

Longitudinal Analysis of Performance of Students in APS Prekindergarten Programs

Prepared for Arlington Public Schools

In this report, The Hanover Research Council examines the ongoing performance of a cohort of students who participated in APS prekindergarten programs, including Montessori, Virginia Preschool Initiative, Special Education, and Dual Enrolled Special Education, along with students who did not participate in such programs. Performance measures include a variety of assessments conducted between kindergarten and the fifth grade, such as PALS, DRP, and SOL tests.

Overview

In support of Arlington Public Schools' review of its prekindergarten programs, we provide an analysis of the impact of participation in these programs on future academic performance. While a number of factors affect student assessment scores, the following report provides a preliminary investigation of the differences in academic performance between participants and non-participants in APS Pre-K programs. Our analysis also highlights differences in performance among participants of the various Pre-K programs.

Scope and Methods of the Report

The data file provided by Arlington Public Schools included demographic and academic assessment data for a cohort of 2,840 students, collected between 2000-2001 and 2006-2007. Student scores were provided for 17 performance assessments, including the kindergarten and first grade Phonemic Awareness Language Screening (PALS), second and fourth grade Degrees of Reading Power (DRP), and third, fourth, and fifth grade Standards of Learning (SOL) tests.

We begin by dividing the cohort in several ways. For example, in the first section we examine the data based on seven categories:

- ❖ Full Cohort - All Students
- ❖ Pre-K Attendees
- ❖ No Pre-K
- ❖ Montessori
- ❖ Virginia Preschool Initiative (VPI)
- ❖ Special Education
- ❖ Dual Enrolled Special Education

For each category, we calculated sample means and standard deviations for students' scores on a number of assessments.¹ This provides a basis for comparison between groups. We are then able to determine how students who participated in an APS Pre-K program compared to students who did not enroll in a Pre-K program on each performance measure. This allows us to answer questions related to specific programs such as: Did individuals who participated in the VPI receive higher scores on their second grade DRP than students in the Montessori program?

¹ Due to the large amount of data, we provide an Excel file accompanying the report which includes all of the sample means and standard deviations for each performance measure included in the original "APS PK Cohort" spreadsheet. In the body of this report we describe major trends, illustrated with a selection of assessment scores.

By examining the data in this manner, we are also able to determine whether the effects of Pre-K program participation appear to diminish over time. Comparing student scores on a number of assessments conducted at different points throughout their educational experiences allows us to see if average scores between participants and non-participants begin to even out at a certain point.

When calculating average scores, we used all available testing data, including SOL scores marked as “excluded in calculating accreditation ratings.” We did this in order to provide the most complete picture of Pre-K participant and non-participant academic performance.

In subsequent sections, we break down the data based on Economically Disadvantaged (ED) and Limited English Proficient (LEP) status. This enables us to control for some factors that may influence student performance beyond participation or non-participation in a Pre-K program. We did not provide a similar breakdown of the data for disabled students, due to both the small number of Pre-K students receiving this designation and a strong fluctuation in this number from year to year.²

Key Findings

Overall, we found that students who participated in Pre-K programs outscored their non-participant counterparts on their fall and spring kindergarten PALS, but by first grade, this difference disappeared. Among the Pre-K programs, Montessori students tended to receive higher scores than both non-participants and participants of other Pre-K programs through their first grade PALS. However, like the full Pre-K group, their average scores on later tests tended to align fairly closely with those of the entire cohort.

Perhaps the most significant finding was that Pre-K participants who were classified as economically disadvantaged performed consistently higher than non-participants who were also economically disadvantaged. This difference persisted through the fifth grade, though the gap in scores fluctuated over this time period. Similar results emerged for Limited English Proficient students.

These results generally appear in step with a study recently published in the *Economics of Education Review*.³ Focusing on the effects of prekindergarten programs on academic skills and behavior, the study found that while participants of Pre-K programs tended to have higher reading and mathematical skills when they entered

² Among all Pre-K attendees, only 13 were listed as disabled in 2003-2004. In the following year, 69 students received this designation. The number dropped back down to 12 in 2005-2006 but rose again to 57 in 2006-2007.

³ Katherine A. Magnuson, Christopher Ruhm, and Jane Waldfogel. “Does Prekindergarten Improve School Preparation and Performance?” *Economics of Education Review*. Vol. 26, 2007.

kindergarten, “by the spring of first grade, estimated effects on academic skills have largely dissipated.”⁴ Further, the study provides support for the contention that disadvantaged students in these programs experience longer-lasting academic gains.⁵ In the following sections, we explore these trends in greater detail.

