

Appendix F

Outcomes

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Pre-K Phonological Awareness Literacy Screening (PALS)

The Phonological Awareness Literacy Screening (PALS) provides a comprehensive assessment of young children's knowledge of the important literacy fundamentals that are predictive of future reading success. PALS is the state-provided screening tool for Virginia's Early Intervention Reading Initiative (EIRI) and is used by 99% of school divisions in Virginia on a voluntary basis.

PALS consists of three instruments, PALS-PreK (for preschool students), PALS-K (for kindergartners), and PALS 1-3 (for students in Grades 1-3). PALS assessments are designed to identify students in need of additional reading instruction beyond that provided to typically developing readers. PALS also informs teachers' instruction by providing them with explicit information about their students' knowledge of literacy fundamentals. Mid-year assessment and PALS Quick Checks allow for ongoing student progress monitoring throughout the year.

In APS, all students in VPI and four-year-old special education Pre-K take this assessment three times annually. Starting in the 2015-2016 school year, four-year-olds in primary Montessori take the Pre-K PALS assessment as well. This report includes three years of PALS data of VPI and two years of PALS data for special education.

Table 1: Pre-K PALS Developmental Ranges

PALS Task	Pre-K Developmental Range
Name Writing	5-7
Upper-Case Alphabet Recognition	12-21
Lower-Case Alphabet Recognition	9-17
Letter Sounds	4-8
Beginning Sound Awareness	5-8
Print and Word Awareness	7-9
Rhyme Awareness	5-7
Nursery Rhyme Awareness	6-10

VPI Pre-K PALS Results

Figure 1: Fall 2015-16, Percent of VPI Students Meeting Pre-K PALS Developmental Ranges

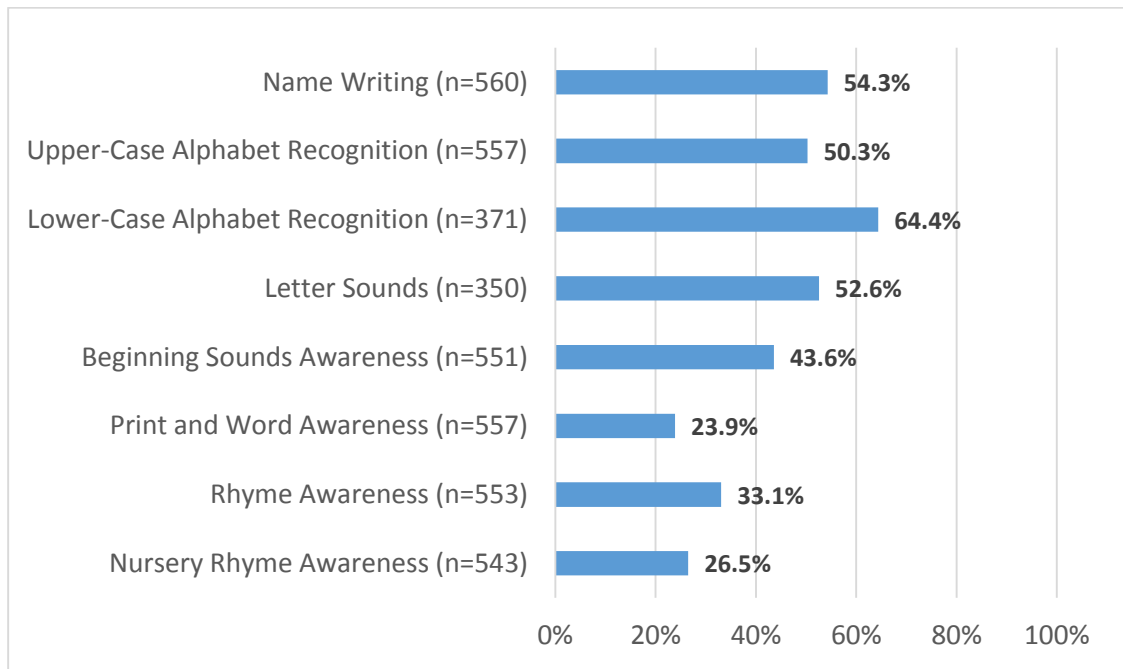


Figure 2: Spring 2015-16, Percent of VPI Students Meeting Pre-K PALS Developmental Ranges

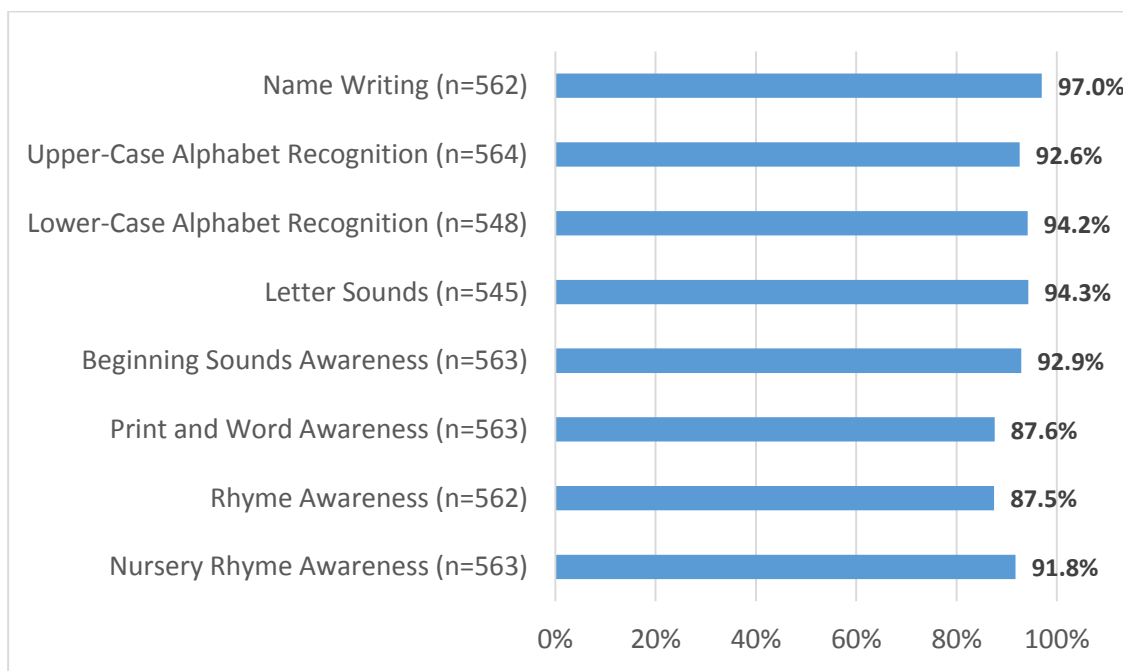


Figure 3: Fall 2014-15, Percent of VPI Students Meeting Pre-K PALS Developmental Ranges

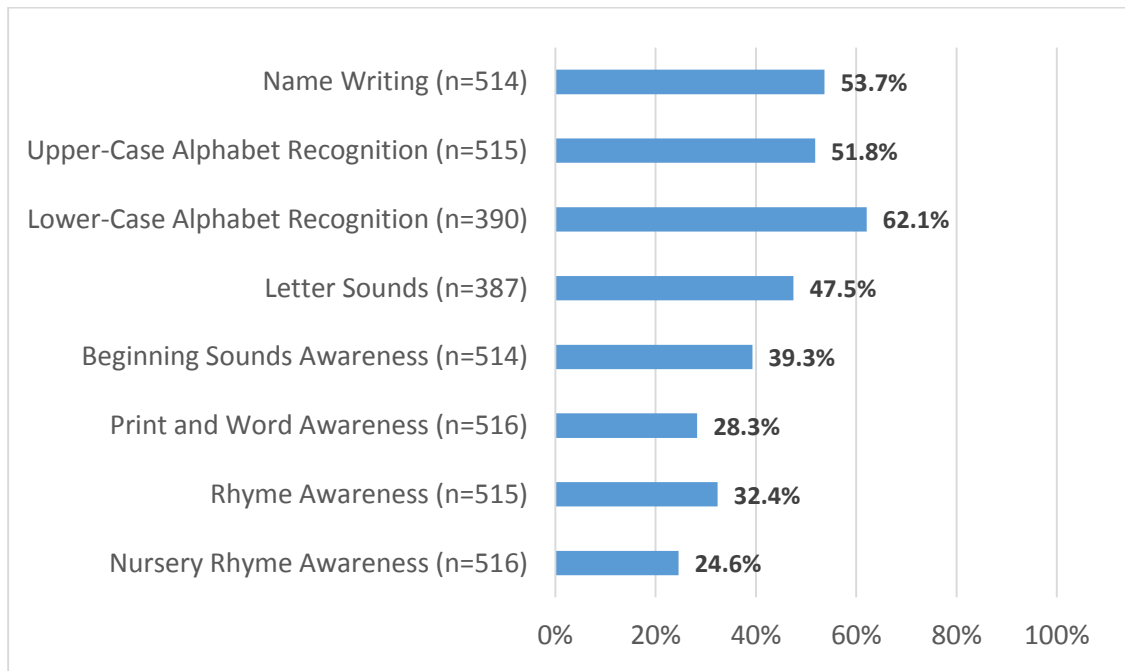


Figure 4: Spring 2014-15, Percent of VPI Students Meeting Pre-K PALS Developmental Ranges

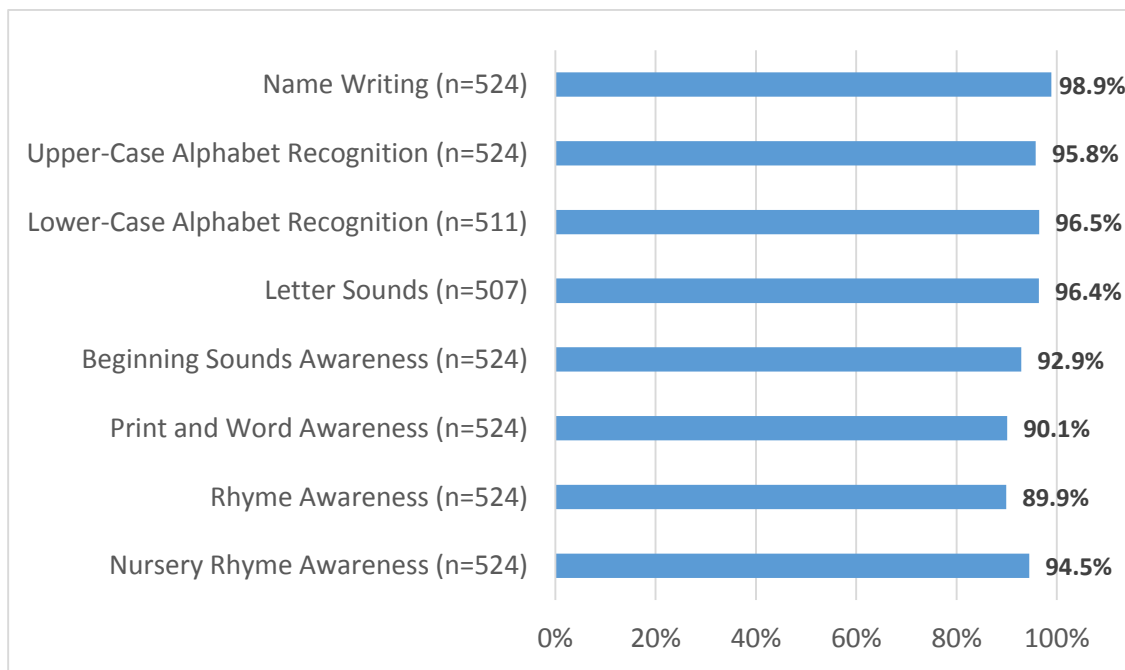


Figure 5: Fall 2013-14, Percent of VPI Students Meeting Pre-K PALS Developmental Ranges

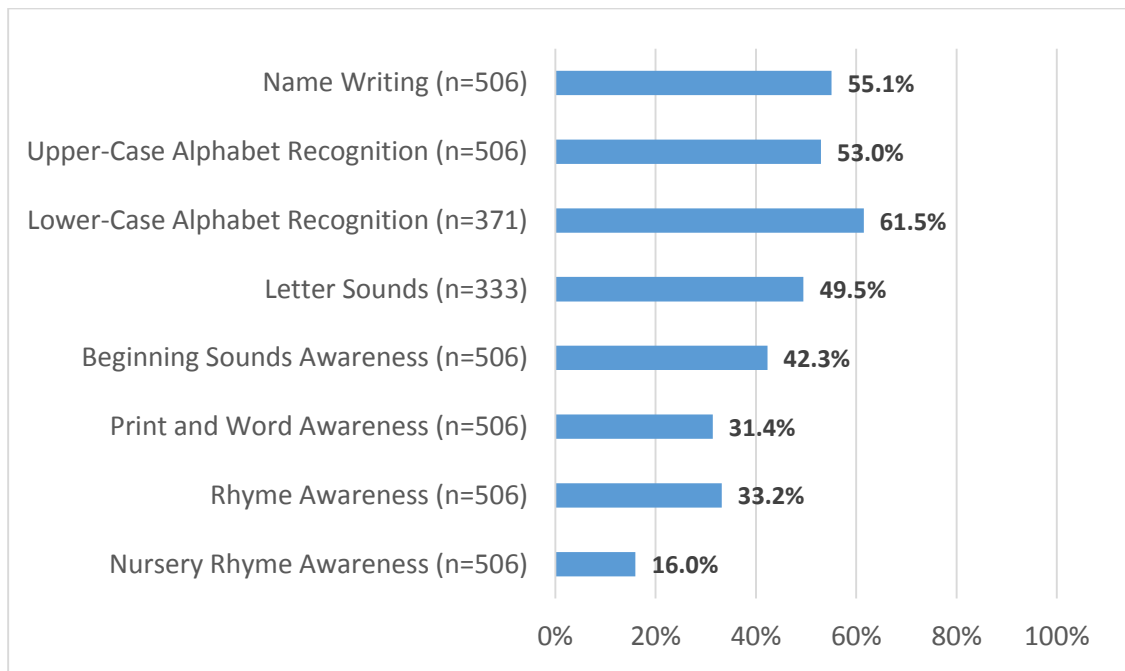


Figure 6: Spring 2013-14, Percent of VPI Students Meeting Pre-K PALS Developmental Ranges

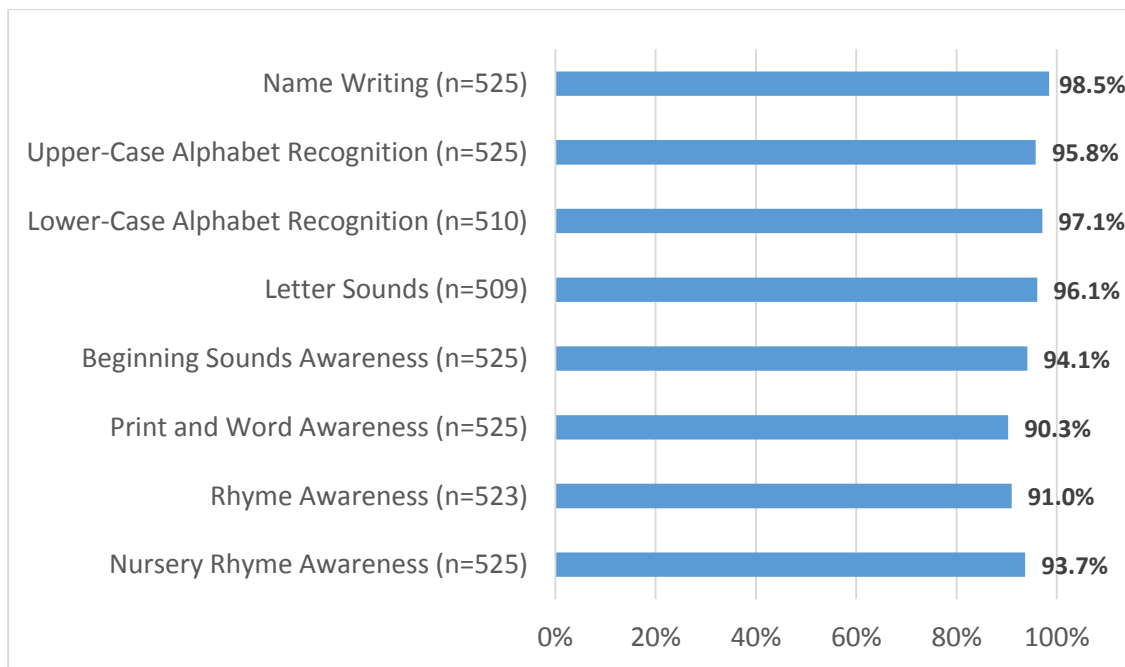


Table 2: 2015-16, Percent of VPI Students Meeting Pre-K PALS Developmental Ranges by LEP Status

