 Mos
Spr 5th
69 Mos
Grade/TimeMos point

**Exhibit 4:**

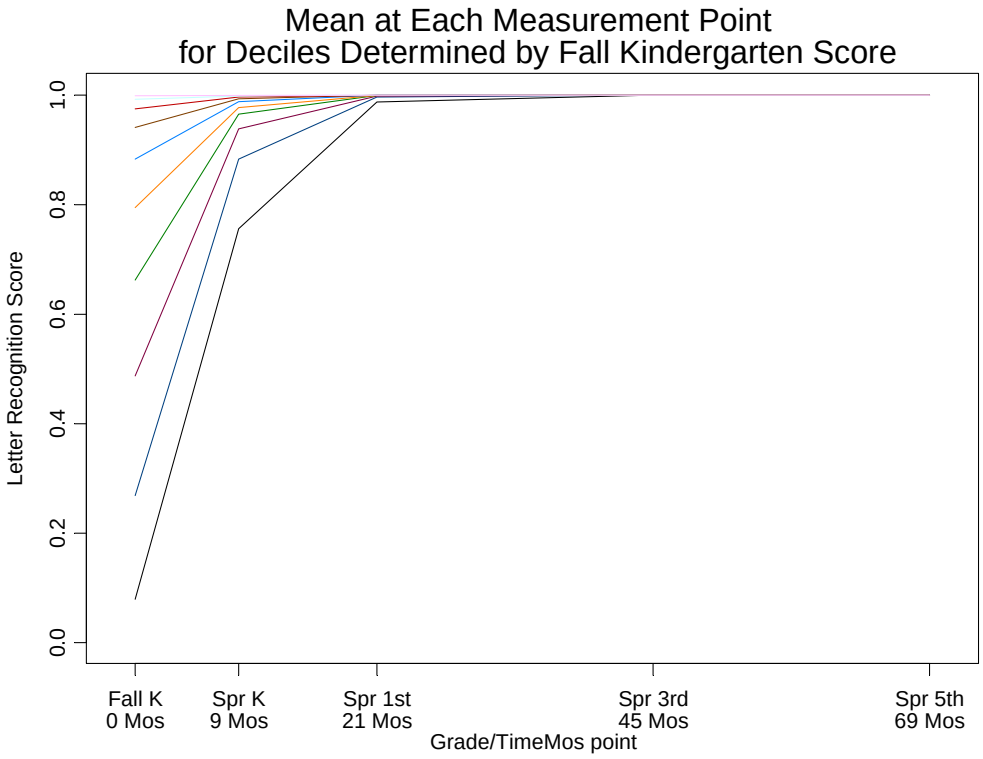

Mean at Each Measurement Point
for Deciles Determined by Fall Kindergarten Score
Letter Recognition Score
0.0
0.2
0.4
0.6
0.8
1.0
Fall K
0 Mos
Spr K
9 Mos
Spr 1st
21 Mos
Spr 3rd
45 Mos
Spr 5th
69 Mos
Grade/TimeMos point