⁴ Ibid.

⁵ Note that the study only examines student performance through the first grade.

Full APS Cohort

As mentioned above, information regarding 2,840 students, 392 of whom attended a Pre-K program, was provided by APS for this report. Of the entire cohort, 51.5 percent were reported as male and 44.4 percent as female. In terms of racial and ethnic composition of the group, 37 percent were White, 35 percent Hispanic, 14 percent Black, and 11 percent Asian.

We began our analysis by comparing the scores of Pre-K participants with students who had not participated in a Pre-K program. As shown in the table below, it is clear that participants of Pre-K programs outscored non-participants on their fall and spring PALS in kindergarten by a fairly wide margin. By the first grade, however, the scores evened out, with Pre-K participants scoring slightly lower than the means for non-participants and the entire cohort.

Kindergarten and Grade 1 PALS – Mean Scores and Remediation					
Grade	Group	Fall PALS		Spring PALS	
		Score	% Needing Remediation	Score	% Needing Remediation
K	Pre-K	67.34	18.18	94.57	3.90
	No Pre-K	61.84	21.89	80.22	23.36
	Full Cohort	62.83	21.24	85.35	16.28
1	Pre-K	54.78	22.49	48.87	15.03
	No Pre-K	55.35	21.65	50.27	13.40
	Full Cohort	55.17	21.78	49.90	13.90

The same pattern exists for students requiring remediation. In kindergarten, 18.18 percent of Pre-K participants needed remediation in the fall, compared to 21.89 percent of non-participants. The difference was more pronounced in the spring kindergarten test, with only 3.9 percent of Pre-K participants recommended for remediation, while 23.36 percent of non-participants received this recommendation. The difference decreased by first grade, with 22.49 percent of Pre-K participants and 21.65 percent of non-participants needing remediation in the fall, and 15.03 percent of participants and 13.4 percent of non-participants in the spring.

Looking at SOL test results, this trend continues to hold, as Pre-K participants perform at approximately the same level or lower than non-participants. The table on the following page provides average scores for a selection of tests in which Pre-K participants and non-participants performed at roughly comparable levels.

Standards of Learning - Mean Scores				
Group	Gr3 SOL Math	Gr4 SOL Math	Gr5 SOL Read	Gr5 SOL Math
Pre-K	500.30	463.31	475.35	498.28
No Pre-K	505.53	470.19	481.96	503.50
Full Cohort	504.59	469.05	480.97	502.69

If we focus on the Degrees of Reading Power tests, it appears that Pre-K participants and non-participants are still performing at fairly close levels, both in terms of average scores and the percentage identified for remediation.

Degrees of Reading Power – Mean Scores and Remediation				
Grade	Group	Average DRP (.75) Score	Standard Dev.	Percentage Identified for Remediation
2	Pre-K	35.84	13.58	8.49
	No Pre-K	38.28	14.39	8.14
	Full Cohort	37.97	14.32	8.26
4	Pre-K	55.06	13.09	20.41
	No Pre-K	56.31	13.83	17.11
	Full Cohort	56.17	13.80	17.49

On a handful of tests, however, Pre-K participants scored significantly lower than non-participants. The following table presents the average SOL scores for tests in which Pre-K students scored lower than non-participants.

Standards of Learning – Mean Scores						
Group	Gr3 SOL English	Gr3 SOL History	Gr3 SOL Science	Gr4 SOL Reading	Gr4 SOL History	Gr5 SOL Science
Pre-K	439.60	495.00	477.10	477.08	472.07	456.26
No Pre-K	457.85	510.35	495.34	491.76	484.16	468.34
Full Cohort	455.27	508.09	492.67	489.71	482.35	466.89

Thus, beyond the first grade, it appears that students who had attended a Pre-K program performed at the same level or lower than non-participating students on almost all tests administered after kindergarten. In the following sections, we examine the scores of students in specific Pre-K programs and provide comparisons between each.

Specific Prekindergarten Programs

In this section, we compare specific Pre-K programs in order to determine whether they display a difference in terms of future academic performance. As an organizational issue, our main comparisons include Montessori versus VPI programs and Special Education versus Dual Enrolled Special Education programs. An appendix provides tables comparing all of these groups together.

Montessori and VPI

There were 159 Montessori students included in the APS cohort. Of these students, approximately half were designated as economically disadvantaged when they entered the program. Further, 1.9 percent of these students were listed as disabled in 2003-2004, and 29.6 percent were designated Limited English Proficient in 2004-2005.⁶ As for racial/ethnic composition, 41.5 percent of the Montessori participants were Hispanic, 27 percent White, 19.5 percent Black, and 11.9 percent Asian. The group was split evenly in terms of gender, with 49.7 percent female representation.