		Name Writing	Upper-Case Alphabet Recognition	Lower-Case Alphabet Recognition	Letter Sounds	Beginning Sound Awareness	Print and Word Awareness	Rhyme Awareness	Nursery Rhyme Awareness
Non-LEP	Fall n	113	112	85	82	113	113	113	108
	Fall Percent	62.8%	61.6%	69.4%	63.4%	55.8%	39.8%	47.8%	42.6%
	Spring n	114	114	108	108	114	113	113	113
	Spring Percent	97.4%	92.1%	96.3%	97.2%	96.5%	95.6%	94.7%	96.5%
LEP	Fall n	418	415	267	250	407	414	410	406
	Fall Percent	52.9%	47.7%	64.0%	48.8%	40.3%	19.6%	29.5%	22.7%
	Spring n	439	440	430	427	439	440	439	440
	Spring Percent	97.3%	93.2%	94.4%	93.9%	92.3%	85.9%	86.3%	90.9%

Table 3: 2014-15, Percent of VPI Students Meeting Pre-K PALS Developmental Ranges by LEP Status

		Name Writing	Upper-Case Alphabet Recognition	Lower-Case Alphabet Recognition	Letter Sounds	Beginning Sound Awareness	Print and Word Awareness	Rhyme Awareness	Nursery Rhyme Awareness
Non-LEP	Fall n	109	108	95	95	109	109	109	109
	Fall Percent	63.3%	73.1%	75.8%	56.8%	60.6%	47.7%	55.0%	43.1%
	Spring n	117	117	116	116	117	117	117	117
	Spring Percent	99.1%	97.4%	97.4%	96.6%	99.1%	98.3%	93.2%	99.1%
LEP	Fall n	372	372	266	265	370	372	371	372
	Fall Percent	50.5%	44.4%	55.6%	44.2%	33.5%	21.8%	27.0%	19.1%
	Spring n	390	390	379	376	390	390	390	390
	Spring Percent	99.0%	95.4%	96.0%	96.3%	91.3%	87.9%	88.7%	93.3%

Table 4: 2013-14, Percent of VPI Students Meeting Pre-K PALS Developmental Ranges by LEP Status

		Name Writing	Upper-Case Alphabet Recognition	Lower-Case Alphabet Recognition	Letter Sounds	Beginning Sound Awareness	Print and Word Awareness	Rhyme Awareness	Nursery Rhyme Awareness
Non-LEP	Fall n	136	136	111	106	136	136	136	136
	Fall Percent	65.4%	69.9%	79.3%	65.1%	63.2%	50.0%	53.7%	30.9%
	Spring n	146	146	143	143	146	146	145	146
	Spring Percent	99.3%	97.9%	98.6%	98.6%	97.3%	93.8%	95.9%	95.2%
LEP	Fall n	352	352	248	216	352	352	352	352
	Fall Percent	49.7%	45.7%	52.8%	40.3%	33.2%	23.9%	24.1%	9.4%
	Spring n	370	370	359	358	370	370	369	370
	Spring Percent	98.1%	95.1%	96.7%	95.3%	93.0%	89.2%	89.7%	93.2%

Table 5: 2015-16, Percent of VPI Students Meeting Pre-K PALS Developmental Ranges by Disadvantage Status

		Name Writing	Upper-Case Alphabet Recognition	Lower-Case Alphabet Recognition	Letter Sounds	Beginning Sound Awareness	Print and Word Awareness	Rhyme Awareness	Nursery Rhyme Awareness
Non-disadvantaged	Fall n	145	143	113	110	141	142	141	136
	Fall Percent	64.8%	65.0%	74.3%	66.4%	63.8%	43.0%	50.4%	36.8%
	Spring n	149	150	147	146	150	149	149	149
	Spring Percent	98.7%	94.7%	95.9%	94.5%	94.0%	91.3%	93.3%	92.6%
Disadvantaged	Fall n	386	384	239	222	379	385	382	378
	Fall Percent	51.3%	45.3%	61.1%	45.5%	36.1%	16.9%	27.2%	23.3%
	Spring n	404	404	391	389	403	404	403	404
	Spring Percent	96.8%	92.3%	94.4%	94.6%	92.8%	86.6%	86.1%	91.8%

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Table 6: 2014-15, Percent of VPI Students Meeting Pre-K PALS Developmental Ranges by Disadvantage Status

		Name Writing	Upper-Case Alphabet Recognition	Lower-Case Alphabet Recognition	Letter Sounds	Beginning Sound Awareness	Print and Word Awareness	Rhyme Awareness	Nursery Rhyme Awareness
Non-disadvantaged	Fall n	91	90	71	70	90	91	91	91
	Fall Percent	65.9%	67.8%	78.9%	64.3%	55.6%	42.9%	48.4%	44.0%
	Spring n	96	96	94	94	96	96	96	96
	Spring Percent	99.0%	97.9%	98.9%	98.9%	97.9%	94.8%	92.7%	99.0%
Disadvantaged	Fall n	390	390	290	290	389	390	389	390
	Fall Percent	50.5%	46.9%	56.6%	43.4%	36.0%	24.1%	29.8%	20.0%
	Spring n	411	411	401	398	411	411	411	411
	Spring Percent	99.0%	95.4%	95.8%	95.7%	92.0%	89.3%	89.1%	93.7%

Table 7: 2013-14, Percent of VPI Students Meeting Pre-K PALS Developmental Ranges by Disadvantage Status

		Name Writing	Upper-Case Alphabet Recognition	Lower-Case Alphabet Recognition	Letter Sounds	Beginning Sound Awareness	Print and Word Awareness	Rhyme Awareness	Nursery Rhyme Awareness
Non-disadvantaged	Fall n	76	76	64	61	76	76	76	76
	Fall Percent	65.8%	73.7%	79.7%	60.7%	69.7%	47.4%	52.6%	27.6%
	Spring n	85	85	83	83	85	85	84	85
	Spring Percent	100.0%	96.5%	98.8%	97.6%	96.5%	95.3%	94.0%	92.9%
Disadvantaged	Fall n	412	412	295	261	412	412	412	412
	Fall Percent	51.9%	48.5%	56.9%	45.6%	36.4%	28.2%	28.6%	13.1%
	Spring n	431	431	419	418	431	431	430	431
	Spring Percent	98.1%	95.8%	96.9%	95.9%	93.7%	89.6%	90.9%	94.0%

Table 8: 2015-16, Percent of VPI Students Meeting Pre-K PALS Developmental Ranges by Ethnicity

		Name Writing	Upper-Case Alphabet Recognition	Lower-Case Alphabet Recognition	Letter Sounds	Beginning Sound Awareness	Print and Word Awareness	Rhyme Awareness	Nursery Rhyme Awareness
Asian	Fall n	60	60	44	39	58	58	59	58
	Fall Percent	63.3%	65.0%	79.5%	61.5%	44.8%	24.1%	22.0%	32.8%
	Spring n	65	65	65	65	65	65	65	65
	Spring Percent	93.8%	95.4%	95.4%	92.3%	87.7%	84.6%	84.6%	89.2%
Black	Fall n	93	93	79	75	92	93	92	93
	Fall Percent	59.1%	73.1%	78.5%	66.7%	55.4%	32.3%	37.0%	44.1%
	Spring n	95	95	93	93	95	94	94	94
	Spring Percent	97.9%	97.9%	100.0%	97.8%	94.7%	94.7%	97.9%	91.6%
Hispanic	Fall n	299	297	167	159	294	299	296	291
	Fall Percent	49.5%	36.7%	55.1%	39.0%	33.7%	16.7%	28.0%	17.5%
	Spring n	309	309	299	297	308	309	308	309
	Spring Percent	97.7%	91.9%	93.3%	93.9%	93.5%	84.8%	85.1%	90.6%
White	Fall n	63	62	50	47	60	61	60	56
	Fall Percent	63.5%	69.4%	66.0%	66.0%	65.0%	44.3%	60.0%	41.1%
	Spring n	65	66	66	65	66	66	66	66
	Spring Percent	98.5%	93.9%	93.9%	95.4%	93.9%	92.4%	93.9%	93.9%
Other	Fall n	16	15	12	12	16	16	16	16
	Fall Percent	68.8%	53.3%	66.7%	58.3%	75.0%	31.3%	56.3%	25.0%
	Spring n	19	19	15	15	15	19	19	19
	Spring Percent	94.7%	73.7%	93.3%	93.3%	94.7%	100.0%	100.0%	89.5%

Table 9: 2014-15, Percent of VPI Students Meeting Pre-K PALS Developmental Ranges by Ethnicity

		Name Writing	Upper-Case Alphabet Recognition	Lower-Case Alphabet Recognition	Letter Sounds	Beginning Sound Awareness	Print and Word Awareness	Rhyme Awareness	Nursery Rhyme Awareness
Asian	Fall n	57	57	53	53	56	57	57	57
	Fall Percent	66.7%	75.4%	77.4%	56.6%	51.8%	35.1%	40.4%	35.1%
	Spring n	60	60	60	59	60	60	60	60
	Spring Percent	100.0%	96.7%	91.7%	93.2%	93.3%	90.0%	88.3%	93.3%
Black	Fall n	94	94	85	86	94	94	94	94
	Fall Percent	58.5%	77.7%	82.45	64.0%	57.4%	41.5%	54.3%	48.9%
	Spring n	101	101	101	101	101	101	101	101
	Spring Percent	100.0%	99.0%	99.0%	98.0%	97.0%	94.1%	93.1%	98.0%
Hispanic	Fall n	270	270	175	174	269	270	269	270
	Fall Percent	45.9%	33.3%	42.3%	32.2%	25.3%	20.4%	19.3%	11.1%
	Spring n	280	280	269	267	280	280	280	280
	Spring Percent	98.6%	94.3%	95.9%	95.9%	90.0%	87.5%	87.5%	93.2%
White	Fall n	46	46	36	35	46	46	46	46
	Fall Percent	65.2%	58.7%	69.4%	57.1%	65.2%	28.3%	60.9%	32.6%
	Spring n	50	50	49	49	50	50	50	50
	Spring Percent	100.0%	96.0%	98.0%	98.0%	100.0%	96.0%	94.0%	98.0%
Other	Fall n	14	13	12	12	14	14	14	14
	Fall Percent	71.4%	84.6%	83.3%	83.3%	64.4%	42.9%	42.9%	50.0%
	Spring n	16	16	16	16	161	16	16	16
	Spring Percent	93.8%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	93.8%

Table 10: 2013-14, Percent of VPI Students Meeting Pre-K PALS Developmental Ranges by Ethnicity

		Name Writing	Upper-Case Alphabet Recognition	Lower-Case Alphabet Recognition	Letter Sounds	Beginning Sound Awareness	Print and Word Awareness	Rhyme Awareness	Nursery Rhyme Awareness
Asian	Fall n	57	57	45	40	57	57	57	57
	Fall Percent	68.4%	66.7%	71.1%	65.0%	49.1%	26.3%	47.4%	17.5%
	Spring n	64	64	63	63	64	64	64	64
	Spring Percent	95.3%	96.9%	100.0%	96.8%	95.3%	90.6%	90.6%	92.2%
Black	Fall n	85	85	73	72	85	85	85	85
	Fall Percent	62.4%	75.3%	82.2%	61.1%	63.5%	44.7%	49.4%	36.5%
	Spring n	88	88	88	88	88	88	88	88
	Spring Percent	100.0%	100.0%	100.0%	100.0%	97.7%	98.9%	98.9%	98.9%
Hispanic	Fall n	281	281	187	159	281	281	281	281
	Fall Percent	47.7%	39.5%	46.5%	35.8%	29.2%	26.3%	21.0%	6.0%
	Spring n	294	294	282	281	294	294	293	294
	Spring Percent	99.0%	94.6%	96.5%	95.7%	93.5%	88.1%	90.1%	92.9%
White	Fall n	52	52	45	45	52	52	52	52
	Fall Percent	63.5%	75.0%	82.2%	60.0%	65.4%	38.5%	50.0%	21.2%
	Spring n	58	58	58	58	58	58	58	58
	Spring Percent	96.1%	94.1%	92.2%	90.2%	88.2%	92.2%	88.2%	94.1%
Other	Fall n	13	13	9	6	13	13	13	13
	Fall Percent	38.5%	30.8%	33.3%	33.3%	38.5%	38.5%	30.8%	46.2%
	Spring n	12	12	11	11	12	12	11	12
	Spring Percent	100.0%	100.0%	100.0%	100.0%	100.0%	83.3%	81.8%	100.0%

Special Education PALS Results

Figure 7: Fall 2015-16, Percent of Students in Special Education Pre-K Meeting Pre-K PALS Developmental Ranges

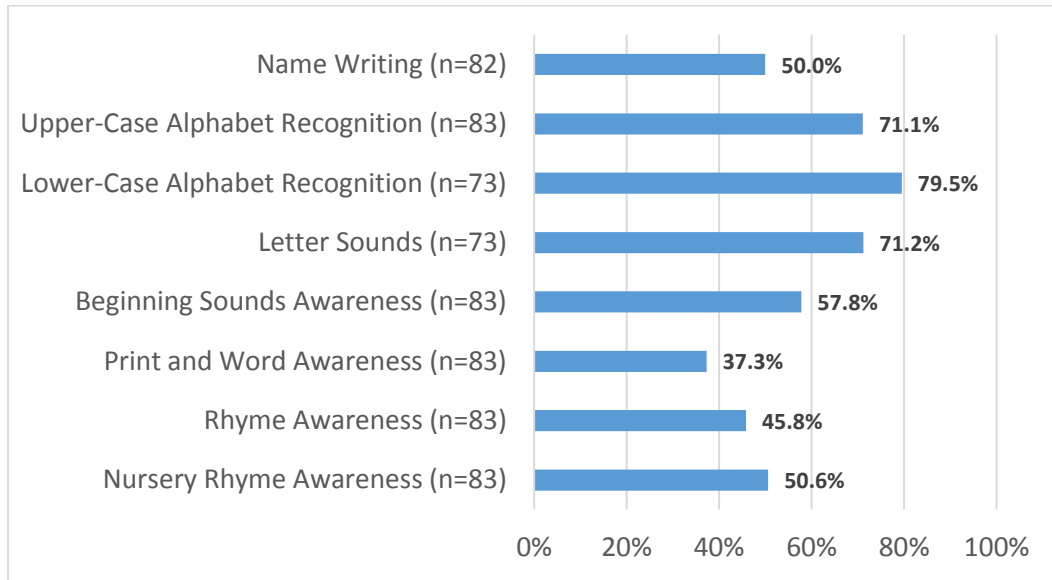


Figure 8: Spring 2015-16, Percent of Students in Special Education Pre-K Meeting Pre-K PALS Developmental Ranges