**Exhibit 5:**

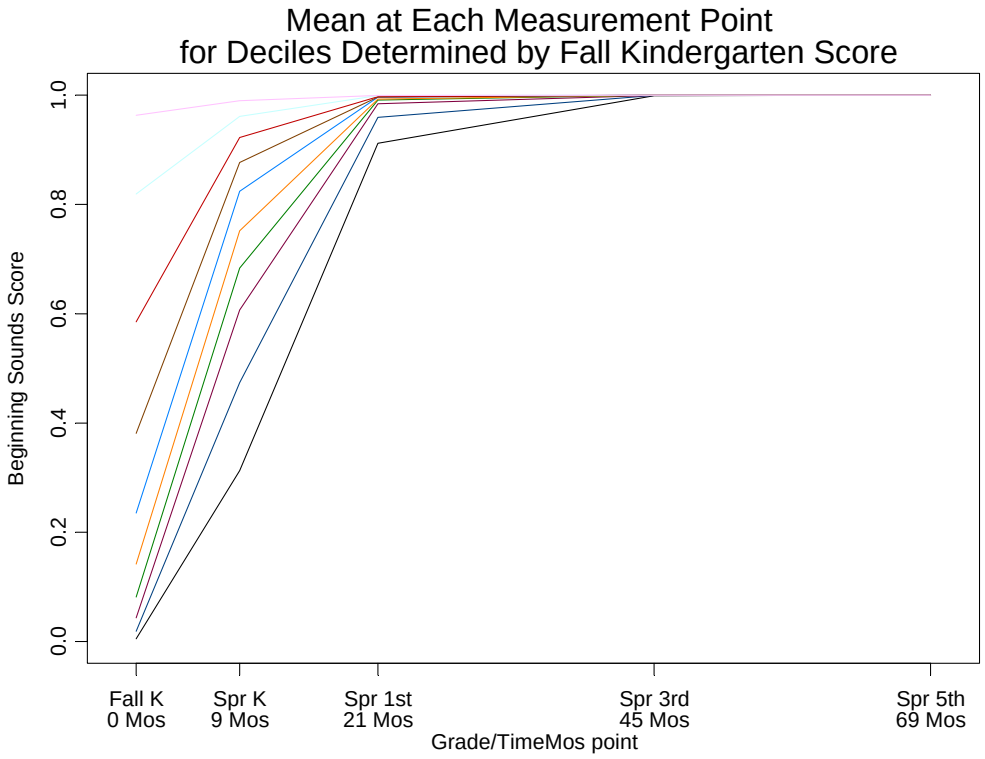

Mean at Each Measurement Point
for Deciles Determined by Fall Kindergarten Score
Beginning Sounds Score
0.0
0.2
0.4
0.6
0.8
1.0
Fall K
0 Mos
Spr K
9 Mos
Spr 1st
21 Mos
Spr 3rd
45 Mos
Spr 5th
69 Mos
Grade/TimeMos point

**Exhibit 6:**

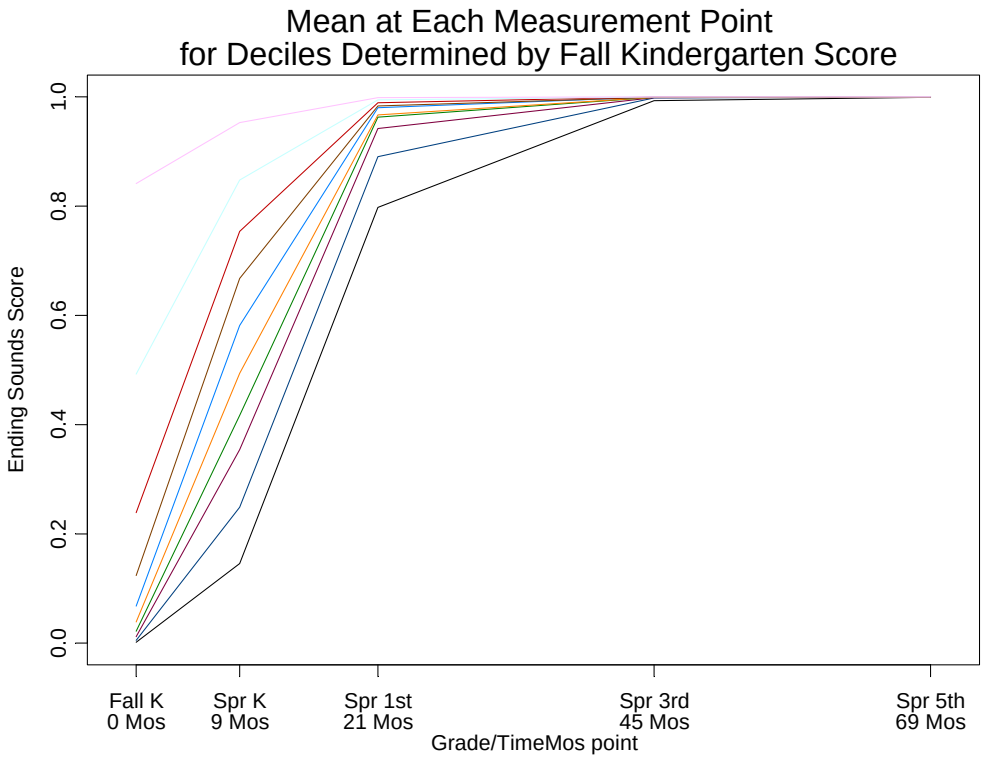

Mean at Each Measurement Point
for Deciles Determined by Fall Kindergarten Score
Ending Sounds Score
0.0
0.2
0.4
0.6
0.8
1.0
Fall K
0 Mos
Spr K
9 Mos
Spr 1st
21 Mos
Spr 3rd
45 Mos
Spr 5th
69 Mos
Grade/TimeMos point