By comparison, 90 students participated in VPI. As would be expected due to the eligibility requirements of the program, a much larger percentage of these students (86.7 percent) were designated as economically disadvantaged when they started prekindergarten.⁷ Only 1 student was disabled in 2003-2004 (1.1 percent), while 42.2 percent were Limited English Proficient in 2004-2005. 72.2 percent of the VPI group was listed as Hispanic, 11.1 percent Asian, 10 percent Black, and 6.7 percent White. As for gender, the group is fairly evenly split, with 47.8 percent female representation.

In terms of mean scores, Montessori students outperformed VPI students on all assessments, including PALS, DRP, and SOL tests, from kindergarten through the fifth grade. For example, the table below presents second and fourth grade DRP scores for these two groups.⁸

⁶ These were the earliest dates for which these designations were provided in the dataset.

⁷ <http://www2.apsva.us/154010811517413/blank/browse.asp?a=383&BMDRN=2000&BCOB=0&c=54620>

⁸ Note that while a higher percentage of Montessori students were identified for remediation on the second grade DRP (.75), this may not be an accurate count. For example one VPI student who received a score of 15 on the DRP (.75) was not flagged for remediation, while another VPI student receiving the same score did receive this recommendation. This was the same case for three Montessori students. If we include these students in the count, 15.38 percent of VPI students and 12.99 percent of Montessori students were identified for remediation.

Degrees of Reading Power – Montessori and VPI Comparison				
Grade	Group	Average DRP (.75) Score	Standard Dev.	Percentage Identified for Remediation
2	Montessori	36.61	13.43	9.09%
	VPI	27.77	10.88	7.69%
4	Montessori	56.58	13.77	18.46%
	VPI	48.67	8.55	25.00%

In terms of SOL scores, the difference is particularly pronounced in the third and fourth grade administrations of the tests. The table below displays the disparity in SOL test scores, with the majority of scores presenting a difference of at least 25 points.

Standards of Learning – Montessori and VPI Score Comparison							
Group	Gr3 SOL English	Gr3 SOL Math	Gr3 SOL History	Gr3 SOL Science	Gr4 SOL Reading	Gr4 SOL Math	Gr4 SOL History
Montessori	452.66	509.27	512.47	481.04	489.49	475.09	488.10
VPI	424.82	474.16	458.74	463.09	454.69	441.90	443.07

While Montessori participants continue to outperform VPI students on all subsequent assessments, by the fifth grade this gap in scores narrows. The table below presents fifth grade SOL scores, all of which differ by 15 points or fewer between the two programs.

Standards of Learning – Montessori and VPI Score Comparison				
Group	Gr5 Reading	Gr5 Math	Gr5 Science	Gr5 Writing
Montessori	485.83	505.21	460.85	480.92
VPI	473.22	490.15	450.12	473.75

Further, in terms of passing rates, the Montessori and VPI programs appear to be much more comparable. In fact, participants of the VPI program had slightly higher passing rates than Montessori participants on the Grade 3 Science SOL, Grade 4 Reading SOL, Grade 5 Reading SOL, and Grade 5 Mathematics SOL. The table below displays SOL passing rates for a selection of third, fourth, and fifth grade assessments.

Comparison of Montessori and VPI Participant SOL Pass Rates											
Grade	Group	Eng: Reading ⁹		Eng: Writing		Mathematics		History		Science	
		#	%	#	%	#	%	#	%	#	%
		Tested	Passing	Tested	Passing	Tested	Passing	Tested	Passing	Tested	Passing
3	Montessori	89	74.16	-	-	90	86.67	90	88.89	90	86.67
	VPI	33	60.61	-	-	37	81.08	34	82.35	34	88.24
4	Montessori	81	91.36	-	-	81	80.25	81	90.12	-	-
	VPI	26	92.31	-	-	29	68.97	29	82.76	-	-
5	Montessori	75	81.33	72	90.28	75	82.67	-	-	75	88.00
	VPI	27	88.89	24	87.50	27	85.19	-	-	25	80.00

Special Education and Dual Enrolled Special Education

92 students participated in an APS special education prekindergarten program. Of these students, 40.2 percent were designated as economically disadvantaged when they entered Pre-K. Only 1 student (1.09 percent) was listed as disabled in 2003-2004. However, 36.6 percent of these students were listed as disabled in the following year. Further, 15 percent of special education students were designated as Limited English Proficient in 2004-2005.