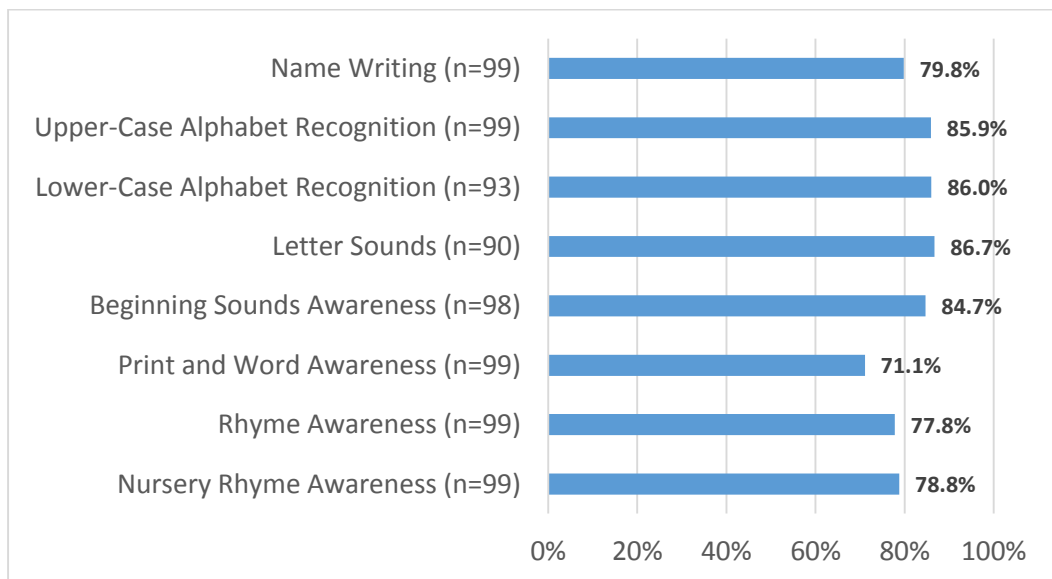


Figure 9: Fall 2014-15, Percent of Students in Special Education Pre-K Meeting Pre-K PALS Developmental Ranges

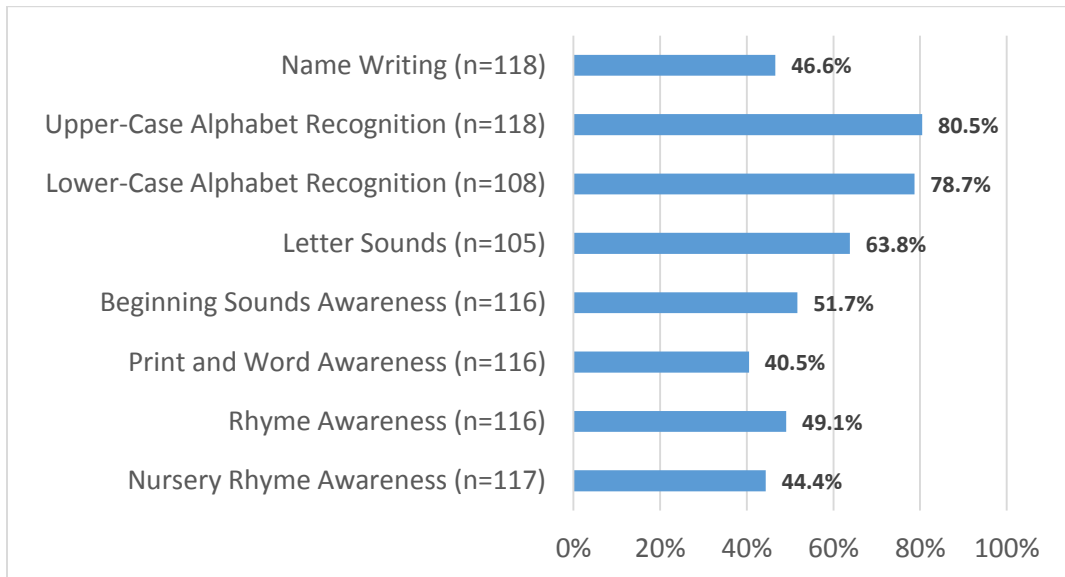


Figure 10: Spring 2014-15, Percent of Students in Special Education Pre-K Meeting Pre-K PALS Developmental Ranges

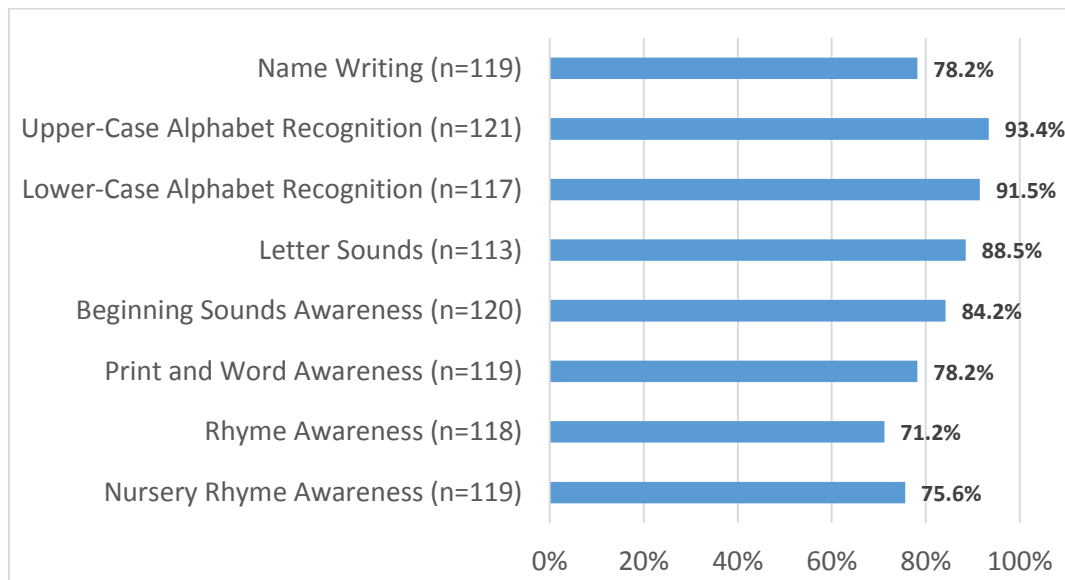


Table 11: 2015-16, Percent of Students in Special Education Pre-K Meeting Pre-K PALS Developmental Ranges by LEP Status

		Name Writing	Upper-Case Alphabet Recognition	Lower-Case Alphabet Recognition	Letter Sounds	Beginning Sound Awareness	Print and Word Awareness	Rhyme Awareness	Nursery Rhyme Awareness
Non-LEP	Fall n	65	66	59	59	66	66	66	66
	Fall Percent	49.2%	71.2%	78.0%	71.2%	60.6%	39.4%	53.0%	53.0%
	Spring n	73	73	69	67	73	73	73	73
	Spring Percent	78.1%	84.9%	85.5%	85.1%	83.6%	68.5%	82.2%	76.7%
LEP	Fall n	13	13	11	11	13	13	13	13
	Fall Percent	53.8%	69.2%	81.8%	63.6%	38.5%	23.1%	15.4%	30.8%
	Spring n	18	18	17	16	17	18	18	18
	Spring Percent	88.9%	94.4%	88.2%	93.8%	88.2%	77.8%	61.1%	88.9%

Table 12: 2014-15, Percent of Students in Special Education Pre-K Meeting Pre-K PALS Developmental Ranges by LEP Status

		Name Writing	Upper-Case Alphabet Recognition	Lower-Case Alphabet Recognition	Letter Sounds	Beginning Sound Awareness	Print and Word Awareness	Rhyme Awareness	Nursery Rhyme Awareness
Non-LEP	Fall n	88	88	78	76	86	86	86	87
	Fall Percent	47.7%	76.1%	74.4%	63.2%	60.5%	43.0%	50.0%	43.7%
	Spring n	93	94	90	88	93	92	92	93
	Spring Percent	78.5%	93.6%	91.1%	87.5%	84.9%	77.2%	71.7%	73.1%
LEP	Fall n	14	14	14	14	14	14	14	14
	Fall Percent	28.6%	100.0%	100.0%	61.5%	28.6%	21.4%	35.7%	42.9%
	Spring n	14	14	14	14	14	14	14	14
	Spring Percent	78.6%	100.0%	100.0%	100.0%	85.7%	92.9%	71.4%	100.0%

Table 13: 2015-16, Percent of Students in Special Education Pre-K Meeting Pre-K PALS Developmental Ranges by Disadvantaged Status

		Name Writing	Upper-Case Alphabet Recognition	Lower-Case Alphabet Recognition	Letter Sounds	Beginning Sound Awareness	Print and Word Awareness	Rhyme Awareness	Nursery Rhyme Awareness
Non-disadvantaged	Fall n	57	58	53	52	58	58	58	58
	Fall Percent	52.6%	75.9%	83.0%	75.0%	65.5%	43.1%	58.6%	55.2%
	Spring n	66	66	62	60	66	66	66	66
	Spring Percent	81.8%	87.9%	88.7%	88.3%	86.4%	74.2%	84.8%	81.8%
Disadvantaged	Fall n	21	21	17	18	21	21	21	21
	Fall Percent	42.9%	57.1%	64.7%	55.6%	33.3%	19.0%	14.3%	33.3%
	Spring n	25	25	24	23	24	25	25	25
	Spring Percent	76.0%	84.0%	79.2%	82.6%	79.2%	60.0%	60.0%	72.0%

Table 14: 2014-15, Percent of Students in Special Education Pre-K Meeting Pre-K PALS Developmental Ranges by Disadvantaged Status

		Name Writing	Upper-Case Alphabet Recognition	Lower-Case Alphabet Recognition	Letter Sounds	Beginning Sound Awareness	Print and Word Awareness	Rhyme Awareness	Nursery Rhyme Awareness
Non-disadvantaged	Fall n	68	68	60	58	66	66	67	67
	Fall Percent	50.0%	80.9%	78.3%	67.2%	69.7%	48.5%	59.7%	49.3%
	Spring n	76	76	74	72	75	74	74	75
	Spring Percent	78.9%	94.7%	91.9%	88.9%	88.0%	79.7%	74.3%	76.0%
Disadvantaged	Fall n	34	34	32	31	34	34	33	34
	Fall Percent	35.3%	76.5%	78.1%	54.8%	29.4%	23.5%	24.2%	32.4%
	Spring n	31	32	30	30	32	32	32	32
	Spring Percent	77.4%	93.8%	93.3%	90.0%	78.1%	78.1%	65.6%	78.1%

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Table 15: 2015-16, Percent of Students in Special Education Pre-K Meeting Pre-K PALS Developmental Ranges by Ethnicity

		Name Writing	Upper-Case Alphabet Recognition	Lower-Case Alphabet Recognition	Letter Sounds	Beginning Sound Awareness	Print and Word Awareness	Rhyme Awareness	Nursery Rhyme Awareness
Asian	Fall* n	<5	<5	<5	<5	<5	<5	<5	<5
	Fall Percent	NA	NA	NA	NA	NA	NA	NA	NA
	Spring n	<5	<5	<5	<5	<5	<5	<5	<5
	Spring* Percent	NA	NA	NA	NA	NA	NA	NA	NA
Black	Fall n	10	10	9	10	10	10	10	10
	Fall Percent	60.0%	90.0%	88.9%	70.0%	40.0%	20.0%	40.0%	70.0%
	Spring n	13	13	13	13	13	13	13	13
	Spring Percent	84.6%	100.0%	100.0%	92.3%	84.6%	61.5%	92.3%	84.6%
Hispanic	Fall n	17	17	15	15	17	17	17	17
	Fall Percent	35.3%	52.9%	60.0%	46.7%	41.2%	23.5%	23.5%	29.4%
	Spring n	19	19	18	17	18	19	19	19
	Spring Percent	68.4%	78.9%	72.2%	70.6%	72.2%	57.9%	57.9%	73.7%
White	Fall n	44	44	38	37	44	44	44	44
	Fall Percent	52.3%	68.2%	78.9%	73.0%	63.6%	40.9%	54.5%	47.7%
	Spring n	48	48	44	42	48	48	48	48
	Spring Percent	85.4%	85.4%	86.4%	92.9%	89.6%	79.2%	81.3%	83.3%
Other	Fall* n	<5	<5	<5	<5	<5	<5	<5	<5
	Fall Percent	NA	NA	NA	NA	NA	NA	NA	NA
	Spring n	8	8	8	8	8	8	8	8
	Spring Percent	62.5%	87.5%	87.5%	75.0%	75.0%	50.0%	75.0%	50.0%

*Samples size groups <5 are not reported

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Table 16: 2014-15, Percent of Students in Special Education Pre-K Meeting Pre-K PALS Developmental Ranges by Ethnicity

		Name Writing	Upper-Case Alphabet Recognition	Lower-Case Alphabet Recognition	Letter Sounds	Beginning Sound Awareness	Print and Word Awareness	Rhyme Awareness	Nursery Rhyme Awareness
Asian	Fall n	7	7	7	7	7	6	7	7
	Fall Percent	28.6%	42.9%	42.9%	28.6%	14.3%	16.7%	14.3%	42.9%
	Spring n	7	7	7	7	7	7	7	7
	Spring Percent	42.9%	71.4%	71.4%	57.1%	71.4%	71.4%	42.9%	71.4%
Black	Fall n	11	11	11	10	10	10	10	11
	Fall Percent	36.4%	90.9%	100.0%	90.0%	70.0%	40.0%	50.0%	45.5%
	Spring n	12	12	12	11	12	11	11	12
	Spring Percent	66.7%	91.7%	91.7%	90.9%	75.0%	90.9%	72.7%	83.3
Hispanic	Fall n	22	22	20	19	22	22	22	22
	Fall Percent	45.5%	86.4%	80.0%	52.6%	31.8%	27.3%	40.9%	36.4%
	Spring n	22	22	21	21	21	22	22	22
	Spring Percent	81.8%	95.5%	95.2%	95.2%	86.4%	81.8%	68.2%	81.8%
White	Fall n	54	54	47	46	54	54	54	53
	Fall Percent	50.0%	75.9%	74.5%	60.9%	64.8%	46.3%	51.9%	47.2%
	Spring n	59	59	56	55	58	58	58	58
	Spring Percent	83.1%	96.6%	92.9%	89.1%	86.2%	75.9%	77.6%	75.9%
Other	Fall n	8	8	7	7	7	8	7	8
	Fall Percent	37.5%	100.0%	100.0%	100.0%	85.7%	50.0%	71.4%	37.5%
	Spring n	7	8	8	8	8	8	8	8
	Spring Percent	85.7%	100.0%	100.0%	100.0%	100.0%	87.5%	62.5%	62.5%

Developmental Math Assessment (DMA)

In 2011-12, a committee of VPI teachers reviewed formal math assessments and determined the Developmental Math Assessment (DMA) to be the best tool to evaluate the mathematical understanding of students in the program. The DMA is used for all VPI and 3-5 year old Special Education Pre-K students. Due to the unique nature of the Montessori program, those students are not formally assessed until the kindergarten year when they take APS kindergarten assessments.

DMA assessments are given at three points in the year: fall, mid-year and spring. Scores for the last three school years were provided to Planning & Evaluation by the Early Childhood Office. Due to limitations in the data, this analysis includes overall scores only and no disaggregation by demographic variables.

