Associations Between District-Provided Pre-K Attendance and Academic and Non-Academic Outcomes for Springdale Public Schools

Dr. Malachi Nichols – Director of Evaluation and Data Quality
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A Message from ForwARd Arkansas Executive Director Susan Bonesteel Harriman

Research has proven that students with a strong start in school become educated, productive members of our workforce. While strides have been made — most notably, an increase of $3 million in permanent funding for the Arkansas Better Chance (ABC) program during the 91st Arkansas General Assembly in 2017, ongoing investment in early childhood education is critical to improving educational outcomes in Arkansas.

Recognizing that the basis for sustained improvement resides with the local vision and capacity for equity and opportunity, community engagement and empowerment are the foundation for our work at ForwARd Arkansas. Alongside our efforts to increase funding for early childhood education, ForwARd Arkansas contracted with a top research firm to determine how the quality of Arkansas’s Pre-K data systems can be improved to provide more reliable longitudinal data. Based on ForwARd’s work, the Walton Family Foundation is currently funding further research on these topics.

Currently, ForwARd is involved in a "community-based data campaign” to empower local educators and parents in these five communities (Springdale, Pea Ridge, Lee County, Independence County and Crossett) that host a combined network of 54 schools to learn more about the effectiveness and efficiency of their Pre-K programs using current data and research methods. This campaign aligns with and supports our ongoing work to ensure that all Arkansas children and families, especially those in high-need areas, have access to high-quality Pre-K learning opportunities so students arrive at kindergarten ready to learn. This report, which focuses on the Springdale School District in Northwest Arkansas, is one of a series of research briefs ForwARd will author as part of this “community-based data campaign.”

There are many pathways to change in Arkansas and we believe that access to quality, integrated longitudinal data to track outcomes between Pre-K, K-12, postsecondary education/training and workforce participation is essential to inform future planning and resource allocation.

In the months ahead, we will continue our work to raise awareness of the importance of early childhood education, while also continuing to advocate for policies and programs to advance education quality and equity, provide additional teaching supports and further improve Arkansas’s data systems. We invite you to join us in this important work.

Susan Bonesteel Harriman  
Executive Director, ForwARd Arkansas
A Message from Springdale School District
Superintendent Dr. Jim D. Rollins

Springdale School District has one overarching goal—to help students achieve their highest personal potential. We embrace the whole child educational approach as defined by the Association for Supervision and Curriculum Development (ASCD), which recognizes that to unlock their potential, children need to be emotionally and physically safe, healthy, supported, engaged and challenged. Our instructional program is innovative, creative, progressive and designed to serve the different learning strengths and learning styles of students. This approach has been demonstrated to mitigate the effects of poverty—a priority in Springdale community.

Springdale educators are ever mindful that we are preparing young men and women to live and work in an increasingly complex and challenging global society. In partnership with students, parents and a strongly supportive community, the District is doing just that. Parents are interested and engaged in their children’s education, and many volunteer their talents and services. Springdale has also developed meaningful partnerships with civic organizations, members of the business community, and other supportive patrons and benefactors.

Our Pre-K program—which promotes social, emotional, academic and developmental skills—currently serves more than 1,400 students at 20 locations. All sites are quality-approved through Arkansas’s Better Beginnings. Each classroom has 20 students enrolled, and instruction is led by a state licensed teacher and a paraprofessional with a Child Development Associate Credential (CDA) or 60 hours of college courses. Daily activities are planned according to Arkansas Child Development Early Learning Standards, the D.I.G. (Develop. Inspire. Grow) curriculum, Common Core Units and various other sources.

We take great pride in the fact that, despite being more economically disadvantaged, Springdale Pre-K students enter kindergarten and first grade performing beyond projected attendance and are more likely to participate in extracurricular activities.

ForwARd Arkansas has been an excellent partner to Springdale School District in supporting our efforts to further improve our programs and to engage our parents, staff and community in a collaborative effort to expand access and opportunity for all our students.

In the next three years, our District will strive to ensure all children in the communities we serve have early opportunities to build their readiness to learn, which will require additional funding for the expansion of Pre-K programs to accommodate all children ages 0-5.

We are carefully reviewing the findings of this report to support our ability to continue to prepare our Pre-K students for success in kindergarten and beyond, to work with parents and our community to ensure they are aware of our excellent Pre-K program, and to inform the development of additional professional development programs for our excellent Pre-K teachers and staff.