**Exhibit 7:**

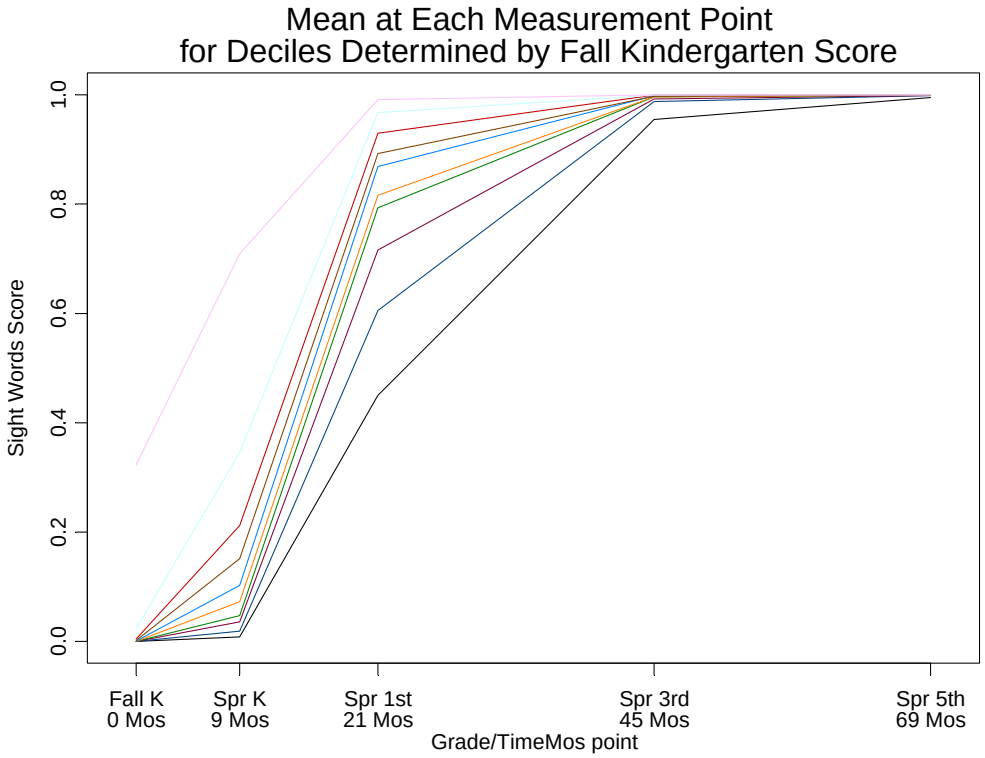

Mean at Each Measurement Point
for Deciles Determined by Fall Kindergarten Score
Sight Words Score
0.0
0.2
0.4
0.6
0.8
1.0
Fall K
0 Mos
Spr K
9 Mos
Spr 1st
21 Mos
Spr 3rd
45 Mos
Spr 5th
69 Mos
Grade/TimeMos point