In terms of racial/ethnic composition, 45.7 percent of special education students were listed as Hispanic, 38 percent White, 9.8 percent Black, and 6.5 percent Asian. As for gender, the group has a rather high proportion of males to females, with 72.8 percent male representation.

By comparison, 51 dual enrolled special education students were included in the APS cohort. 5.88 percent of these students were designated as economically disadvantaged when they started Pre-K, 11.76 percent were listed as disabled in 2003-2004, and 5.88 percent were Limited English Proficient in 2004-2005. 62.7 percent of these students were listed as White, 23.5 percent Hispanic, 7.8 percent Asian, and 5.9 percent Black. This group also has a higher proportion of males to females, with 66.7 percent male representation.

Overall, dual enrolled students scored higher than special education students across the board. For example, the following table displays a comparison of kindergarten and first grade PALS scores for these two groups.

⁹ Note that for the Grade 3 English SOL, scores were provided under the variables "Gr3SOLSSENG," "Gr3SOLSSREAD," and "Gr3SOLSSG3WRI," but there is only one "Gr3SOLpfENG" indicating whether a student passed or failed. The passing percentage provided in this table for Grade 3 Eng: Reading refers to the variable: "Gr3SOLpfENG."

Kindergarten and Grade 1 PALS – Special Ed and Dual Enrolled Comparison					
Grade	Group	Fall PALS		Spring PALS	
		Score	% Needing Remediation	Score	% Needing Remediation
K	Special Ed	41.13	42.5	63.50	25.00
	Dual Enrolled	61.72	8.00	80.50	0.00
1	Special Ed	44.21	45.83	40.35	34.78
	Dual Enrolled	47.75	30.00	43.67	14.29

One exception to this pattern is presented by the second grade DRP test, where special education students received an average DRP (.75) score of 47, compared to the dual-enrolled group's 37.5. However, in this case, scores for only two special education students were recorded. With such a small sample, this score may not be useful for making generalizations. The following table presents second and fourth grade DRP scores for these two groups.

Degrees of Reading Power – Special Ed and Dual Enrolled Comparison				
Grade	Group	Average DRP (.75) Score	Standard Dev.	% Needing Remediation
2	Special Ed	47.00	16.97	0.00
	Dual Enrolled	37.50	14.63	7.14
4	Special Ed	49.20	12.48	40.00
	Dual Enrolled	55.50	12.24	18.75

An interesting point to note is the extremely high SOL passing rate of dual enrolled students. On the majority of assessments, these students even outperformed the Montessori group. The following table presents SOL passing rates for special education, dual enrolled, and Montessori students.

Comparison of Montessori, Dual Enrolled, and Special Education SOL Pass Rates											
Grade	Program	Eng: Reading ¹⁰		Eng: Writing		Mathematics		History		Science	
		#	%	#	%	#	%	#	%	#	%
		Tested	Passing	Tested	Passing	Tested	Passing	Tested	Passing	Tested	Passing
3	Montessori	89	74.16	-	-	90	86.67	90	88.89	90	86.67
	Dual Enrolled	21	76.19	-	-	22	95.45	21	95.24	21	100.00
	Special Ed	18	38.89	-	-	20	75.00	18	72.22	18	66.67
4	Montessori	81	91.36	-	-	81	80.25	81	90.12	-	-
	Dual Enrolled	22	95.45	-	-	22	90.91	21	90.48	-	-
	Special Ed	18	66.67	-	-	20	50.00	18	66.67	-	-
5	Montessori	75	81.33	72	90.28	75	82.67	-	-	75	88.00
	Dual Enrolled	21	90.48	20	90.00	21	95.24	-	-	21	95.24
	Special Ed	18	61.11	16	75.00	18	72.22	-	-	17	58.82

¹⁰ The passing percentage provided in this table for Grade 3 Eng: Reading refers to the variable: "Gr3SOLpfENG."

Upon reviewing the differences in student performance by program, another point to keep in mind is the composition of students in these programs. In the following sections, we divide Pre-K participants and non-participants by their classification as economically disadvantaged and Limited English Proficient. It is plausible that Pre-K education could have a different level of impact on students in either of these categories than it would other students.

Economically Disadvantaged Students

Since economically disadvantaged (ED) status is reviewed each year, we begin by examining students who were designated ED as early as prekindergarten (or kindergarten, for students who did not attend Pre-K). As they progress through school, some of these students are no longer classified as ED. Therefore, we exclude them from our analysis beginning in the year during which they changed status.