Not all students had a total of three DMA assessments and Figures 1-8 include these students who may not have 3 assessments. The mean scores for all students who were assessed during the fall, mid-year, and spring are provided in Figures 1, 3, 5 and 7. Figures, 2, 4, 6 and 8 show the percentage of students in each DMA level during the fall, mid-year, and spring assessments. The 3 levels include:

- **Emergent**- students requiring instruction in Pre-Kindergarten number concepts.
- **Pre-K**- students developing Pre-Kindergarten number concepts
- **Kindergarten**- students demonstrate Kindergarten readiness concepts

Figure 1: 2013-14 VPI Mean DMA Scores

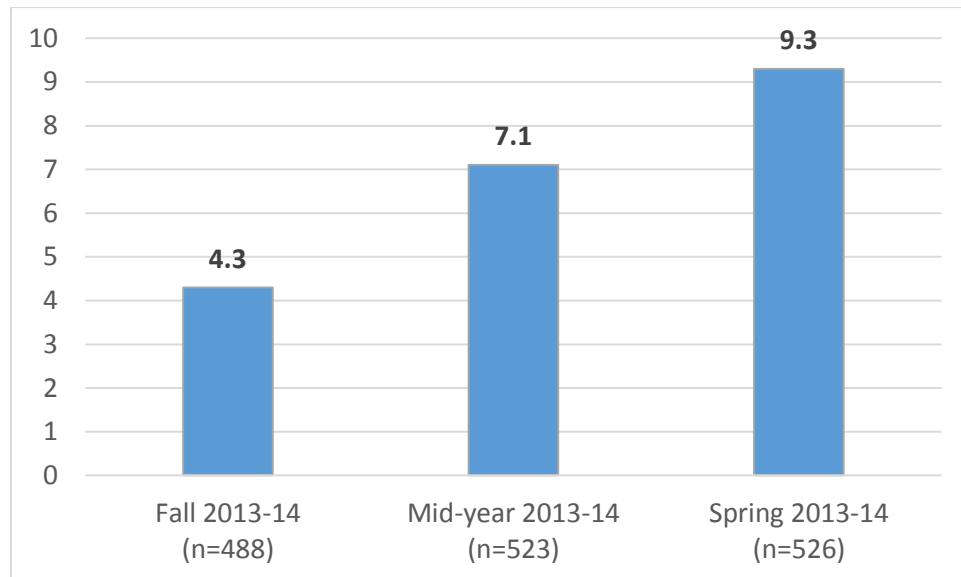


Figure 2: 2013-14 Percent of VPI Students at each DMA Level

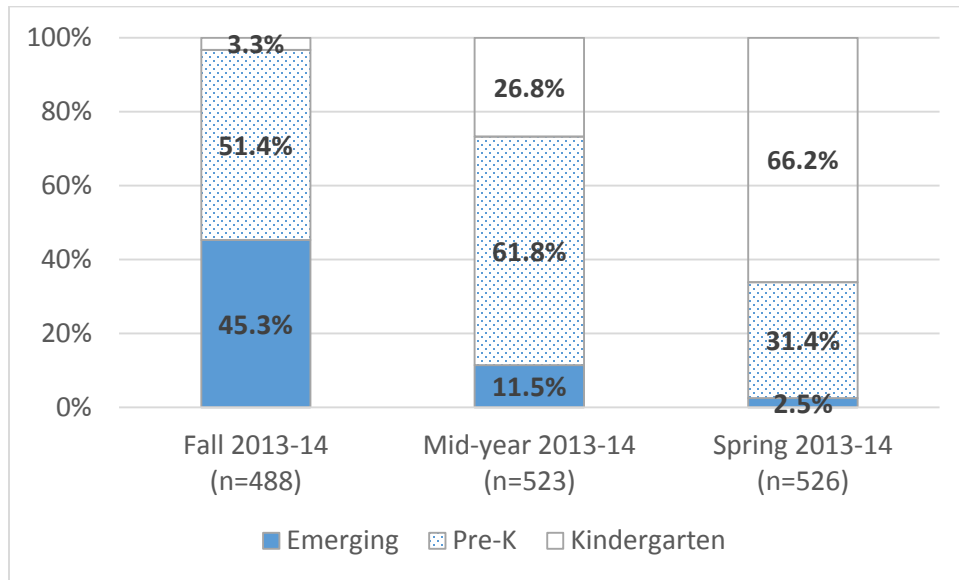


Figure 3: 2014-15 VPI Mean DMA Scores

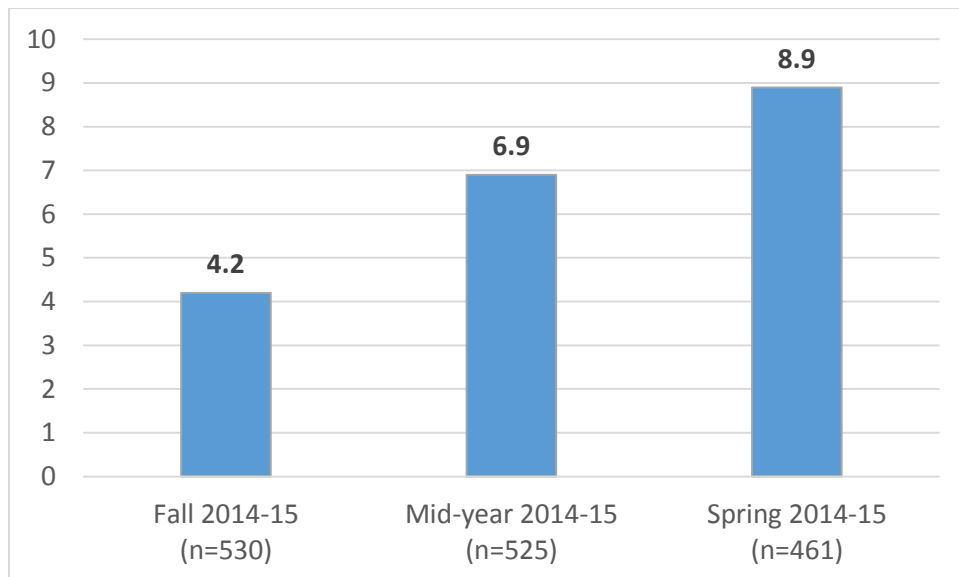


Figure 4: 2014-15 Percent of VPI Students at each DMA Level

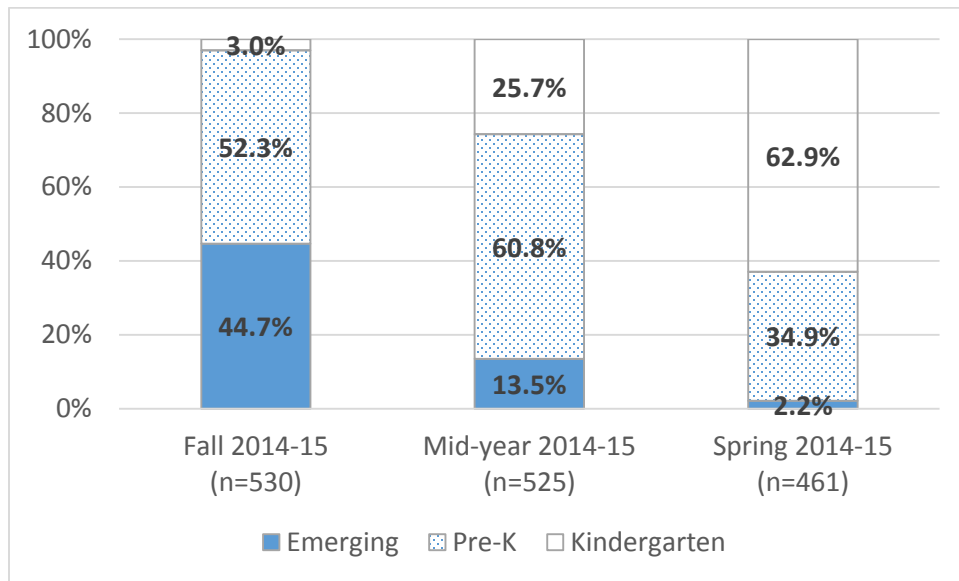


Figure 5: 2015-16 VPI Mean DMA Scores

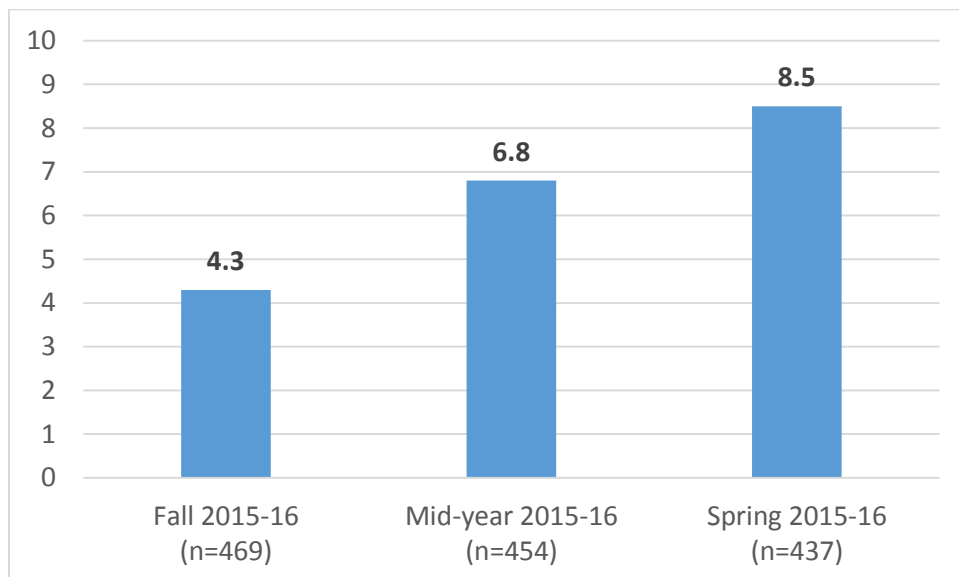


Figure 6: 2015-16 Percent of VPI Students at each DMA Level

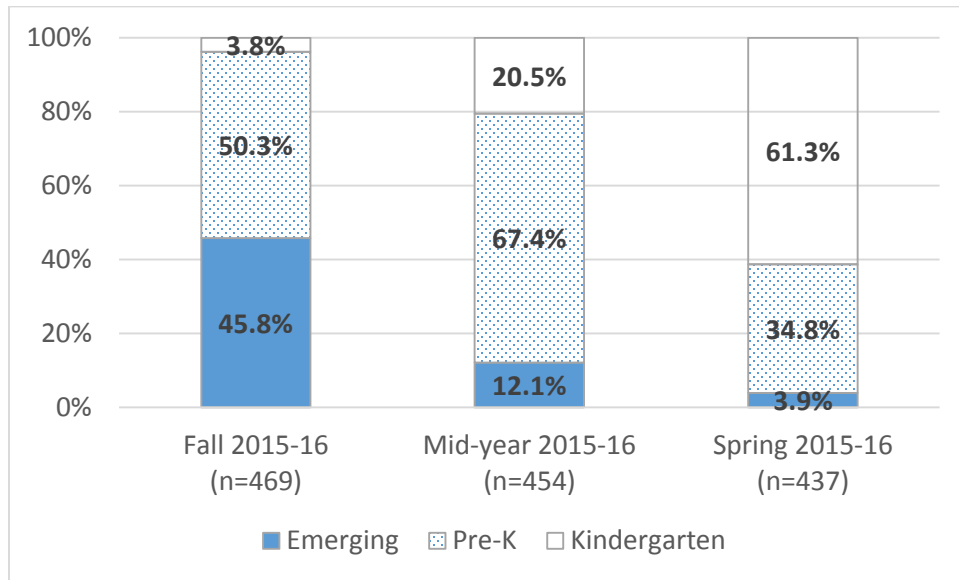


Figure 7: 2015-16 Special Education Mean DMA Scores

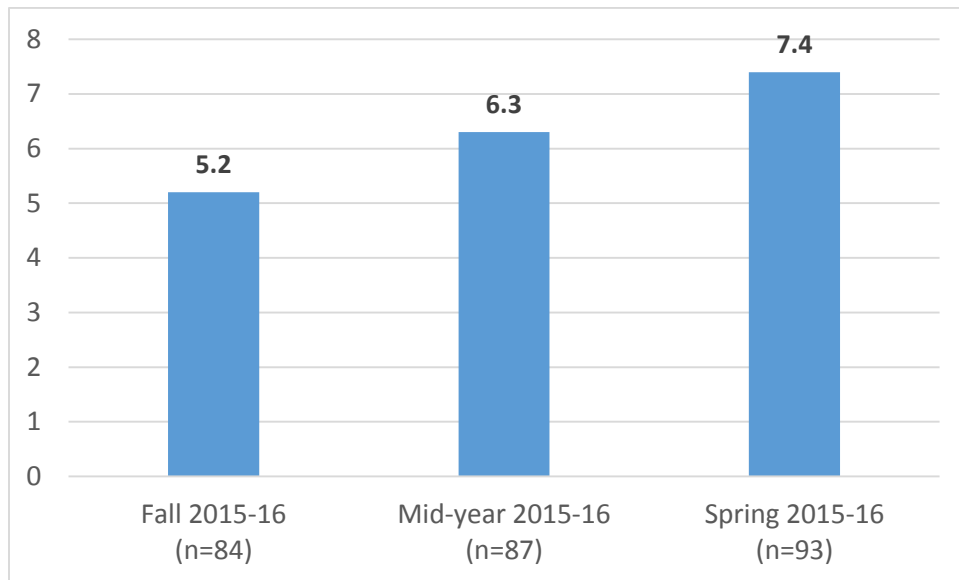
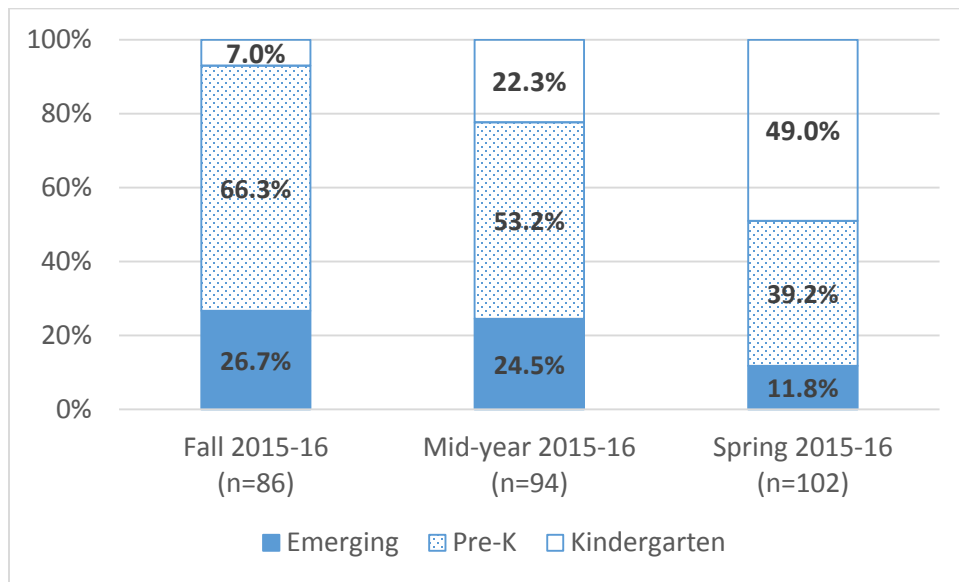


Figure 8: 2015-16 Percent of Special Education Students at each DMA Level



Figures 9 and 10 include data for students with both a fall and spring DMA assessment. Figures 9 and 10 show changes in mean scores from fall to spring.