Dr. Jim D. Rollins
Superintendent, Springdale School District
EXECUTIVE SUMMARY

Overall, academic research suggests positive effects of Pre-K programs on short-term outcomes, such as kindergarten academic performance and medium-term outcomes, such as elementary school performance (DeAngelis et al., 2018; Hustedt et al., 2015). This report analyzes the associations between district-provided Pre-K attendance and academic and non-academic outcomes for Springdale Public Schools. Using anonymous student-level data across the 2001-02 academic year until the 2018-19 academic year and from grades Pre-K to the 12th grade, this report provides robust descriptive analysis across time, grades, and outcomes. Four research questions guide the analysis, and you can find the research questions and a summary of the findings below:

Research question 1: From 2001 until 2018, what are the observable characteristics of students attending the district-provided Pre-K in Springdale?
   • There remains a consistent equalization between female and male attendees, hovering around 50% each, respectively.
   • Since 2004, there has been a steady uptick in Free and Reduced Lunch (FRL) students enrolled, peaking at 99% in 2015.
   • The majority of students observed were either Hispanic or Caucasian, representing over 80% of the students enrolled in multiple years.

Research question 2: Are there detectable academic achievement gaps when students enter Pre-K and if so, does Pre-K help close those gaps?
   • Disadvantaged students are entering Pre-K with gaps in English Language Arts (ELA) and Math academic performance.
   • A reduction in those performance gaps does occur by the Spring testing cycle.
   • However, the detected reductions are not statistically significant.

Research question 3: How does the academic achievement of Pre-K attendees compare to their non-attending peers longitudinally?
   • Pre-K attendees are more likely to be underprivileged than their non-attending peers.
   • Despite this apparent drawback, Pre-K students enter into kindergarten and 1st grade and academically perform with no apparent academic disadvantaged than their peers.

Research question 4: How do Pre-K attendees compare to their non-attending peers across various non-academic outcomes?
   • Pre-K attendance is associated with about a half-day decrease in total absences per-year.
Similar to Pre-K attendance was associated with a decrease in the number of times a student received In-school Suspension (ISS).

Attending the district-provided Pre-K program was associated with an 8.3 percentage point increase in the likelihood of participating in extracurricular activities in middle and high school.

In addition, Pre-K attendance was associated with a ten-percentage point increase in the probability of participating in extracurriculars, especially in drama.

**Next Steps:**

According to our report, we do find some positive associations among Pre-K attendance and academic and non-academic outcomes for one district-provided Pre-K program. The consistency of those findings across multiple years, alongside previous research findings, provides us with a level of confidence in our conclusions. However, the research methodology used in the report does not perfectly control for all observable and unobservable influencers (i.e., bias) of the outcomes evaluated. Therefore, this report is only an initial step in determining the actual effects of the district-provided Pre-K program. As school administrators, policymakers, and community members seek the continued evaluation of the district-provided Pre-K program, the correct next step should be conducting more rigorous research.

Employing research methods such as randomized control trials (RCT), regression discontinuity designs (RDD), and matching designs aid in the attempt to control for bias and subsequently determine the "true" effect of district-provided Pre-K. RCTs are the gold standard in research, and randomize students into Pre-K, providing the most efficient bias eliminating tool. However, the philosophies behind some Pre-K programs might not align with the RCT research method. RDDs, use age cutoffs as a method to control for bias in estimates. Lastly, matching techniques match Pre-K students to non-Pre-K attendees by observable characteristics and if done well can mimic an RCT. Conducting additional research employing the research methods mentioned above will set a precedent for the effective evaluation of other district-provided Pre-K programs.

Overall, the findings of the report suggest the district-provided program analyzed is moving in the right direction. Nevertheless, conducting more rigorous research to provide stakeholders with a consistent understanding of the health of the program is imperative.
INTRODUCTION

The state of Arkansas has been committed to providing its citizens with access to state-funded Pre-K for over two decades. The state started its pledge towards providing Pre-K with the creation of the Arkansas Better Chance program in 1991 and has since bolstered its commitment with the development of the Arkansas Better Chance for School Success (ABCSS) initiative. The ABCSS provides funding for three and four-year-olds to attend Pre-K in both public and non-public school settings.

The current iteration of the ABCSS initiative serves families with income levels below 200% of the federal income level (Hustedt et al., 2015). However, some public-school districts still serve families outside of the stated income brackets through full pay services and sliding scale programs. Currently, the state appropriates slightly over $110 million towards state-funded Pre-K and serves 19% of the state's three-year-olds and 32% of the state's four-year-olds, respectively, which has grown from 3% and 6% in 2002 (Friedman-Krauss et al., 2019).