Our main rationale for using this method is that we are attempting to isolate the interaction of ED status and prekindergarten participation on student academic performance. As participation in a Pre-K program takes place at the beginning of a student's formal educational experience, we aim to examine students who are also classified as economically disadvantaged at that stage. Arguably, students who are economically disadvantaged at an earlier period of their education will experience different effects than students who later become classified as ED. By this logic, it would not make sense to include students who become economically disadvantaged after Pre-K or kindergarten.

We remove students from the cohort as their status changes to ensure that we are only looking at students who are economically disadvantaged. We do the same for non-participants so that we are comparing two roughly similar groups that differ only in their participation or non-participation in Pre-K programs.

As an example, for Pre-K students, we take all of the individuals who are classified as ED in the year 2000-2001. Among this group, we then look for students who are still classified as ED in 2001-2002. For these students, we tabulate the average scores and standard deviations for their fall and spring kindergarten PALS and report these results. Moving on to the next year, we remove any students no longer classified as ED in 2002-2003 from the group. For the remaining students, we calculate the means and standard deviations of their fall and spring first grade PALS and report these results. We continue in this manner through the fifth grade assessments, weeding out individuals no longer classified as ED each year. We do the same for ED students who were not enrolled in a Pre-K program. Using this method, we identified 198 participants listed as ED when they entered prekindergarten and 617 non-participants listed as ED when they entered kindergarten.

Pre-K Participants versus Non-Participants

As mentioned at the outset of the report, one of the most interesting results of our investigation regarded the performance of ED students who had participated in Pre-K programs. This group outperformed ED non-participants on *every assessment* through fifth grade. For example, the following table provides details on the two groups' kindergarten and first grade PALS scores.

Kindergarten and Grade 1 PALS – Economically Disadvantaged Students					
Grade	Group	Fall PALS		Spring PALS	
		Score	% Needing Remediation	Score	% Needing Remediation
K	ED Pre-K	57.62	22.48	86.03	5.56
	ED No Pre-K	40.43	42.14	75.41	27.17
1	ED Pre-K	51.07	20.59	46.54	20.00
	ED No Pre-K	44.96	39.45	42.98	25.69

Despite this trend, the disparity in scores, remediation, and pass rates fluctuates throughout these students' educational experiences. For example, third grade writing SOL scores were very close, with Pre-K participants receiving an average score of 30.98, and non-participants averaging scores of 30.40. Third grade reading SOL scores were almost as close, with Pre-K participants scoring 33.63 and non-participants averaging scores of 32.35. The difference is also less pronounced in second and fourth grade DRP tests.

Degrees of Reading Power – Economically Disadvantaged Students				
Grade	Group	Average DRP (.75) Score	Standard Dev.	% Needing Remediation
2	ED Pre-K	30.08	13.88	7.69
	ED No Pre-K	29.69	11.70	16.90
4	ED Pre-K	48.45	12.09	30.00
	ED No Pre-K	45.87	9.35	37.31

On a number of SOL tests, aside from third grade reading and writing, the disparity is quite large. The table below displays this difference in scores for a selection of assessments.

Standards of Learning – Economically Disadvantaged Students							
Group	Gr3 Math	Gr3 History	Gr4 Reading	Gr4 Math	Gr4 History	Gr5 Reading	Gr5 Math
ED Pre-K	476.98	469.16	457.81	440.48	451.31	455.14	492.93
ED No Pre-K	460.61	447.94	434.99	418.15	432.93	430.07	462.41

Montessori versus VPI

Due to the substantial percentage of economically disadvantaged students in the VPI and Montessori programs, we further break down the ED data set by Pre-K program affiliation.

Economically disadvantaged students in the Montessori program outscored VPI students by a fairly wide margin on their kindergarten fall and spring PALS. However, in the first grade, this gap closes dramatically, with VPI students outscoring Montessori students by two points in the fall and Montessori students outscoring VPI students by less than a point in the spring. The following chart displays these scores.

Kindergarten and Grade 1 PALS – Economically Disadvantaged Students					
Grade	Group	Fall PALS		Spring PALS	
		Score	% Needing Remediation	Score	% Needing Remediation
K	ED Montessori	69.37	17.65	99.82	0.00
	ED VPI	54.66	19.67	76.36	7.14
1	ED Montessori	52.18	18.18	48.66	11.43
	ED VPI	54.69	15.38	47.88	23.08

This trend appears again in DRP scores. On their second grade DRP (.75), Montessori students outscored their VPI counterparts by nearly ten points. On their fourth grade DRP, however, the difference fell within three points.