Figure 9: Mean Scores for VPI Students with Fall and Spring DMA Scores

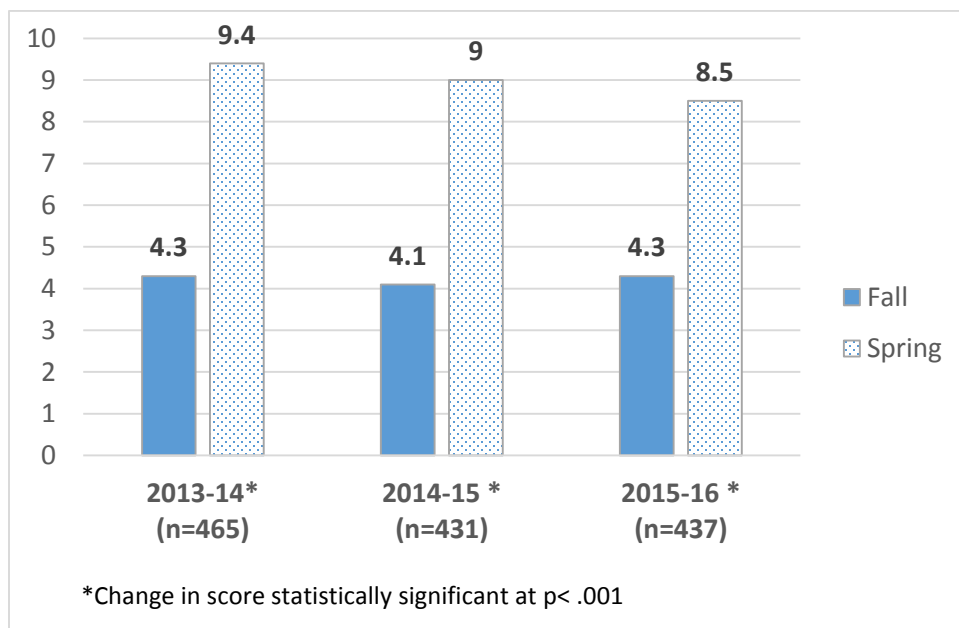


Figure 10: 2015-16 Mean Scores for Special Education Students with Fall and Spring DMA Scores

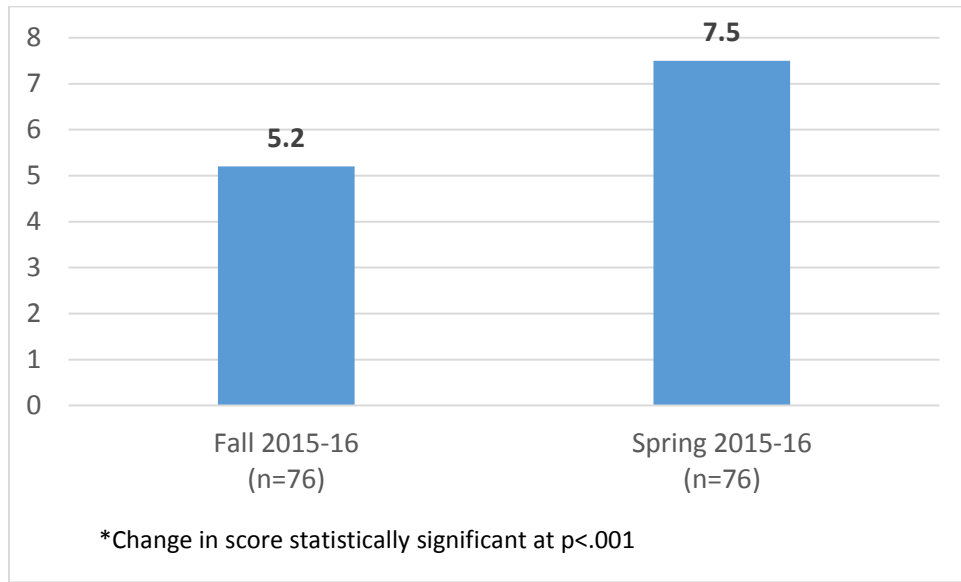


Figure 11: 2013-14 Change in DMA Level for VPI Students with Fall and Spring DMA Scores

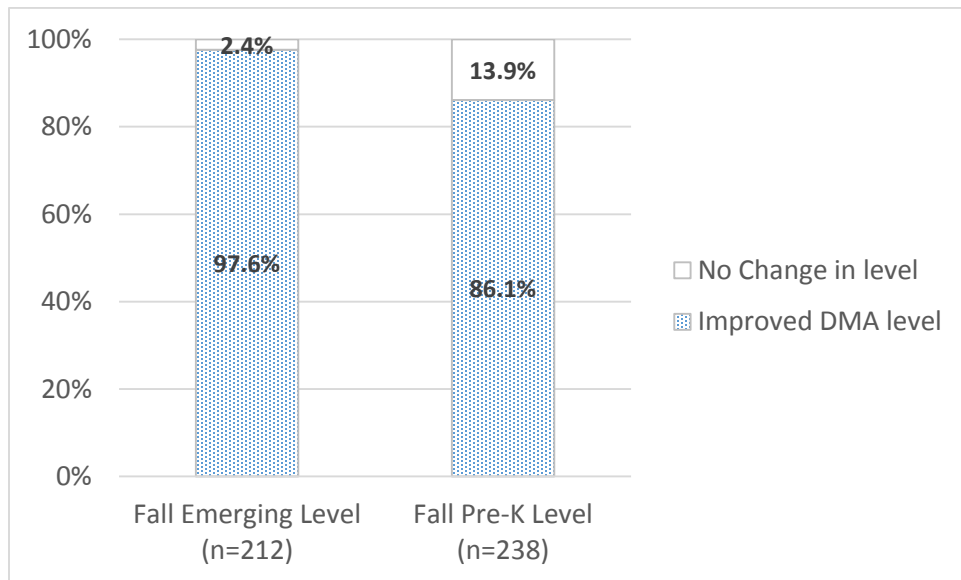


Figure 12: 2014-15 Change in DMA Level for VPI Students with Fall and Spring DMA Scores

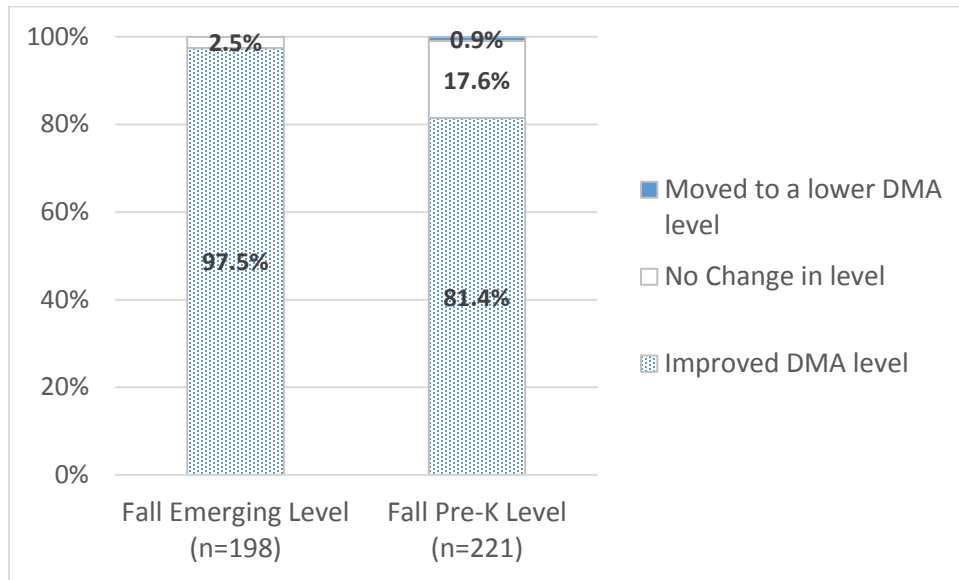


Figure 13: 2015-16 Change in DMA Level for VPI Students with Fall and Spring DMA Scores

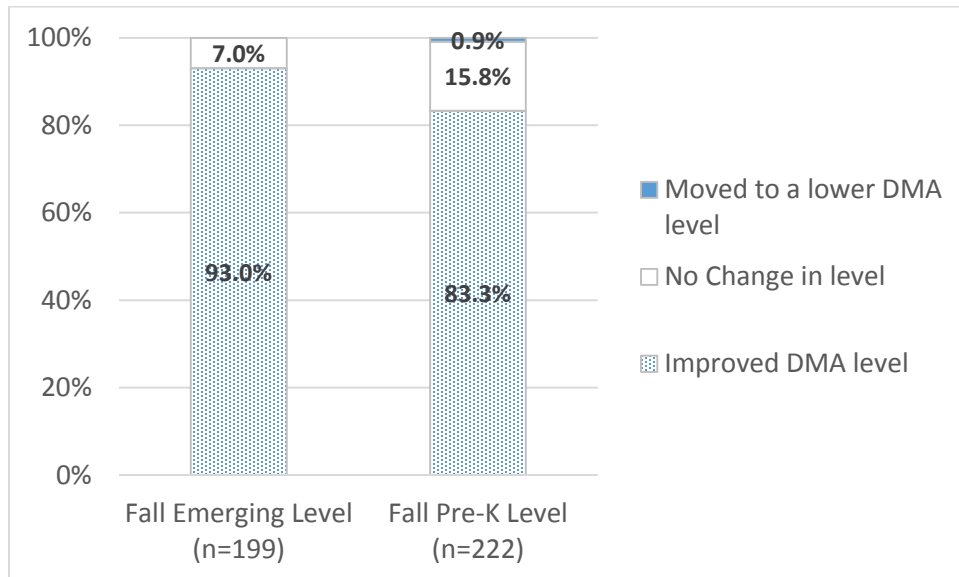
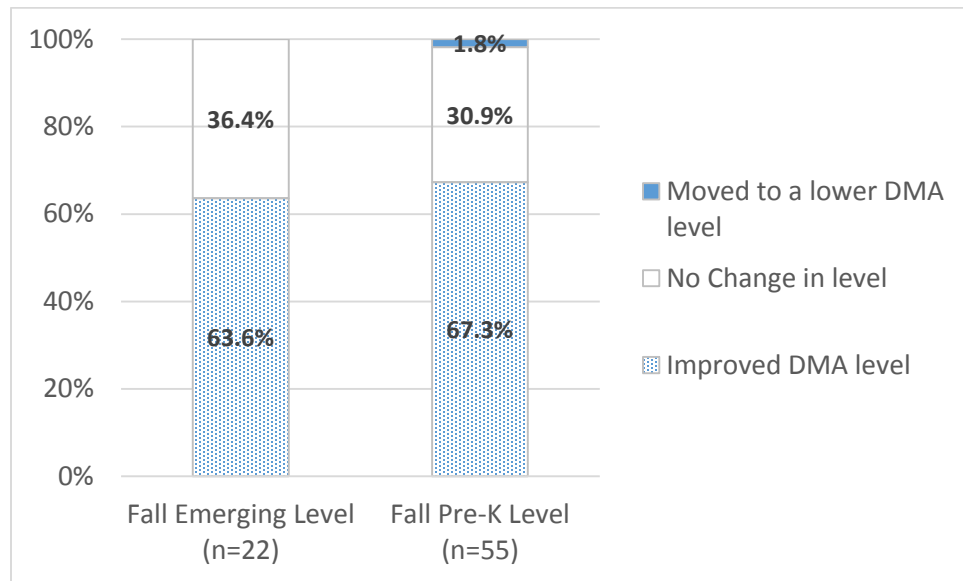


Figure 14: 2015-16 Change in DMA Level for Special Education Students with Fall and Spring DMA Scores



Kindergarten Beginning of Year Math Assessment

APS uses an APS-developed math assessment in kindergarten which includes items in the following mathematical categories:

- Number and number sense
- Computation and estimation
- Geometry
- Patterns, functions and algebra
- Probability and statistics

The kindergarten math assessment is unlike the PALS in that there is no benchmark and the score is a simple percentage of correct responses. In addition, the test is administered at multiple points throughout the year and students are expected to increase their score, or percentage correct, as the year progresses, meaning that they are not expected to achieve a high score at the beginning of the year.

This appendix includes a summary of student performance on the beginning-of-year kindergarten math assessment between 2012-13 and 2015-16. Data is disaggregated by Pre-K experience to show the possible impact of APS Pre-K programs on students' kindergarten readiness.

Figures 1-4 show the overall scores disaggregated by Pre-K experience for each of the four years included in this analysis. Note that the 2013-14 data does not include any students with a Pre-K experience of **private provider** or **no formal Pre-K**; this is due to data reliability issues.