The level of investment towards the state-funded Pre-K programs by state policymakers shows their commitment to providing access to early childhood education. In addition, the lesser-known investment by individual communities around the state has provided additional access points to Pre-K. Therefore, the number of individuals affected by the investment and the number of students served in the district-run Pre-K programs requires consistent evaluation and understanding of each program.

The need for consistent evaluation and understanding of Pre-K is a welcomed agenda for researchers. In the U.S., the research indicates that Pre-K attendees experience positive outcomes compared to their non-attending counterparts. In a systematic review of all research articles utilizing only rigorous research methods (i.e., experimental and quasi-experimental designs), a team of researchers identified that the Pre-K effect on math academic achievement was over 0.3 standard deviations (SD) and 0.6 SD in reading (DeAngelis et al., 2018). Further, studies have evaluated the impact of state-funded Pre-K in Arkansas.

Overall, the literature suggests positive effects of state-funded Pre-K programs, specifically the ABC program, on short-term outcomes, such as kindergarten academic performance (Hustedt et al., 2015), and medium-term outcomes, such as 3rd through 6th-grade academic performance (Argue & Holland, 2017; Jung et al., 2013). For instance, Hustedt and team (2015) using a quasi-experimental design, evaluated the effects of the ABC program on kindergarten readiness measured through language, literacy, and math skills. The researchers indicated that program attendees experienced a 0.28 SD increase in vocabulary, a 0.33 SD increase for math, and a 0.82 SD increase for print awareness.

Having the ability to evaluate the state-funded Pre-K is imperative for protecting the wellbeing of individuals who the program affects. Also, providing public-school districts with an informative analysis of their Pre-K programs allows individual
communities to make informed decisions. These data-informed decisions offer both students and parents a quality district-provided Pre-K experience.

This report seeks to provide an informative analysis of one district-provided Pre-K program, with the hopes of offering the individual district and corresponding community stakeholders data to have informed discussions and make subsequent decisions. Using anonymous student-level data, we provide a glimpse of the associations between Pre-K attendance and academic and non-academic outcomes. The following four research questions guide the subsequent analysis.

1. From 2001 until 2018, what are the observable characteristics of students attending the district-provided Pre-K in Springdale?
2. Are there detectable academic achievement gaps when students enter Pre-K and if so, does Pre-K help close those gaps?
3. How does the academic achievement of Pre-K attendees compare to their non-attending peers longitudinally?
4. How do Pre-K attendees compare to their non-attending peers across various non-academic outcomes?

**DEFINITIONS**

**Children’s Progress Academic Assessment (CPAA)** - The CPAA is a criterion-referenced, computer-based test used by the district’s Pre-K teachers. The assessment can be administered three to six times a year and takes 20 to 30 minutes to complete. The CPAA Detailed Teacher User Guide states, "CPAA adjusts to provide just the right level of challenge for each student. It displays more difficult content when children excel and scaffolding if they make errors."

**District-Provided Pre-K** - District-provided Pre-K refers to the entire Pre-K program offered by the school district independent of Arkansas Better Chance status, sliding-scale enrollment, or other identifiable enrollment classifications.

**English Language Learner (ELL)** - ELL refers to students identified as non-native English speakers who are not yet proficient in English. Discussion of ELL students in this report refers to those students who have ever been identified as ELL during their Pre-K through 12th-grade enrollment.

**Free and Reduced Lunch (FRL)** - FRL refers to students who qualify for free or reduced lunch based on family income. The program is federally administered and designed to provide nutritionally balanced lunches each school day. Discussion of FRL students in this report refers to those students who have ever been identified as FRL during their Pre-K through 12th-grade enrollment.

**In-School Suspension (ISS)** - ISS refers to students who have incurred a disciplinary infraction requiring them to be excluded from the general population and placed in a

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designated room for ISS, for a set amount of days. A student could receive ISS by committing one of the following disciplinary infractions: having Drugs/Alcohol, possessing weapons, or committing a violent, major non-violent or minor non-violent infraction.

**Measures of Academic Progress (MAP) Test** - The MAP test refers to the NWEA MAP Growth test assessed at the K-12 level with the possibility of being administered in the fall, winter, and spring. The MAP test provides an equal-interval scale score, called the Rasch Unit (RIT) score, which allows for the production of averages and comparisons from year to year.

**Out of School Suspension (OSS)** - OSS refers to students who have incurred a disciplinary infraction requiring them to be sent home and not allowing them to return to school for a set amount of days. A student could receive OSS by committing one of the following disciplinary infractions: having Drugs/Alcohol, possessing weapons, or committing a violent, major non-violent or minor non-violent infraction.