Degrees of Reading Power – Economically Disadvantaged Students				
Grade	Group	Average DRP (.75) Score	Standard Dev.	% Needing Remediation
2	ED Montessori	32.63	14.23	5.26
	ED VPI	23.14	10.90	14.29
4	ED Montessori	48.92	13.82	33.33
	ED VPI	46.00	9.13	28.57

SOL tests displayed less predictable variation. Here, VPI students outscore Montessori students on some tests, while Montessori students outscore VPI students on others. The following table includes a sample of these scores.

Standards of Learning – Economically Disadvantaged Students							
Group	Gr3 English	Gr3 History	Gr3 Science	Gr4 Reading	Gr4 Math	Gr5 Math	Gr5 Science
ED Montessori	423.84	485.12	449.48	461.29	434.24	492.54	437.92
ED VPI	423.50	459.25	461.20	456.36	450.50	489.17	451.36

It is important to keep in mind that since we are observing a subset of each Pre-K program, we are dealing with a relatively small number of students. However, based on the available data, there does not appear to be a long-term difference between ED students in Montessori and VPI programs. Coupled with the earlier observation that ED students who participated in any Pre-K program outperform non-participant ED students on assessments, these findings suggest that economically disadvantaged students benefit from either of these Pre-K offerings.

Limited English Proficient Students

As indicated earlier, the data set designated students as Limited English Proficient beginning in 2004-2005. Based on the definition of LEP students, provided by the Virginia Department of Education,¹¹ we made the assumption that students listed as LEP in that year were most likely LEP in previous years, too. Through a method comparable to that employed for economically disadvantaged students, we exclude students whose LEP statuses change from our calculations of mean assessment scores.

Among Pre-K participants, 102 individuals were designated as LEP in 2004-2005. 572 Pre-K non-participants were designated as LEP in that year.

Pre-K Participants versus Non-Participants

Overall, LEP students who participated in a Pre-K program outperformed students who did not participate. This was particularly apparent in their kindergarten assessments. The following table presents kindergarten and first grade PALS scores for LEP Pre-K participants and non-participants.

Kindergarten and Grade 1 PALS – Limited English Proficient Students					
Grade	Group	Fall PALS		Spring PALS	
		Score	% Needing Remediation	Score	% Needing Remediation
K	LEP Pre-K	62.52	22.83	91.57	3.57
	LEP No Pre-K	43.01	39.93	74.37	32.26
1	LEP Pre-K	52.41	24.14	48.59	15.56
	LEP No Pre-K	44.93	39.68	43.18	26.48

Like economically disadvantaged students, LEP students who participated in Pre-K programs maintained their lead over non-participants, but the differences fluctuated from test to test. For example, DRP scores were much closer than the PALS scores. In their second grade DRP (.75), Pre-K participants outperformed non-participants by a fraction of a point and approximately two points on the fourth grade administration of the test. The following table presents DRP scores for LEP students in the two groups.

¹¹ <http://www.doe.virginia.gov/VDOE/Instruction/ESL/LEPDef.pdf>

Degrees of Reading Power – Limited English Proficient Students				
Grade	Group	Average DRP (.75) Score	Standard Dev.	% Needing Remediation
2	LEP Pre-K	33.53	12.18	8.82
	LEP No Pre-K	33.39	10.59	7.23
4	LEP Pre-K	52.68	11.21	19.35
	LEP No Pre-K	50.34	8.96	18.56

LEP Pre-K participants also outperformed non-participants on SOL tests, though once again, the disparity in scores fluctuated greatly. For example, fourth grade reading SOL scores fell within approximately two points of each other, while third grade history scores differed by nearly 25 points. A sample of SOL scores displaying these variations is provided below.

Standards of Learning – Limited English Proficient Students							
Group	Gr3 English	Gr3 History	Gr3 Science	Gr4 Reading	Gr4 Math	Gr5 Reading	Gr5 Math
LEP Pre-K	428.68	481.02	462.59	452.89	447.40	452.55	481.49
LEP No Pre-K	416.90	456.30	449.24	450.51	426.80	435.09	463.93

Montessori versus VPI

We examined LEP-designated Montessori and VPI students in order to determine whether students from one program exhibit higher academic performance than students from the other. We found that Montessori LEP students received higher scores than VPI LEP students on almost every assessment through the fourth grade. The following table provides PALS scores for these students.