Figure 1: 2015-16 Kindergarten Beginning of Year Math Scores by Pre-K Experience

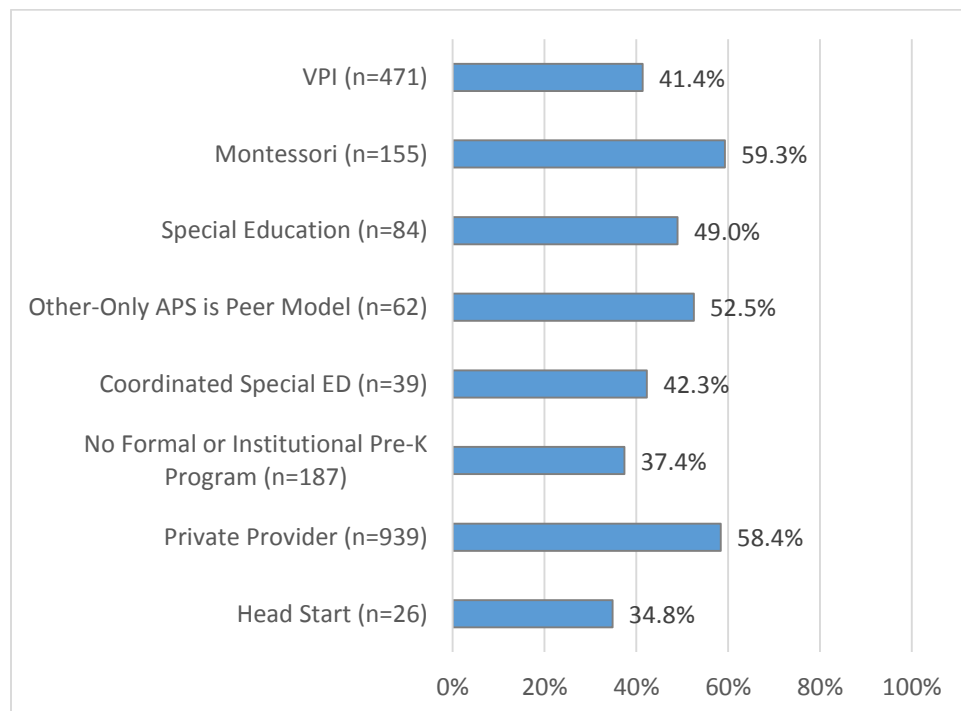


Figure 2: 2014-15 Kindergarten Beginning of Year Math Scores by Pre-K Experience

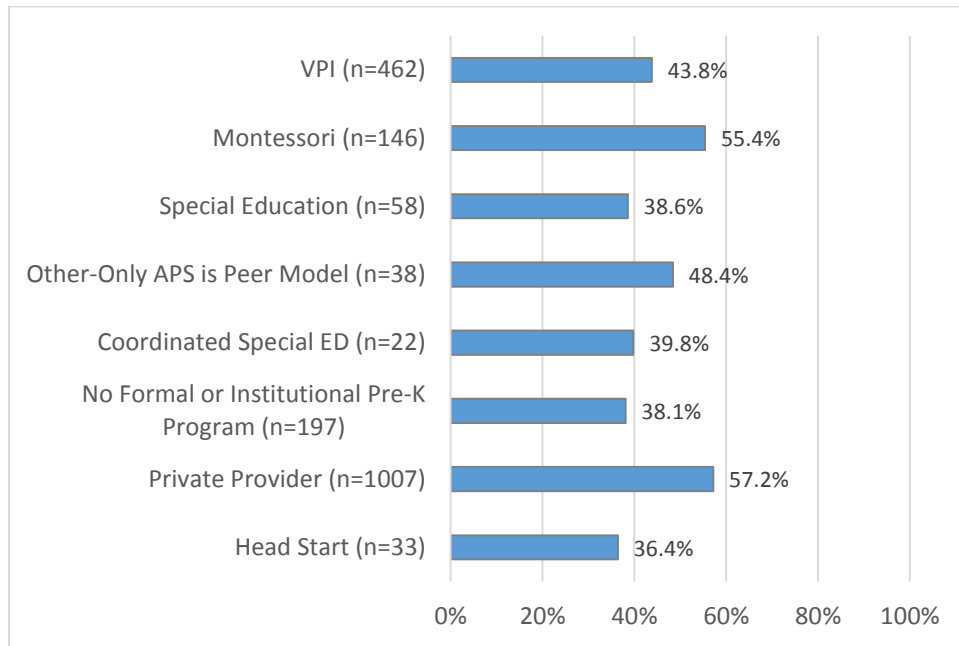


Figure 3: 2013-14 Kindergarten Beginning of Year Math Scores by Pre-K Experience

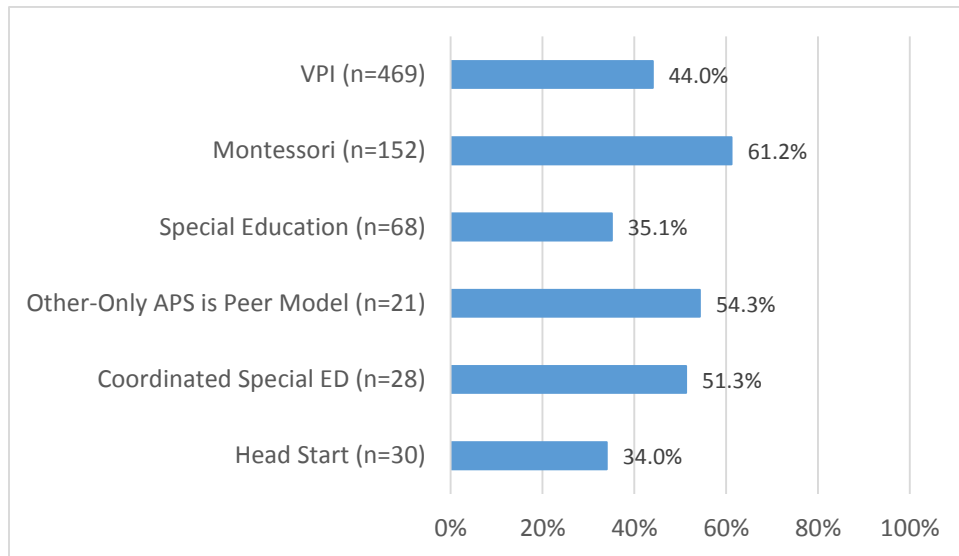
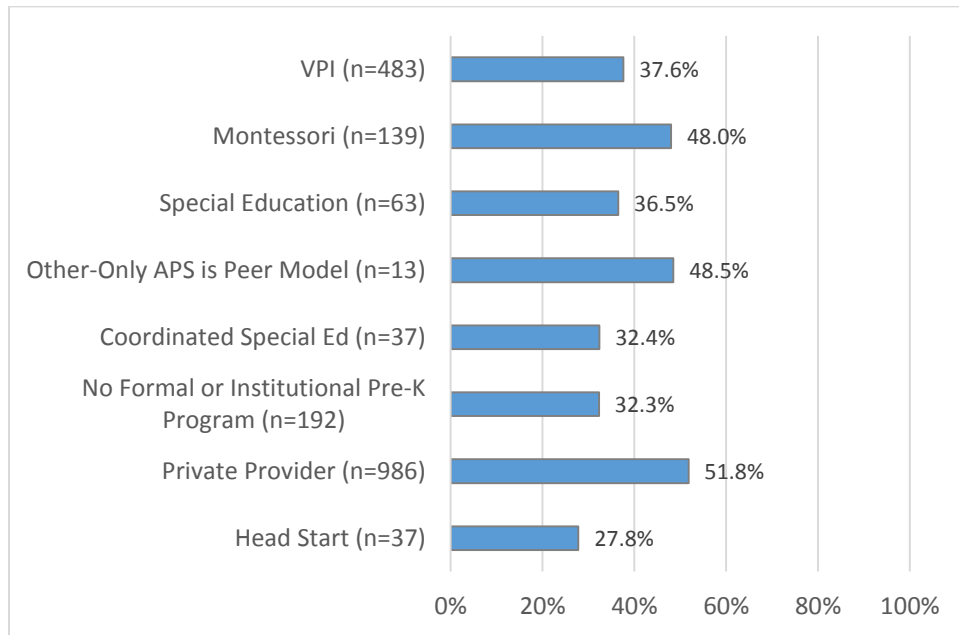


Figure 4: 2012-13 Kindergarten Beginning of Year Math Scores by Pre-K Experience



Figures 5-24 and Tables 1-20 show total assessment scores by Pre-K experience disaggregated by demographic variables.

Figure 5: 2015-16 Kindergarten Beginning of Year Math Scores by Pre-K Experience and Gender

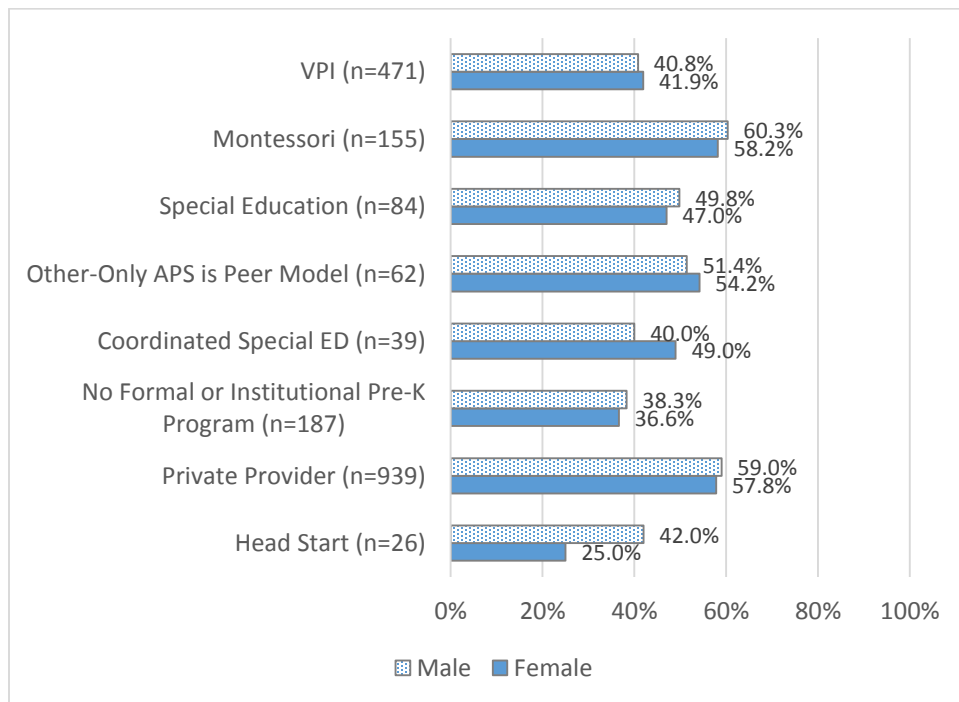
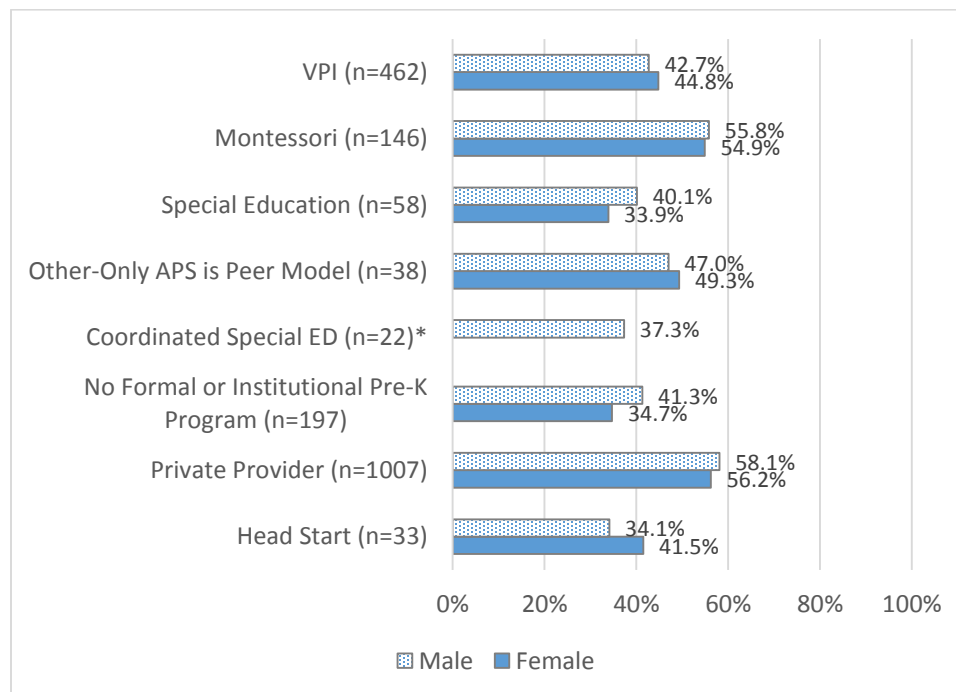


Table 1: 2015-16 Kindergarten Beginning of Year Math Scores and Sample Sizes by Pre-K Experience and Gender

	Male		Female	
	n	%Total Score	n	%Total Score
VPI	224	40.8%	247	41.9%
Montessori	78	60.3%	77	58.2%
Special Education	62	49.8%	22	47.0%
Other-Only APS Peer Model	37	51.4%	25	54.2%
Coordinated Special Education	29	40%	10	49%
No Formal or Institutional Pre-K Program	90	38.3%	97	36.6%
Private Provider	470	59.0%	469	57.8%
Head Start	15	42.0%	11	25.0%

Figure 6: 2014-15 Kindergarten Beginning of Year Math Scores by Pre-K Experience and Gender



*Sample size groups less than 5 are not reported

Table 2: 2014-15 Kindergarten Beginning of Year Math Scores and Sample Sizes by Pre-K Experience and Gender

	Male		Female	
	n	%Total Score	n	%Total Score
VPI	231	42.7%	231	44.8%
Montessori	80	55.8%	66	54.9%
Special Education	44	40.1%	14	33.9%
Other-Only APS Peer Model	15	47.0%	23	49.3%
Coordinated Special Education	20	37.3%	2	*
No Formal or Institutional Pre-K Program	104	41.3%	93	34.7%
Private Provider	514	58.1%	493	56.2%
Head Start	23	34.1%	10	41.5%

*Sample size groups less than 5 are not reported

Figure 7: 2013-14 Kindergarten Beginning of Year Math Scores by Pre-K Experience and Gender

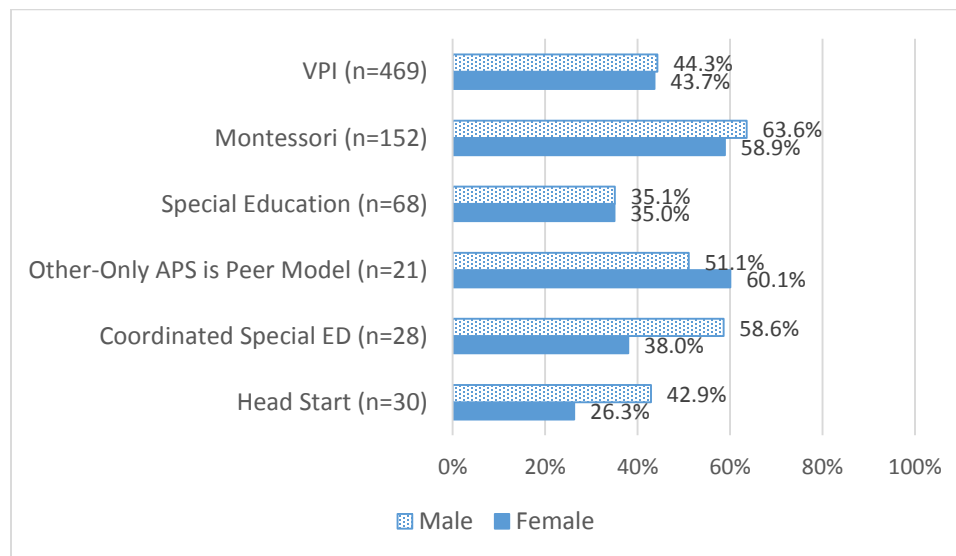
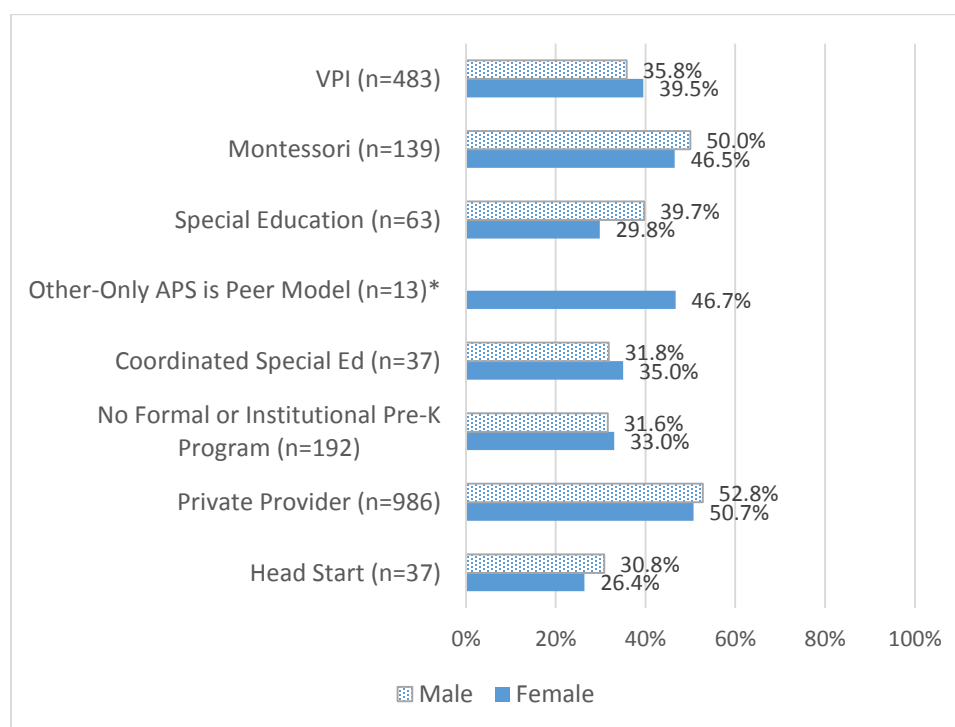


Table 3: 2013-14 Kindergarten Beginning of Year Math Scores and Sample Sizes by Pre-K Experience and Gender

	Male		Female	
	n	%Total Score	n	%Total Score
VPI	207	44.3%	262	43.7%
Montessori	74	63.6%	78	58.9%
Special Education	47	35.1%	21	35.0%
Other-Only APS Peer Model	14	51.1%	7	60.1%
Coordinated Special Education	18	58.6%	10	38.0%
Head Start	14	42.9%	16	26.3%

Figure 8: 2012-13 Kindergarten Beginning of Year Math Scores by Pre-K Experience and Gender



*Sample size groups less than 5 are not reported

Table 4: 2012-13 Kindergarten Beginning of Year Math Scores and Sample Sizes by Pre-K Experience and Gender

	Male		Female	
	n	%Total Score	n	%Total Score
VPI	247	35.8%	236	39.5%
Montessori	59	50.0%	80	46.5%
Special Education	43	39.7%	20	29.8%
Other-Only APS Peer Model	4	*	9	46.7%
Coordinated Special Education	30	31.8%	7	35.0%
No Formal or Institutional Pre-K Program	99	31.6%	93	33.0%
Private Provider	515	52.8%	471	50.7%
Head Start	12	30.8%	25	26.4%

*Sample size groups less than 5 are not reported

Figure 9: 2015-16 Kindergarten Beginning of Year Math Scores by Pre-K Experience and LEP Status

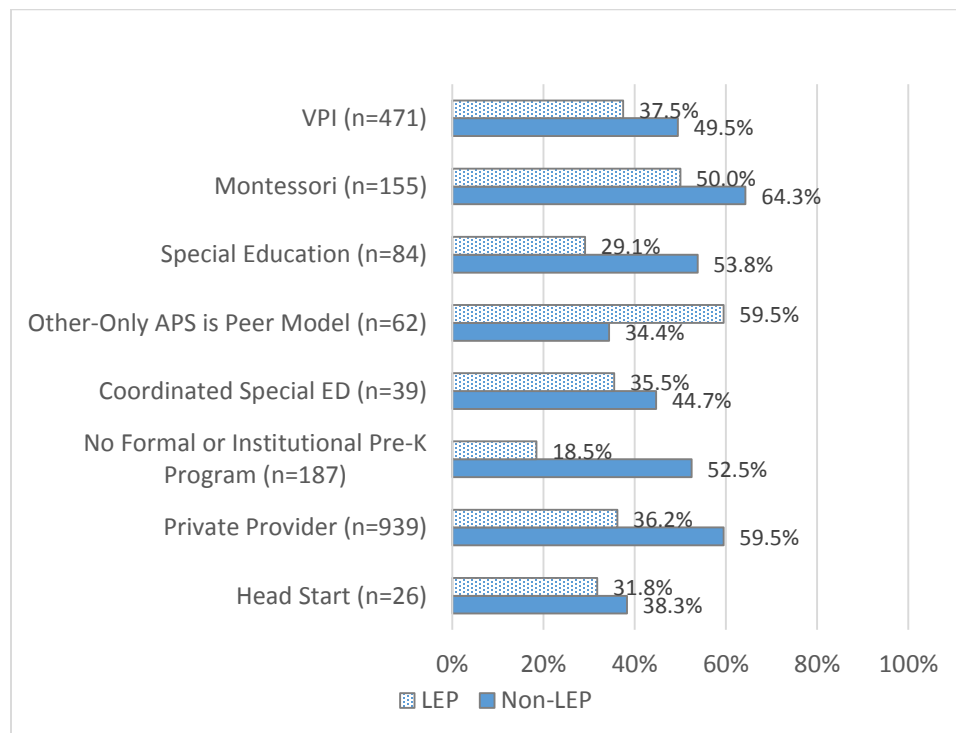


Table 5: 2015-16 Kindergarten Beginning of Year Math Scores and Sample Sizes by Pre-K Experience and LEP Status