**Statistically Significant** - The likelihood that a measured relationship between two or more variables is caused by an occurrence other than chance. In this report, statistical significance is represented by a p-value or the probability that random chance could explain the measured relationship. For instance, p=0.05 means there is a 5% chance the relationship measured is a random occurrence. In this report, a p-value of 5% or lower constitutes as statistical significance or the connection is caused by factors other than chance.

**Student with Disabilities (SWD)** - SWD refers to students referred, tested, and approved to receive additional support services under the Individuals with Disabilities Education Act. The 13 areas of disability in Arkansas include autism, deaf-blindness, hearing impairment including deafness, emotional disturbance (ages 5-21 only), intellectual disability (ages 5-21 only), multiple disabilities, non-categorical (ages 3-5 only), orthopedic impairment, other health impairment, specific learning disability (ages 5-21 only), speech or language impairment, traumatic brain injury, and visual impairment. Discussion of SWD students in this report refers to those students who have ever been identified as SWD during their Pre-K through 12th-grade enrollment.

**METHODOLOGY, DATA, AND LIMITATIONS**

This report is descriptive and does not provide exact estimates of the causal effect of district-provided Pre-K on academic or non-academic outcomes. However, the analysis provided by this report highlights suggestive trends across time that could point us toward the “true” effect of district-provided Pre-K. Despite the lack of an ability to rigorously detect the presences of a Pre-K effect, robust descriptive analysis across time, grades, and outcomes can provide an understanding of the
associations between Pre-K and desirable outcomes, aiding in support of effective decision making.

Springdale Public Schools (SPS) directly provided the data used in the analysis. SPS provided us with over 300,000 anonymous student-level data points from the 2001-02 academic year until the 2018-19 academic year and from grades Pre-K to the 12th grade, following FERPA and other federal and state data regulatory laws. The data set included student-level data points, consisting of Pre-K enrollment, demographics (i.e. gender, ethnicity, home language, ELL, FRL, and SWD), the academic achievement scores of their grade-appropriate tests, extracurricular participation, and discipline records. Due to the vast amount of information collected, several data points don’t span the entire 2001-02 to 2018-19 timeframe. However, each specific research question identifies the variables, timeline, and limitations of the data selected for the analysis.

Data and methodology for each specific research question

Research Question 1: From 2001 until 2018, what are the observable characteristics of students attending the district-provided Pre-K in Springdale?

In this section, we use data provided by the SPS to compare the raw averages of observable characteristics of students who attended the district-provided Pre-K program from the 2001-02 academic year until the 2017-18 academic year. Specifically, we graph the percentages of student characteristics under the identifiers of gender, language, ELL, SWD, and FRL status from the 2001-02 academic year until the 2017-18 academic year. Also, we graph the percentages of student ethnicities enrolled from the 2001-02 academic year until the 2018-19 academic year.

Research Question 2: Are there detectable academic achievement gaps when students enter Pre-K and if so, does Pre-K help close those gaps?

To answer the following research question, we use a two-step approach. First, we employ t-tests, which compare the differences in means between two groups to see if the differences found are statistically significant, or not caused by chance. We use the overall standardized Fall and Spring CPAA scores in both ELA and Math in the 2016-17 and 2017-18 academic years for this analysis. We compare the differences in mean scores of various student populations to all other students in Pre-K during the particular year and testing cycle. For example, we compare the mean Fall ELA score of Hispanic students to all other students to see if possible differences in CPAA scores are statistically significant. Since many students enter Pre-K and leave mid-year, we only compare students who took both the Fall and Spring tests and enrolled the entire academic year.
In the second step, we compare changes between the Fall difference and the Spring difference to see if any potential reduction in gaps occurs between the Fall and Spring testing cycles. A statistically significant decrease in the gaps in scores between groups from the Fall to the Spring could suggest a positive academic association of the district-provided Pre-K program.

**Research Question 3: How does the academic achievement of Pre-K attendees compare to their non-attending peers longitudinally?**

To obtain a measurable association between attending district-provided Pre-K and subsequent student achievement, we run an ordinary least squares (OLS) regression on the following model, for each grade and year:

\[
\text{Respective MAP test} = f(\text{District-provided Pre-K Indicator, gender, ethnicity, Language, SWD, FRL})
\]

We employ the use of student-level math and reading MAP scores as the main outcome variables of choice. Since parents select into Pre-K, the selection introduces bias into potential estimates because of potential observable and unobservable differences in those who choose the district-provided Pre-K and those who don’t. To help adjust for the potential bias, we employ the use of the following covariates or controls: gender, ethnicity, Language, SWD, and FRL status.