Kindergarten and Grade 1 PALS – Limited English Proficient Students					
Grade	Group	Fall PALS		Spring PALS	
		Score	% Needing Remediation	Score	% Needing Remediation
K	LEP Montessori	78.27	15.91	102.81	0.00
	LEP VPI	52.49	25.71	82.13	0.00
1	LEP Montessori	54.60	21.43	52.86	4.55
	LEP VPI	53.59	21.88	46.85	21.21

As displayed above, Montessori LEP students received substantially higher scores than VPI students on their kindergarten fall and spring PALS tests. First grade PALS test scores are much closer.

Montessori LEP students also outscored VPI students on their second and fourth grade DRP tests, as shown in the table below.

Degrees of Reading Power – Limited English Proficient Students				
Grade	Group	Average DRP (.75) Score	Standard Dev.	% Needing Remediation
2	LEP Montessori	35.60	11.80	8.00
	LEP VPI	27.78	11.99	11.11
4	LEP Montessori	54.75	11.78	15.00
	LEP VPI	47.80	9.17	30.00

With the exception of the third grade science SOL, Montessori students outperform VPI students on all third and fourth grade SOL assessments. However, in the fifth grade, the trend reverses and VPI students begin to receive higher scores on each SOL. A sample of students' SOL scores is presented below.

Standards of Learning – Limited English Proficient Students							
Group	Gr3 English	Gr3 History	Gr3 Science	Gr4 Reading	Gr4 Math	Gr5 Reading	Gr5 Math
LEP Montessori	441.50	505.95	462.14	461.58	460.55	449.06	487.88
LEP VPI	423.66	456.50	464.40	451.64	443.80	468.57	490.38

Thus, it appears that LEP students who are placed in a Montessori Pre-K program generally perform higher than VPI LEP students. The data indicate, however, that as students get older, the performance differences begin to decrease. Like economically disadvantaged students, it appears that Montessori and VPI Pre-K programs have a beneficial effect on future academic performance. In the case of LEP students, placement in Montessori programs may have the stronger positive impact on student performance than placement in VPI programs.

Appendix A – Summary Tables

Kindergarten and Grade 1 PALS – Score and Remediation Summary							
Grade	Group	Fall PALS			Spring PALS		
		# Tested	Score	% Needing Remediation	# Tested	Score	% Needing Remediation
K	All Students ¹²	1488	62.83	21.24	215	85.35	16.28
	Pre-K	264	67.34	18.18	77	94.57	3.90
	No Pre-K	1215	61.84	21.89	137	80.22	23.36
	Montessori	123	85.41	9.76	56	101.91	1.79
	VPI	76	53.72	22.37	15	77.33	6.67
	Special Ed	40	41.13	42.50	4	63.50	25.00
	Dual Enrolled	25	61.72	8.00	2	80.50	0.00
1	All Students	1102	55.17	21.78	1122	49.90	13.90
	Pre-K	169	54.78	22.49	173	48.87	15.03
	No Pre-K	924	55.35	21.65	940	50.27	13.40
	Montessori	89	59.16	15.73	92	52.92	7.61
	VPI	36	54.89	19.44	37	47.05	21.62
	Special Ed	24	44.21	45.83	23	40.35	34.78
	Dual Enrolled	20	47.75	30.00	21	43.67	14.29

¹² Note that the sum of Pre-K and No Pre-K students does not add up to the All Students category. The Pre-K and No Pre-K categories refer to students who were designated as having participated in a Pre-K program or were listed as “None.” The All Students category refers to all students for which scores were available on a specific test.

Degrees of Reading Power – Score and Remediation Summary					
Grade	Group	# Tested	Average DRP (.75) Score	Standard Dev.	% Needing Remediation
2	All Students	908	37.97	14.32	8.26%
	Pre-K	106	35.84	13.58	8.49%
	No Pre-K	799	38.28	14.39	8.14%
	Montessori	77	36.61	13.43	9.09%
	VPI	13	27.77	10.88	7.69%
	Special Ed	2	47.00	16.97	0%
	Dual Enrolled	14	37.50	14.63	7.14%
4	All Students	926	56.17	13.80	17.49%
	Pre-K	98	55.06	13.09	20.41%
	No Pre-K	824	56.31	13.83	17.11%
	Montessori	65	56.58	13.77	18.46%
	VPI	12	48.67	8.55	25.00%
	Special Ed	5	49.20	12.48	40.00%
	Dual Enrolled	16	55.50%	12.24	18.75%