**Exhibit 8:**

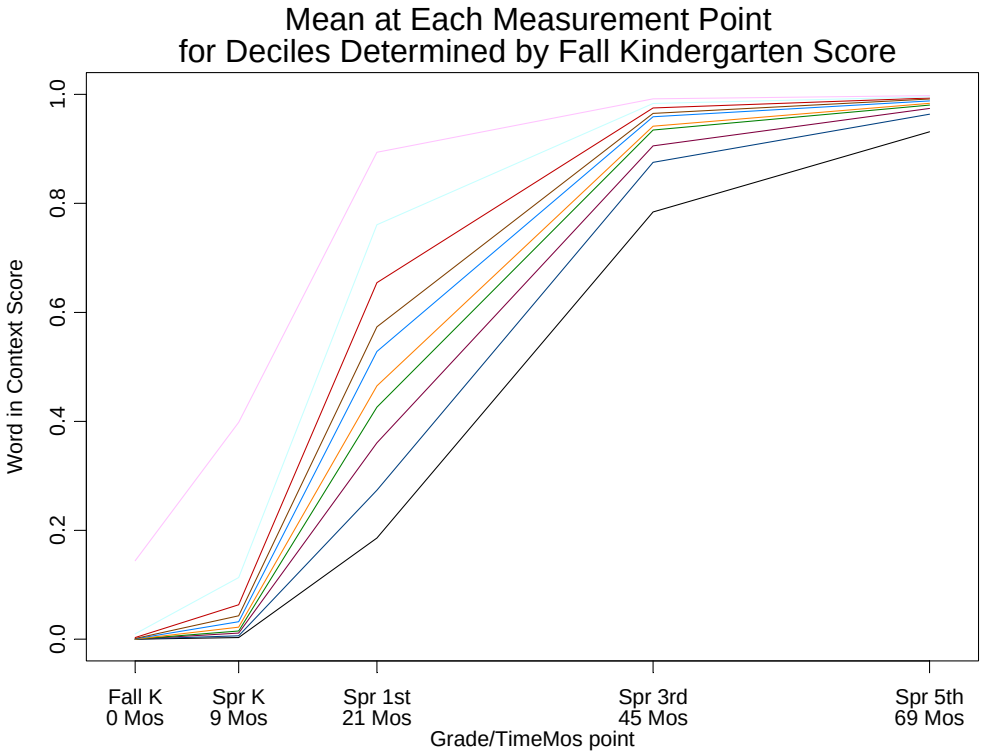

Mean at Each Measurement Point
for Deciles Determined by Fall Kindergarten Score
Word in Context Score
0.0
0.2
0.4
0.6
0.8
1.0
Fall K
0 Mos
Spr K
9 Mos
Spr 1st
21 Mos
Spr 3rd
45 Mos
Spr 5th
69 Mos
Grade/TimeMos point

**Exhibit 9:**

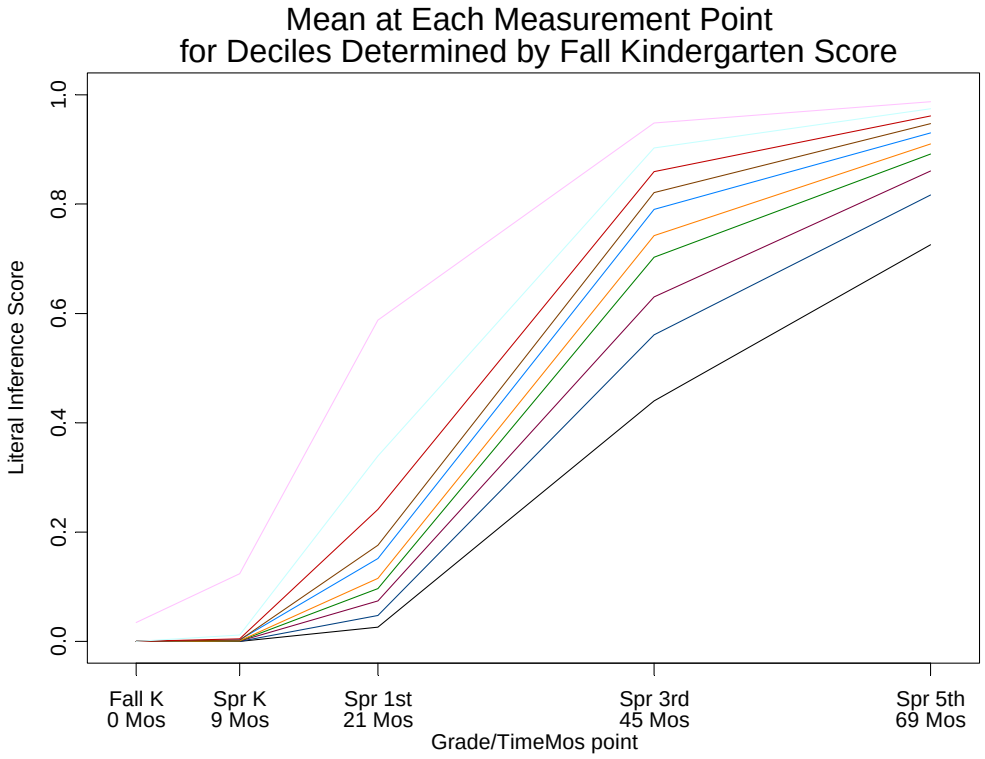

Mean at Each Measurement Point
for Deciles Determined by Fall Kindergarten Score
Literal Inference Score
0.0
0.2
0.4
0.6
0.8
1.0
Fall K
0 Mos
Spr K
9 Mos
Spr 1st
21 Mos
Spr 3rd
45 Mos
Spr 5th
69 Mos
Grade/TimeMos point