The analysis uses data for students in kindergarten to the 12th grade spanning academic years 2012-13 to 2017-18. Some years and grades lack estimations due to insufficient amounts of data.

A limitation of this analysis is that we cannot adjust for possible attrition out of the district. However, the estimates produced from the model can provide a sound association between attending district-provided Pre-K and subsequent student achievement.

**Research Question 4: How do Pre-K attendees compare to their non-attending peers across various non-academic outcomes?**

To obtain a measurable association between attending district-provided Pre-K and subsequent non-academic student outcomes, we run an ordinary least squares (OLS) regression on the following model:

\[
\text{Respective Non-academic Outcomes} = f(\text{District-provided Pre-K Indicator, gender, ethnicity, Language, SWD, FRL, grade dummies, and school year dummies})
\]
Absenteeism, disciplinary outcomes, and extracurricular participation make up the non-academic categories included in the analysis. Looking at absenteeism, we use the number of days absent as the outcome of interest for kindergarten to 12th-grade students from the 2014-15 academic year until the 2017-18 academic year. Regarding disciplinary outcomes, we analyze the number of times a student is sent to ISS and OSS in a given academic year for first-graders through 12th graders in academic years 2015-16 through 2017-18. Lastly, extracurricular participation came in the form of overall extracurricular involvement in middle and high school (i.e. 7th - 12th grade), and extracurricular involvement in drama, from academic years 2014-15 to 2018-19.

RESULTS

From 2001 until 2018, what are the observable characteristics of students attending the district-provided Pre-K in Springdale?

The section below provides a longitudinal view of the demographic composition of Pre-K students enrolled in the district-provided program from the academic year of 2001-02 until 2018-19. Understanding the observable characteristics of students enrolled in the district-provide program provides context for previous success and potential challenges of the program.

From the 2001-02 academic year to the 2017-18 academic year, the students enrolled in the district-provided Pre-K comprise of 50% females, except for a blip in 2003-04, seen in Figure 1. Driven by the priority of providing lower-income families access to quality Pre-K, the composition of Pre-K attendees saw a steady uptick in FRL students, peaking at 99% in 2015. Turning to ethnicity in Figure 2, a majority of students identified as either Hispanic or Caucasian, representing over 80% of the students enrolled in multiple years. Lastly, a vast majority of students come from homes that identified Spanish as their primary language. However, in the most recent years, the proportion of Spanish to English speakers have almost equalized. Finally, uncommon in other areas, the Marshallese language is a widely used language inside the district, with up to 10% of families self-reporting in some years.
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**Figure 1:** Percentages of Students Enrolled Each Academic Year by Gender, ELL, SWD, and FRL

**Figure 2:** Percentages of Students Enrolled Each Academic Year by Ethnicity

Notes: Other includes two or more, native American, Asian, and Hawaii/Pacific Islander.
Are there detectable academic achievement gaps when students enter Pre-K and if so, does Pre-K help mediate those gaps?

This section provides a descriptive analysis of the academic performance of students enrolled in district-provided Pre-K. The goal of this section is to detect any potential gaps in performance between students with different observable characteristics such as ethnicity, gender, language, and disability. Secondly, if gaps are detectable at Pre-K entrance, measured by Fall academic achievement, we seek to detect if Pre-K closes those gaps by the Spring testing cycle.

Table 1 and Table 2 present the comparative differences in the average ELA and Math academic performance in the CPAA among various student groups, respectively. Overall, we detect a consistent statistically significant gap in the performance of historically disadvantaged student groups compared to their peers in both their Fall and Spring CPAA scores, shown in columns one and two. Meaning, historically disadvantaged groups, such as Hispanic and Marshallese students, are consistently scoring below their peers, and the outcome isn’t just a random occurrence.

However, the size of the gaps in the Spring are generally smaller than the gaps detected in the Fall. For instance, the Marshallese speakers scored at 0.60 SD lower than their peers on the Fall ELA test in 2016-17, but only scored 0.53 SD lower in the Spring of the same academic year, shown in Table 1 columns one and two respectively. However, we cannot confirm that the 0.07 SD decrease in the gap is statistically significant.
Although we cannot contribute seen reductions in gaps to mechanisms other than chance, there could be alternative explanations. For instance, it could be a product of the CPAA test being more of a formative test designed for learning and not a summative test, designed to assess knowledge. The design subtlety of the test could mask reductions in gaps between disadvantaged groups.