	LEP		Non-LEP	
	n	%Total Score	n	%Total Score
VPI	320	37.5%	151	49.5%
Montessori	54	50.0%	101	64.3%
Special Education	16	29.1%	68	53.8%
Other-Only APS Peer Model	9	34.4%	53	55.6%
Coordinated Special Education	10	35.5%	29	44.7%
No Formal or Institutional Pre-K Program	83	18.5%	104	52.5%
Private Provider	45	36.2%	894	59.5%
Head Start	14	31.8%	12	38.3%

Figure 10: 2014-15 Kindergarten Beginning of Year Math Scores by Pre-K Experience and LEP Status

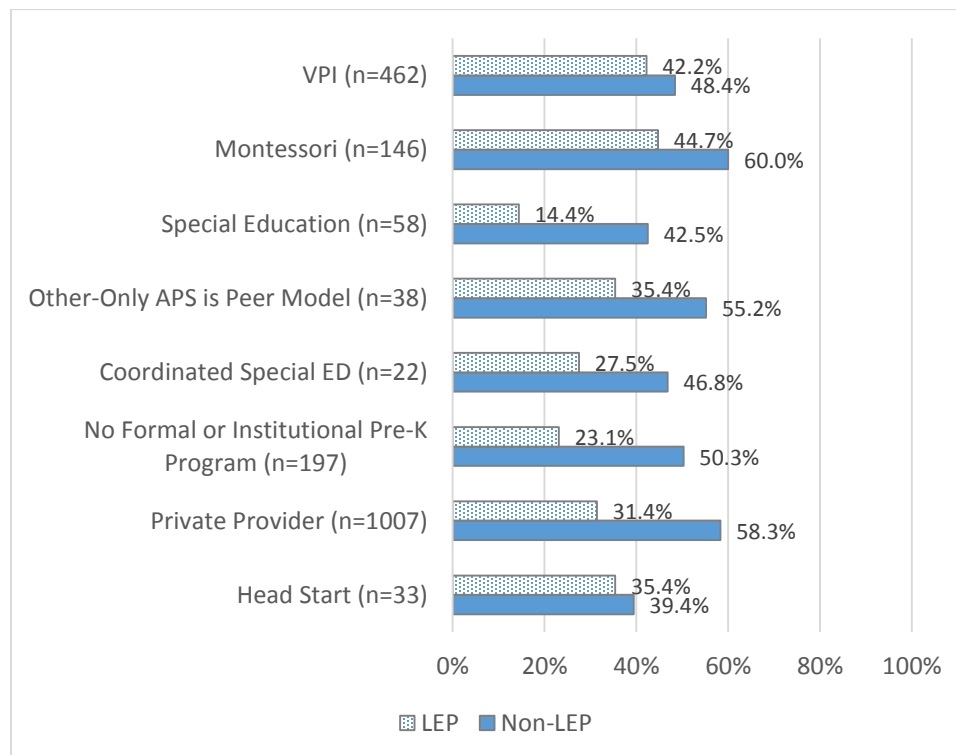
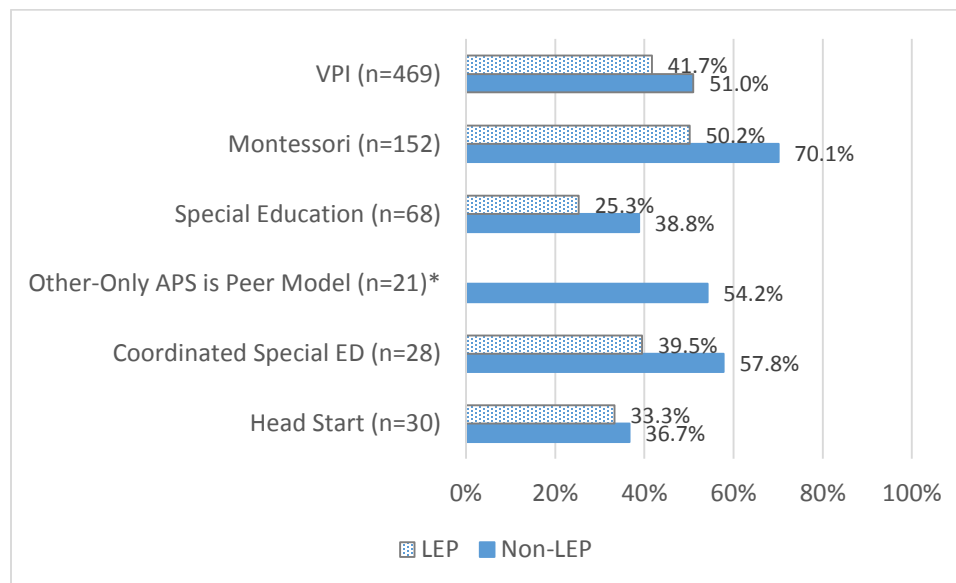


Table 6: 2014-15 Kindergarten Beginning of Year Math Scores and Sample Sizes by Pre-K Experience and LEP Status

	LEP		Non-LEP	
	n	%Total Score	n	%Total Score
VPI	349	42.2%	113	48.4%
Montessori	50	44.7%	96	60.0%
Special Education	8	14.4%	50	42.5%
Other-Only APS Peer Model	13	35.4%	25	55.2%
Coordinated Special Education	8	27.5%	14	46.8%
No Formal or Institutional Pre-K Program	88	23.1%	109	50.3%
Private Provider	43	31.4%	964	58.3%
Head Start	25	35.4%	8	39.4%

Figure 11: 2013-14 Kindergarten Beginning of Year Math Scores by Pre-K Experience and LEP Status



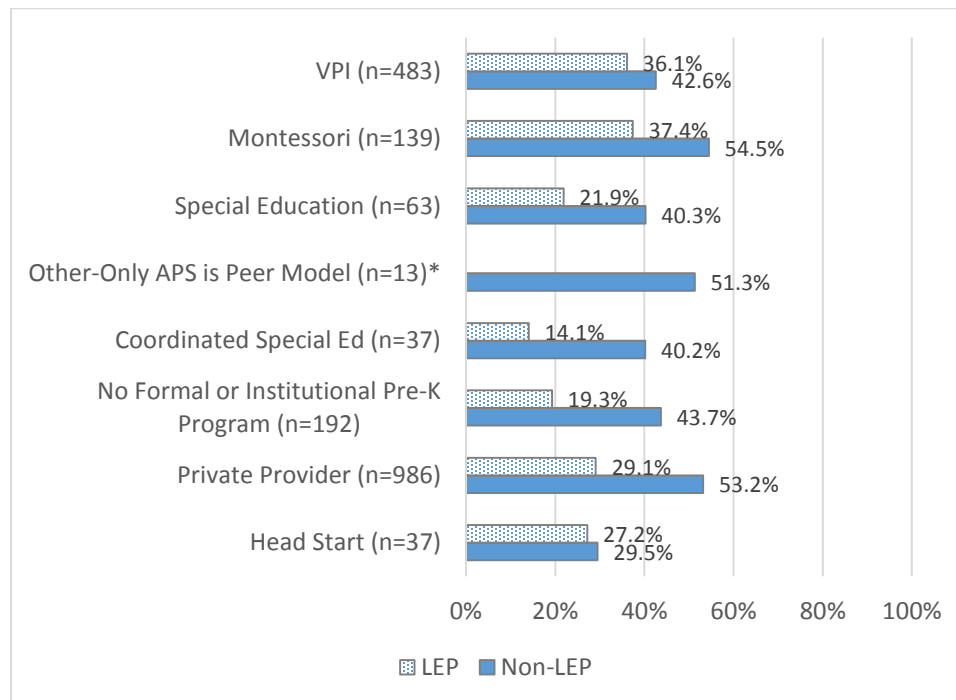
*Sample size groups smaller than 5 are not reported

Table 7: 2013-14 Kindergarten Beginning of Year Math Scores and Sample Sizes by Pre-K Experience and LEP Status

	LEP		Non-LEP	
	n	%Total Score	n	%Total Score
VPI	354	41.7%	115	51.0%
Montessori	68	50.2%	84	70.1%
Special Education	19	25.3%	49	38.9%
Other-Only APS Peer Model	0		21	54.3%
Coordinated Special Education	10	39.5%	18	57.8%
Head Start	24	33.3%	6	36.7%

*Sample size groups smaller than 5 are not reported

Figure 12: 2012-13 Kindergarten Beginning of Year Math Scores by Pre-K Experience and LEP Status



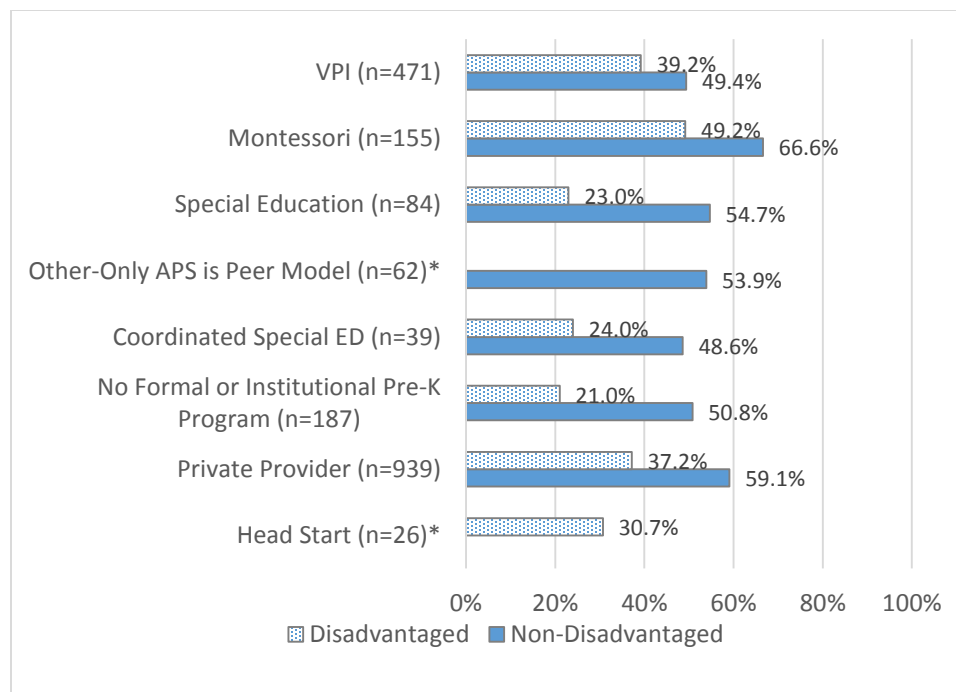
*Sample size groups smaller than 5 are not reported

Table 8: 2012-13 Kindergarten Beginning of Year Math Scores and Sample Sizes by Pre-K Experience and LEP Status

	LEP		Non-LEP	
	n	%Total Score	n	%Total Score
VPI	372	36.1%	111	42.6%
Montessori	53	37.4%	86	54.5%
Special Education	13	21.9%	50	40.3%
Other-Only APS Peer Model	1	*	12	51.3%
Coordinated Special Education	11	14.1%	26	40.2%
No Formal or Institutional Pre-K Program	90	19.3%	102	43.7%
Private Provider	58	29.1%	928	53.2%
Head Start	27	27.2%	10	29.5%

*Sample size groups smaller than 5 are not reported

Figure 13: 2015-16 Kindergarten Beginning of Year Math Scores by Pre-K Experience and Disadvantage Status



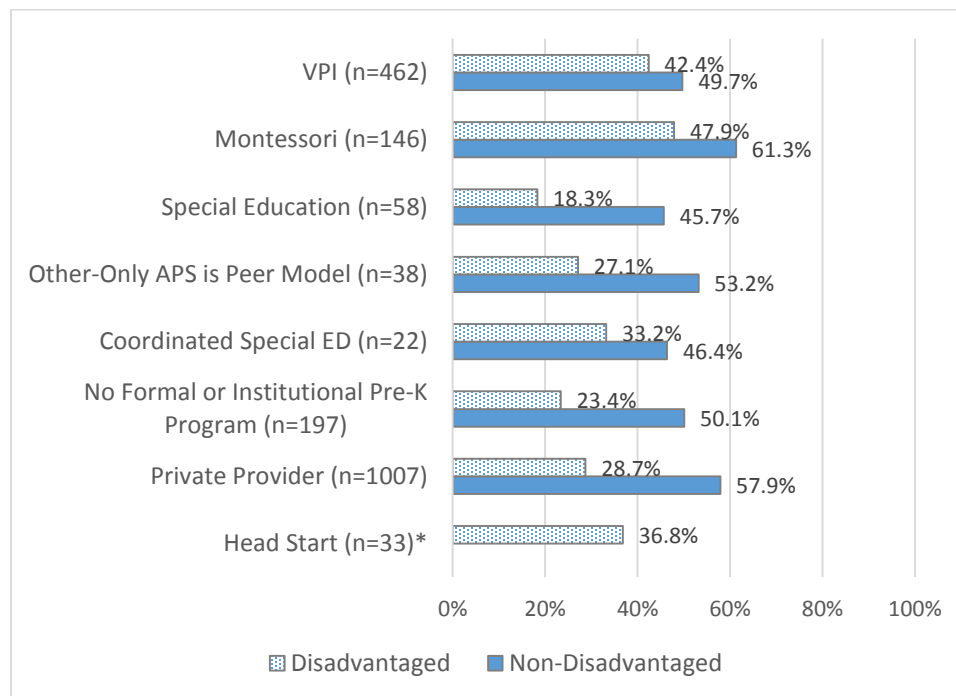
*Sample size groups smaller than 5 are not reported

Table 9: 2015-16 Kindergarten Beginning of Year Math Scores and Sample Sizes by Pre-K Experience and Disadvantage Status

	Disadvantaged		Non-disadvantaged	
	n	%Total Score	n	%Total Score
VPI	371	39.2%	100	49.4%
Montessori	65	49.2%	90	66.6%
Special Education	15	23.0%	69	54.7%
Other-Only APS Peer Model	3	*	59	53.9%
Coordinated Special Education	10	24.0%	29	48.6%
No Formal or Institutional Pre-K Program	84	21.0%	103	50.8%
Private Provider	29	37.2%	910	59.1%
Head Start	22	30.7%	4	*

*Sample size groups smaller than 5 are not reported

Figure 14: 2014-15 Kindergarten Beginning of Year Math Scores by Pre-K Experience and Disadvantage Status