Standards of Learning – Passing Rates Summary											
Grade	Program	Eng: Reading ¹³		Eng: Writing		Mathematics		History		Science	
		# Tested	% Passing	# Tested	% Passing	# Tested	% Passing	# Tested	% Passing	# Tested	% Passing
3	All Students	1270	76.14	-	-	1361	87.51	1258	88.63	1260	88.81
	PreK	161	67.70	-	-	169	85.21	163	86.50	163	86.50
	No PreK	1101	77.57	-	-	1183	87.91	1086	88.95	1088	89.15
	Montessori	89	74.16	-	-	90	86.67	90	88.89	90	86.67
	VPI	33	60.61	-	-	37	81.08	34	82.35	34	88.24
	Special Ed	18	38.89	-	-	20	75.00	18	72.22	18	66.67
	Dual Enrolled	21	76.19	-	-	22	95.45	21	95.24	21	100.00
4	All Students	1202	88.94	-	-	1309	76.93	1258	84.02	-	-
	PreK	147	89.12	-	-	152	75.66	149	85.91	-	-
	No PreK	1048	89.03	-	-	1150	77.39	1102	83.94	-	-
	Montessori	81	91.36	-	-	81	80.25	81	90.12	-	-
	VPI	26	92.31	-	-	29	68.97	29	82.76	-	-
	Special Ed	18	66.67	-	-	20	50.00	18	66.67	-	-
	Dual Enrolled	22	95.45	-	-	22	90.91	21	90.48	-	-
5	All Students	1248	84.21	1190	92.44	1273	86.57	-	-	1210	88.10
	PreK	141	81.56	132	87.88	141	83.69	-	-	138	84.06
	No PreK	1101	84.56	1052	92.97	1126	87.03	-	-	1066	88.56
	Montessori	75	81.33	72	90.28	75	82.67	-	-	75	88.00
	VPI	27	88.89	24	87.50	27	85.19	-	-	25	80.00
	Special Ed	18	61.11	16	75.00	18	72.22	-	-	17	58.82
	Dual Enrolled	21	90.48	20	90.00	21	95.24	-	-	21	95.24

¹³ The passing percentage provided in this table for Grade 3 Eng: Reading refers to the variable: “Gr3SOLpfENG.”

Standards of Learning – Score Summary						
Grade	Program	Eng: Reading	Eng: Writing	Mathematics	History	Science
3	All Students	36.22	35.23	504.59	508.09	492.67
	Pre-K	34.80	33.33	500.30	495.00	477.10
	No Pre-K	36.47	35.53	505.53	510.35	495.34
	Montessori	35.96	34.65	509.27	512.47	481.04
	VPI	33.97	31.30	474.16	458.74	463.09
	Special Ed	31.17	29.17	471.25	459.78	453.00
	Dual Enrolled	34.29	34.48	533.95	509.05	503.57
4	All Students	489.71	-	469.05	482.35	-
	Pre-K	477.08	-	463.31	472.07	-
	No Pre-K	491.76	-	470.19	484.16	-
	Montessori	489.49	-	475.09	488.10	-
	VPI	454.69	-	441.90	443.07	-
	Special Ed	426.22	-	420.10	441.33	-
	Dual Enrolled	499.45	-	487.45	476.62	-
5	All Students	480.97	481.75	502.69	-	466.89
	Pre-K	475.35	472.69	498.28	-	456.26
	No Pre-K	481.96	482.99	503.50	-	468.34
	Montessori	485.83	480.92	505.21	-	460.85
	VPI	473.22	473.75	490.15	-	450.12
	Special Ed	419.00	436.06	447.50	-	415.29
	Dual Enrolled	488.95	471.10	527.52	-	480.33

Appendix B – Description of Excel File

The Excel file that accompanies this report, entitled “APS Summary Assessment File,” includes mean scores, standard deviations, pass rates, and percentages of students identified for remediation for each performance measure that was included in the original “APS PK Cohort” data file. The first worksheet, entitled “Cohort Breakdown,” lists these values for each major subset of the data including:

- ❖ Full APS Cohort
- ❖ All Pre-K Attendees
- ❖ No Pre-K
- ❖ Montessori
- ❖ Virginia Preschool Initiative
- ❖ Special Education
- ❖ Dual Enrolled Special Education

For every measure, each subset has a numerical value (i.e., the number of students who took the test, number of students who passed, number identified for remediation, etc.), a mean score (or percentage in the case of pass rates or remediation), and a standard deviation, if applicable.

The second worksheet, titled “ED and LEP” presents similar data for Pre-K participants and non-participants, broken down by economically disadvantaged and Limited English Proficient status.

The third and final worksheet provides similar data for Montessori and VPI students, broken down by economically disadvantaged and LEP status.

Note

This brief was written to fulfill the specific request of an individual member of The Hanover Research Council. As such, it may not satisfy the needs of all members. We encourage any and all members who have additional questions about this topic – or any other – to contact us.

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