**Table 1: Comparison of CPAA ELA Scores Between the Fall and Spring**

<table>
<thead>
<tr>
<th></th>
<th>2016-17 Academic Year - ELA</th>
<th>2017-18 Academic Year - ELA</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fall Differences (1)</td>
<td>Spring Differences (2)</td>
<td>Difference btwn. the Fall and Spring (3)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>0.38</td>
<td>0.33</td>
<td>0.05</td>
</tr>
<tr>
<td>White</td>
<td>-0.63</td>
<td>-0.54</td>
<td>-0.09</td>
</tr>
<tr>
<td>Marshallese</td>
<td>0.57</td>
<td>0.55</td>
<td>0.02</td>
</tr>
<tr>
<td>SWD</td>
<td>0.76</td>
<td>0.83</td>
<td>-0.07</td>
</tr>
<tr>
<td>Spanish Speakers</td>
<td>0.41</td>
<td>0.31</td>
<td>0.09</td>
</tr>
<tr>
<td>Marshallese Speakers</td>
<td>0.60</td>
<td>0.53</td>
<td>0.07</td>
</tr>
<tr>
<td>LEP</td>
<td>0.10</td>
<td>0.06</td>
<td>0.04</td>
</tr>
<tr>
<td>Female</td>
<td>-0.15</td>
<td>-0.12</td>
<td>-0.04</td>
</tr>
</tbody>
</table>

|                        | Fall Differences (4)        | Spring Differences (5)      | Difference btwn. the Fall and Spring (6) |
|                        | 0.25                        | 0.20                        | 0.05            |
|                        | -0.39                       | -0.29                       | -0.10           |
|                        | 0.60                        | 0.34                        | 0.26            |
|                        | 0.16                        | 0.21                        | -0.05           |
|                        | 0.25                        | 0.14                        | 0.11            |
|                        | 0.59                        | 0.37                        | 0.22            |
|                        | x                           | x                           | x               |
|                        | -0.17                       | -0.12                       | -0.05           |

Notes: n=1,158

- P < 0.05
- P < 0.01
- P < 0.001
- Not statistically significant
Table 2: Comparison of CPAA Math Scores Between the Fall and Spring

<table>
<thead>
<tr>
<th></th>
<th>2016-17 Academic Year - Math</th>
<th>2017-18 Academic Year - Math</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fall Differences (1)</td>
<td>Spring Differences (2)</td>
</tr>
<tr>
<td>All peers compared to:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>0.36</td>
<td>0.30</td>
</tr>
<tr>
<td>White</td>
<td>-0.58</td>
<td>-0.55</td>
</tr>
<tr>
<td>Marshallese</td>
<td>0.64</td>
<td>0.63</td>
</tr>
<tr>
<td>SWD</td>
<td>0.71</td>
<td>0.80</td>
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<tr>
<td>Spanish Speakers</td>
<td>0.45</td>
<td>0.32</td>
</tr>
<tr>
<td>Marshallese Speakers</td>
<td>0.64</td>
<td>0.59</td>
</tr>
<tr>
<td>LEP</td>
<td>0.03</td>
<td>0.10</td>
</tr>
<tr>
<td>Female</td>
<td>-0.02</td>
<td>-0.05</td>
</tr>
</tbody>
</table>

Notes: n=1,067  
P < 0.05  P < 0.01  P < 0.001  Not statistically significant

Figures 4 and 5 illustrate a further explanation of the findings in Tables 1 and 2. Figure 4 shows the mean CPAA ELA performance of all Marshallese students and all other students in the Fall and Spring of the academic year 2016-17. As seen in Figure 4, in the Fall, Marshallese students averaged a score of -0.33 SD, and all other students averaged a score of 0.24 SD. In the Spring, the respective mean scores for the Marshallese and all other students were -0.31 SD and 0.25 SD, respectively.

A simple subtraction of the Fall average Marshallese score, from the average Fall score of all other peers, would generate the difference presented in Figure 5, which corresponds to Table 1, column 1. The same method is used to create the Spring difference shown in Figure 5 and corresponds to Table 1, column 2. Thus, all other peers of the Marshallese student population scored 0.57 SD higher in the Fall ELA CPAA and 0.55 SD higher in the Spring. At first glance at Figure 5, it appears that the gap in achievement between the two groups decreases by 0.02 SD. However, though true, we fail to detect that this decrease is statistically significant and couldn’t have arisen randomly, corresponding to Table 1, column 3.
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Figure 4: Mean Performance in the CPAA - ELA for Marshallese Students vs. All Other Students

- Fall: -0.33
- Spring: -0.31

Figure 5: Difference in Mean Performance in the CPAA - ELA for Marshallese Students vs. All Others Students

- Fall: 0.57
- Spring: 0.55
How does the academic achievement of Pre-K attendees compare to their non-attending peers longitudinally?