**Exhibit 10:**

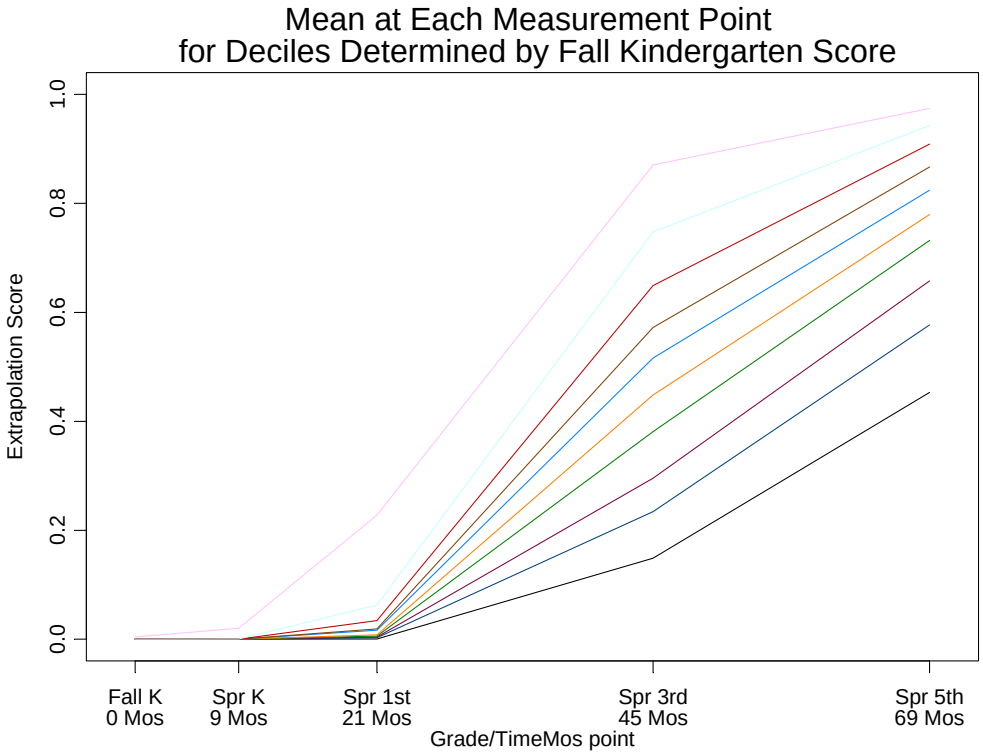

Mean at Each Measurement Point
for Deciles Determined by Fall Kindergarten Score
Extrapolation Score
0.0
0.2
0.4
0.6
0.8
1.0
Fall K
0 Mos
Spr K
9 Mos
Spr 1st
21 Mos
Spr 3rd
45 Mos
Spr 5th
69 Mos
Grade/TimeMos point