In the following section, we seek to understand the academic performance of students who attended the district-provided Pre-K program compared to their peers who did not participate in the program. A vital component of a comparative analysis is to disentangle the effect of attending the district-provided Pre-K program from other factors. One method in accomplishing this goal is to engage in a randomized control trial (RCT), which randomly allows students to attend the Pre-K program. However, the program does not employ a lottery to assign their seats, and subsequently, parents select into the Pre-K program.

Since the program is designed as an equitable tool to allow families access to quality Pre-K and parents individually select into the program, one would expect to witness the observable differences between Pre-K attendees and their non-attending counterparts, shown in Appendix Table A1. For instance, Pre-K attendees are more likely to be Hispanic, non-White, native Spanish speakers, and FRL students. The occurrence of observable differences between the two groups foreshadows the potential of unobservable differences between the two groups.

Due to not being capable of addressing potential unobservable differences, such as motivation, for students and parents selecting into the District-provided Pre-K program, the following results are merely descriptive. However, when controlling for observable characteristics, it allows for the estimation of associations between Pre-K attendance and academic achievement. Overall, when Pre-K attendees enter kindergarten, there is no apparent disadvantage to students who didn’t attend the district provided Pre-K program. This failure to detect an academic disadvantage is consistent across kindergarten and 1st grade and becomes modest in later years.

Figures 6 through 9 show the estimated association between attending the district-provided Pre-K on the respective MAP test across multiple years and grade levels. In general, across both the Math and Reading tests, students who attended Pre-K see statistically significant higher scores than their peers in kindergarten and the first grade. For instance, in Figure 6, attending Pre-K is associated with about a 5 point increase in the math MAP test in kindergarten for the 2017-18 academic year. However, it is imperative to remember the potential unobservable differences in Pre-K attendees versus non-attendees, such as motivation that could account for the higher scores beyond attending Pre-K.
As seen in both Figures 7 and 9, the statistically significant bump in academic achievement by Pre-K attendees begins to dissipate and becomes indistinguishable from a random occurrence as students enter grades 7th through 12th. For instance, in Figure 9, attending Pre-K is associated with about a 6-point increase in the Reading MAP test in 12th grade for the 2017-18 academic year.
How do Pre-K attendees compare to their non-attending peers across various non-academic outcomes?

Since previous researchers have detected effects of Pre-K beyond academic outcomes (Heckman and Karapakula, 2019a; Heckman and Karapakula, 2019b), understanding the relationship between district-provided Pre-K attendance and non-academic outcomes is imperative. This section estimates the relationship between Pre-K attendance and absences, disciplinary consequences, and extracurricular participation. Overall, Pre-K attendance appears to be associated with a reduction in undesirable behavior and a promotion of extracurricular involvement.
Table 3 shows the point estimates of Pre-K attendance on absences, disciplinary outcomes, and extracurricular participation. Pre-K attendance was associated with about a half-day reduction in absences, shown in column 1. Similarly, Pre-K attendance was associated with a decrease in the number of times a student received ISS. However, the seen reduction regarding OSS placements is not statistically significant.

Lastly, we detect a positive association between Pre-K attendance and extracurricular participation, though modest. Attending the district-provided Pre-K program was associated with an 8.3 percentage point increase in the likelihood of participating in extracurricular activities in middle and high school. In addition, Pre-K attendance was associated with a ten-percentage point increase in the probability of participating in extracurriculars which emphasize drama.

### Table 3: Associations Between Pre-K Attendance and Non-Academic Outcomes

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
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<tbody>
<tr>
<td>Attended Pre-K</td>
<td>-0.583*** (0.0646)</td>
<td>-0.180*** (0.0652)</td>
<td>-0.0290 (0.0478)</td>
<td>0.0813*** (0.00687)</td>
<td>0.102*** (0.00993)</td>
</tr>
<tr>
<td>Constant</td>
<td>5.944*** (0.143)</td>
<td>1.157*** (0.0818)</td>
<td>1.043*** (0.0663)</td>
<td>0.483*** (0.00871)</td>
<td>0.585*** (0.0122)</td>
</tr>
<tr>
<td>Controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>82,899</td>
<td>3,231</td>
<td>2,204</td>
<td>41,147</td>
<td>41,147</td>
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<tr>
<td>R-squared</td>
<td>0.069</td>
<td>0.073</td>
<td>0.046</td>
<td>0.089</td>
<td>0.064</td>
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</tbody>
</table>

Notes: Controls include: School year, gender, ethnicity, language, SWD, FRL, Grade Dummies. *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.
Conclusion

The goal of this report was to provide an informative analysis of one district-provided Pre-K program, analyzing the associations between Pre-K attendance and academic and non-academic outcomes. With the summary of the findings below, we hope this report offers the individual district and corresponding community stakeholders data to have informed discussions and make subsequent decisions:

**Research question 1**: From 2001 until 2018, what are the observable characteristics of students attending the district-provided Pre-K in Springdale?
- Across time, there remains a consistent equalization between female and male attendees, hovering around 50% respectively.
- Since 2004, there has been a steady uptick in FRL students enrolled, peaking at 99% in 2015.
- A majority of students across the years observed were either Hispanic or Caucasian, representing over 80% of the students enrolled in multiple years.

**Research question 2**: Are there detectable academic achievement gaps when students enter Pre-K and if so, does Pre-K help mediate those gaps?
- Disadvantaged students are entering Pre-K with gaps in ELA and Math academic performance.
- A reduction in those performance gaps does occur by the Spring testing cycle.
- However, the detected reductions are not statistically significant.

**Research question 3**: How does the academic achievement of Pre-K attendees compare to their non-attending peers longitudinally?
- Pre-K attendees are more likely to be underprivileged than their non-attending peers.
- Despite this apparent drawback, Pre-K students enter into kindergarten and 1st grade and academically perform with no apparent academic disadvantaged than their peers.

**Research question 4**: How do Pre-K attendees compare to their non-attending peers across various non-academic outcomes?
- Pre-K attendance is associated with about a half-day decrease in total absences per-year.
- Similarly, Pre-K attendance is associated with a decrease in the number of times a student received ISS. However, the seen reduction regarding OSS placements is not statistically significant.
- Attending the district-provided Pre-K program was associated with an 8.3 percentage point increase in the likelihood of participation in extracurricular activities in middle and high school.
- In addition, Pre-K attendance is associated with a ten-percentage point increase in the probability of participation in extracurriculars that emphasize in drama.
**Next Steps:**
According to our report, we do find some positive associations among Pre-K attendance and academic and non-academic outcomes for one district-provided Pre-K program. The consistency of those findings across multiple years, alongside previous research findings, provides us with a level of confidence in our conclusions. However, the research methodology used in the report cannot perfectly control for all observable and unobservable influencers (i.e., bias) of the outcomes evaluated. Therefore, this report is only an initial step in determining the actual effects of the district-provided Pre-K program. As school administrators, policymakers, and community members seek the continued evaluation of the district-provided Pre-K program, the correct next step should be conducting more rigorous research.

Employing research methods such as randomized control trials (RCT), regression discontinuity designs (RDD), and matching designs aid in the attempt to control for bias and subsequently determine the "true" effect of district-provided Pre-K. RCTs are the gold standard in research, and randomize students into Pre-K, providing the most efficient bias eliminating tool. However, the philosophies behind some Pre-K programs might not align with the RCT research method. RDDs, use age cutoffs as a method to control for bias in estimates. Lastly, matching techniques match Pre-K students to non-Pre-K attendees by observable characteristics and if done well can mimic an RCT. Conducting additional research employing the research methods mentioned above will set a precedent for the effective evaluation of other district-provided Pre-K programs.

Overall, the findings of the report suggest the district-provided program analyzed is moving in the right direction. Nevertheless, conducting more rigorous research to provide stakeholders with a consistent understanding of the health of the program is imperative.

**References**


### Table A1. Equivalence of Pre-K and Non-Pre-K Attendees on Observable Characteristics

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<tr>
<td></td>
<td>n</td>
<td>Pre-K Attendee Average</td>
<td>Non-Pre-K Attendee Average</td>
<td>Differences</td>
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<tr>
<td>Female</td>
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<td>0.48</td>
<td>0.013***</td>
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<tr>
<td>Ethnicity</td>
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</tr>
<tr>
<td>Asian</td>
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<td>0.02</td>
<td>-0.012***</td>
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<td>0.02</td>
<td>0.03</td>
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<td>Language</td>
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</tr>
<tr>
<td>Female</td>
<td>120,955</td>
<td>0.50</td>
<td>0.48</td>
<td>0.013***</td>
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<td>Ethnicity</td>
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</tr>
<tr>
<td>Asian</td>
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</tr>
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Notes: *** p<0.01, ** p<0.05, * p<0.1