**Exhibit 11:**

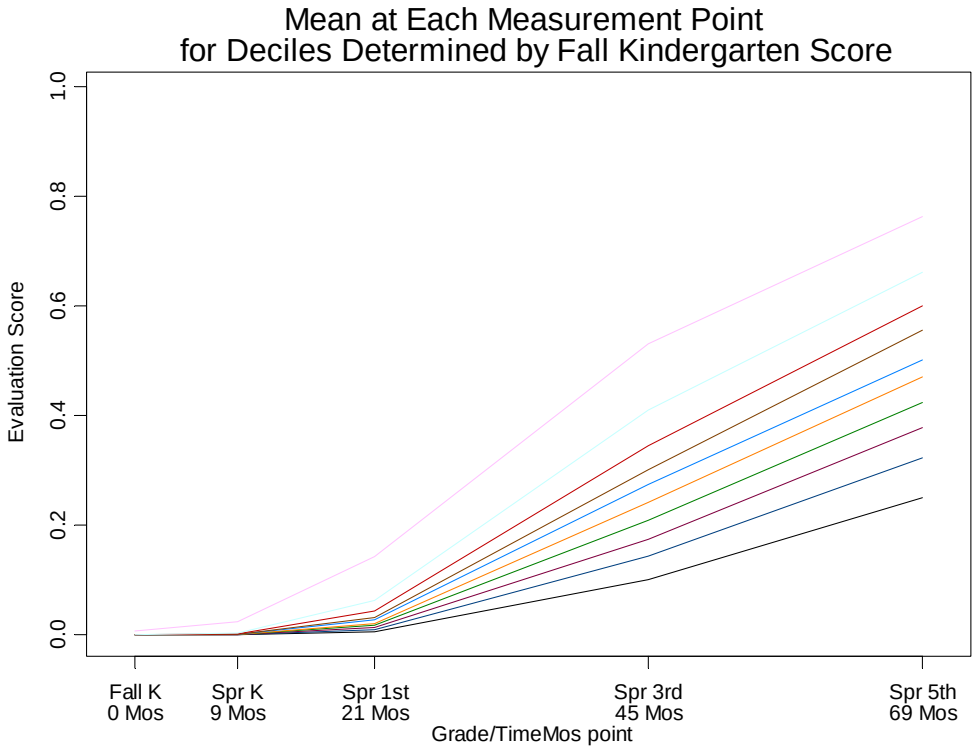
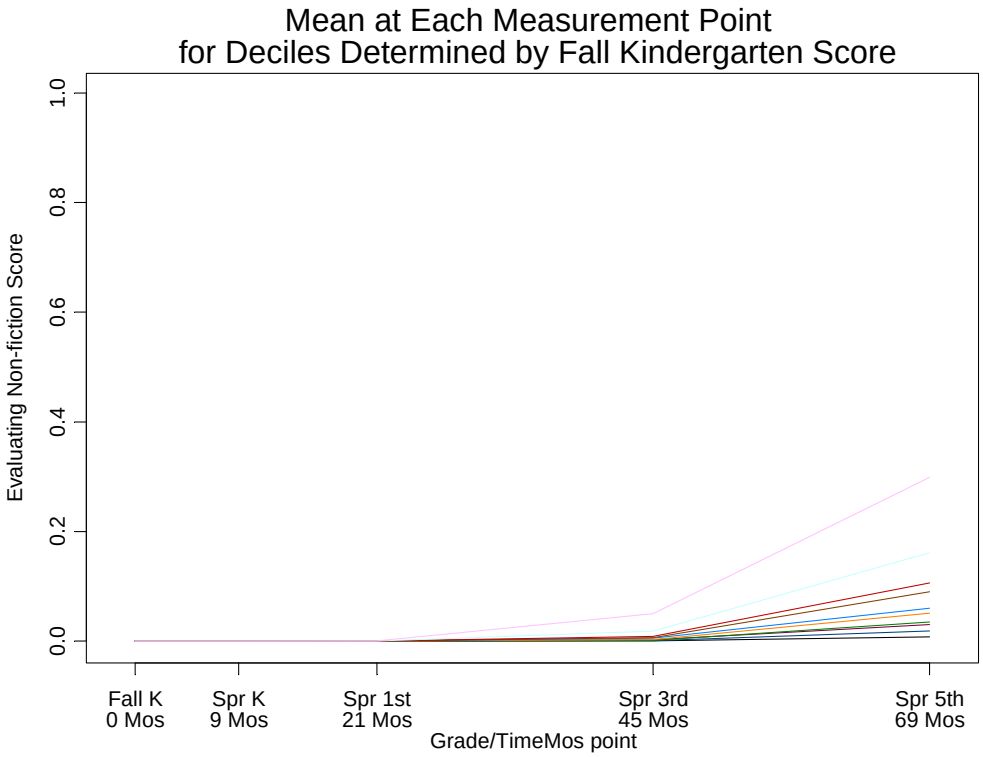

Mean at Each Measurement Point
for Deciles Determined by Fall Kindergarten Score
Evaluation Score
0.0
0.2
0.4
0.6
0.8
1.0
Fall K
0 Mos
Spr K
9 Mos
Spr 1st
21 Mos
Spr 3rd
45 Mos
Spr 5th
69 Mos
Grade/TimeMos point

**Exhibit 12:**


Mean at Each Measurement Point
for Deciles Determined by Fall Kindergarten Score
Evaluating Non-fiction Score
0.0
0.2
0.4
0.6
0.8
1.0
Fall K
0 Mos
Spr K
9 Mos
Spr 1st
21 Mos
Spr 3rd
45 Mos
Spr 5th
69 Mos
Grade/TimeMos point

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