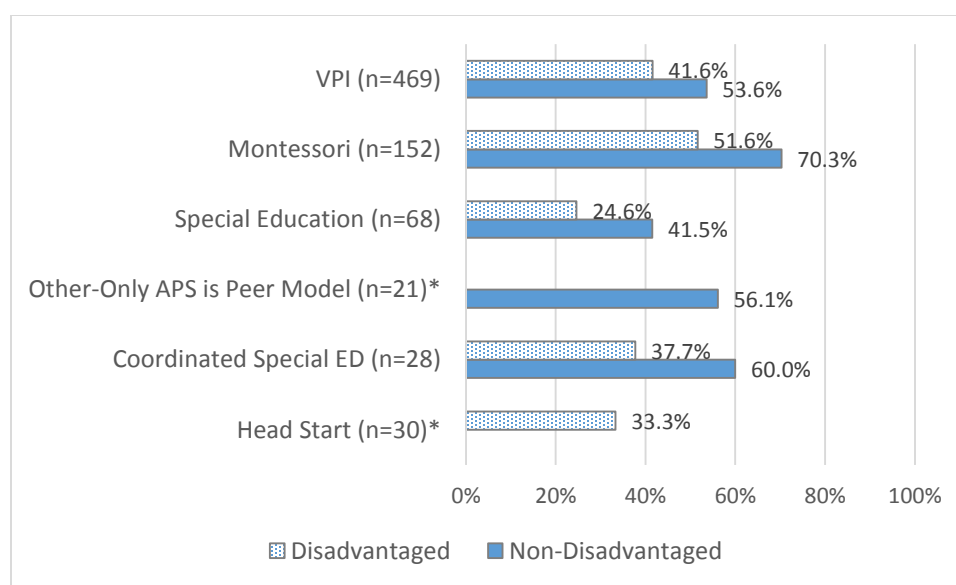
*Sample size groups smaller than 5 are not reported

Table 10: 2014-15 Kindergarten Beginning of Year Math Scores and Sample Sizes by Pre-K Experience and Disadvantage Status

	Disadvantaged		Non-disadvantaged	
	n	%Total Score	n	%Total Score
VPI	374	42.4%	8	49.7%
Montessori	63	47.7%	83	61.3%
Special Education	15	18.3%	43	45.7%
Other-Only APS Peer Model	7	27.1%	31	53.2%
Coordinated Special Education	11	33.2%	11	46.4%
No Formal or Institutional Pre-K Program	90	23.4%	107	50.5%
Private Provider	26	28.7%	981	57.9%
Head Start	30	36.8%	3	*

*Sample size groups smaller than 5 are not reported

Figure 15: 2013-14 Kindergarten Beginning of Year Math Scores by Pre-K Experience and Disadvantage Status



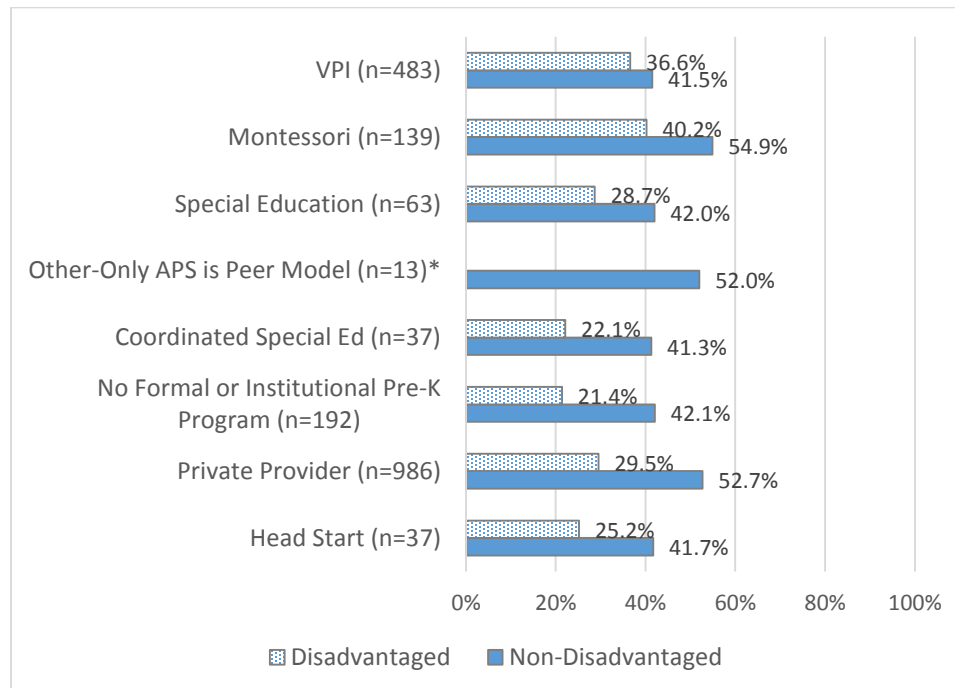
*Sample size groups smaller than 5 are not reported

Table 11: 2013-14 Kindergarten Beginning of Year Math Scores and Sample Sizes by Pre-K Experience and Disadvantage Status

	Disadvantaged		Non-disadvantaged	
	n	%Total Score	n	%Total Score
VPI	375	41.6%	94	53.6%
Montessori	74	51.6%	78	70.3%
Special Education	26	24.6%	42	41.5%
Other-Only APS Peer Model	3	*	18	56.1%
Coordinated Special Education	11	37.7%	17	60.0%
Head Start	27	33.3%	3	*

*Sample size groups smaller than 5 are not reported

Figure 16: 2012-13 Kindergarten Beginning of Year Math Scores by Pre-K Experience and Disadvantage Status



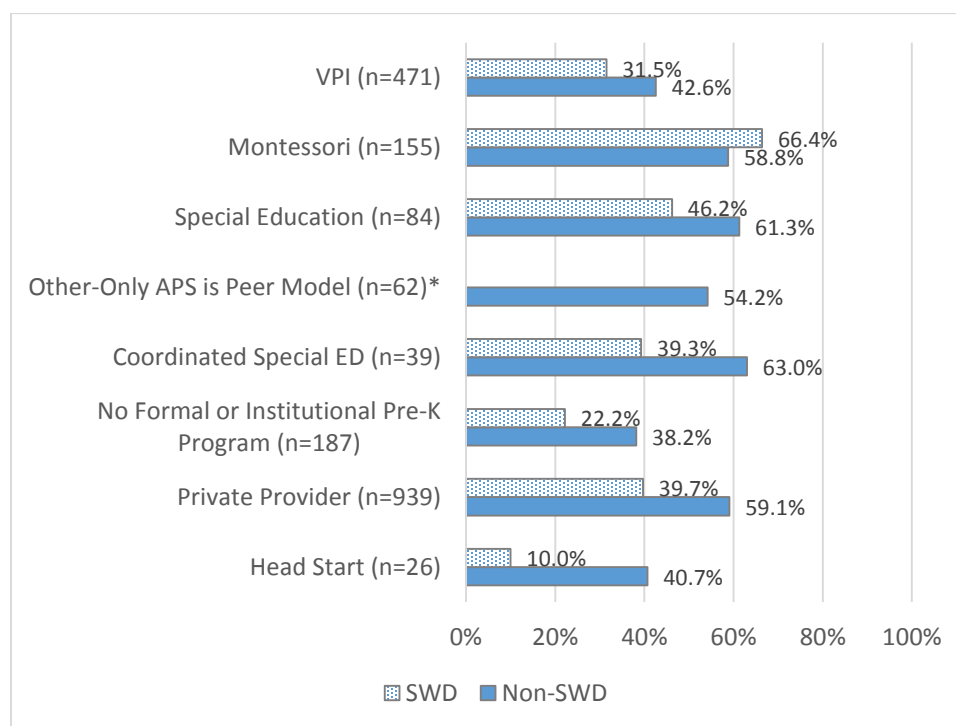
*Sample size groups smaller than 5 are not reported

Table 12: 2012-13 Kindergarten Beginning of Year Math Scores and Sample Sizes by Pre-K Experience and Disadvantage Status

	Disadvantaged		Non-disadvantaged	
	n	%Total Score	n	%Total Score
VPI	383	36.6%	100	41.5%
Montessori	65	40.2%	74	54.9%
Special Education	26	28.7%	37	42.0%
Other-Only APS Peer Model	3	*	10	52.0%
Coordinated Special Education	17	22.1%	20	41.3%
No Formal or Institutional Pre-K Program	91	21.4%	101	42.1%
Private Provider	38	29.5%	948	52.7%
Head Start	31	25.2%	6	41.7%

*Sample size groups smaller than 5 are not reported

Figure 17: 2015-16 Kindergarten Beginning of Year Math Scores by Pre-K Experience and SWD Status



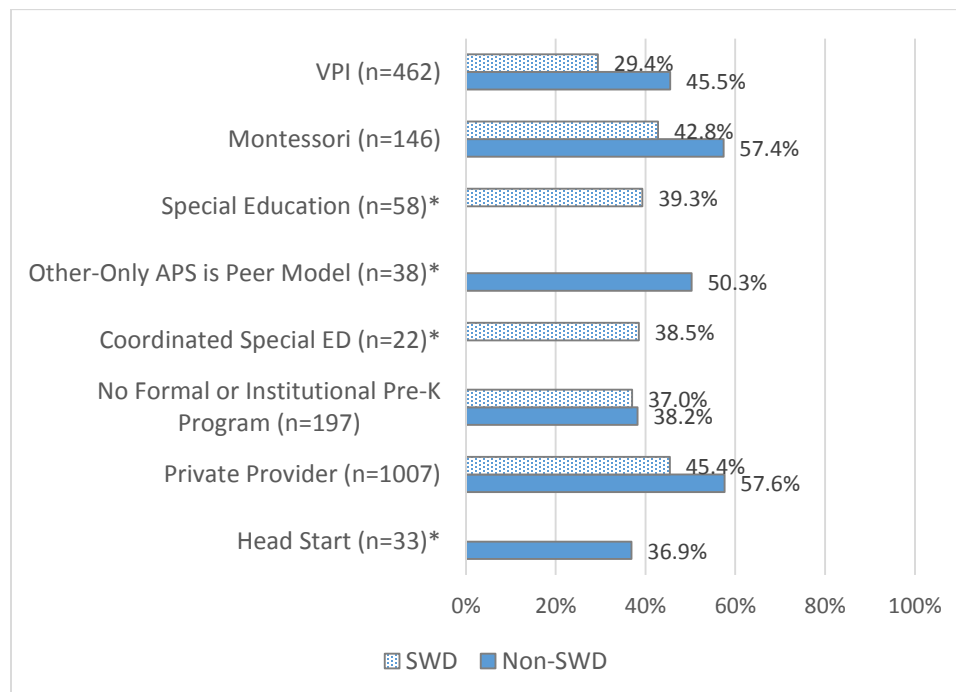
*Sample size groups smaller than 5 are not reported

Table 13: 2015-16 Kindergarten Beginning of Year Math Scores and Sample Sizes by Pre-K Experience and SWD Status

	SWD		Non-SWD	
	n	%Total Score	n	%Total Score
VPI	53	31.5%	418	42.6%
Montessori	11	66.4%	144	58.8%
Special Education	68	46.2%	16	61.3%
Other-Only APS Peer Model	4	*	58	54.2%
Coordinated Special Education	34	39.3%	5	63.0%
No Formal or Institutional Pre-K Program	9	22.2%	178	38.8%
Private Provider	32	39.7%	907	59.1%
Head Start	5	10.0%	21	40.7%

*Sample size groups smaller than 5 are not reported

Figure 18: 2014-15 Kindergarten Beginning of Year Math Scores by Pre-K Experience and SWD Status



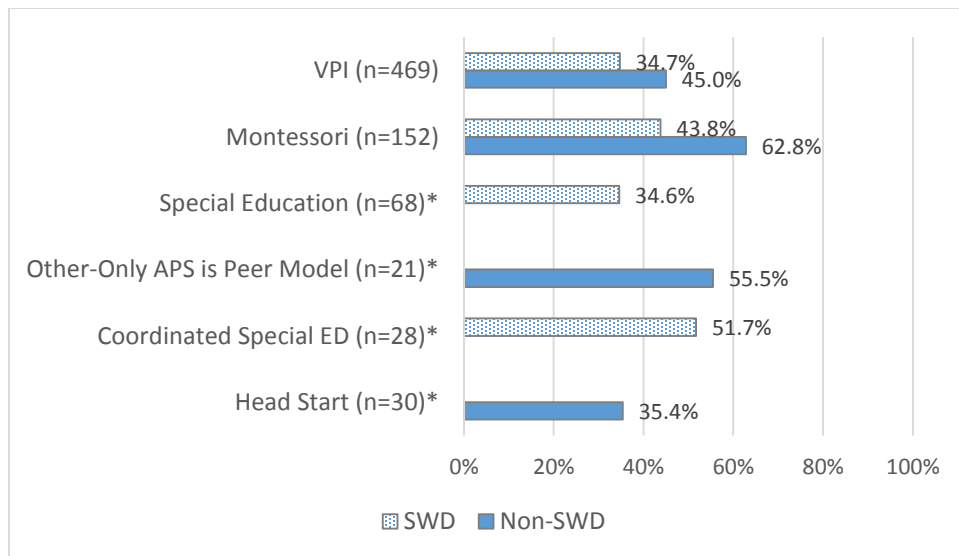
*Sample size groups smaller than 5 are not reported

Table 14: 2014-15 Kindergarten Beginning of Year Math Scores and Sample Sizes by Pre-K Experience and SWD Status

	SWD		Non-SWD	
	n	%Total Score	n	%Total Score
VPI	51	29.4%	411	45.5%
Montessori	20	42.8%	126	57.4%
Special Education	56	39.3%	2	*
Other-Only APS Peer Model	3	*	35	50.3%
Coordinated Special Education	20	38.5%	2	*
No Formal or Institutional Pre-K Program	10	37.0%	187	38.2%
Private Provider	36	45.4%	971	57.6%
Head Start	1	*	32	36.9%

*Sample size groups smaller than 5 are not reported

Figure 19: 2013-14 Kindergarten Beginning of Year Math Scores by Pre-K Experience and Student with Disability Status



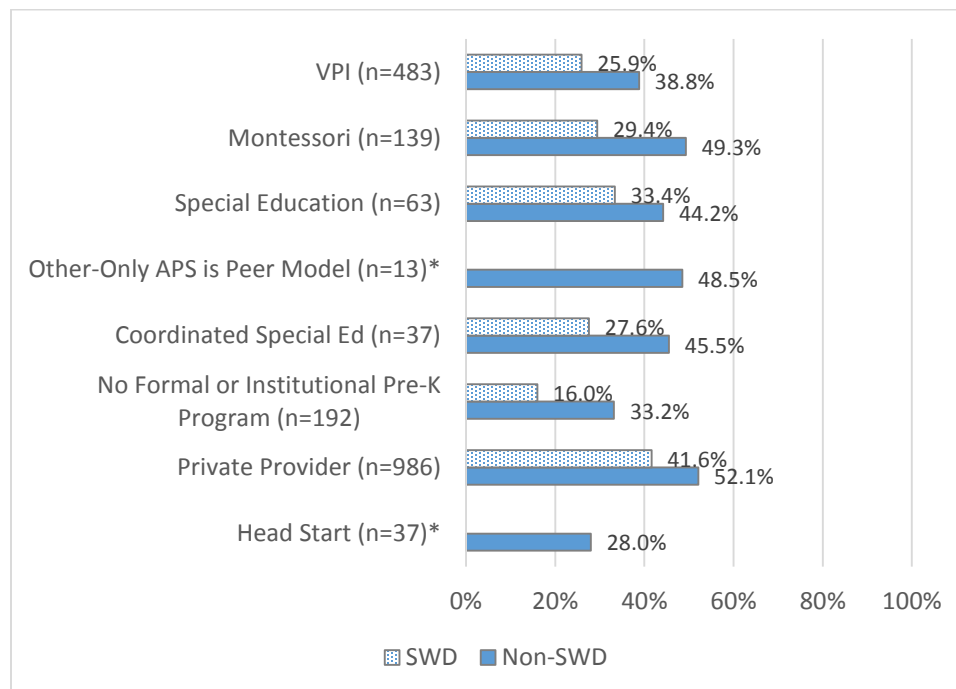
*Sample size groups smaller than 5 are not reported

Table 15: 203-14 Kindergarten Beginning of Year Math Scores and Sample Sizes by Pre-K Experience and SWD Status

	SWD		Non-SWD	
	n	%Total Score	n	%Total Score
VPI	47	34.7%	422	45.0%
Montessori	13	43.8%	139	62.8%
Special Education	65	34.6%	3	*
Other-Only APS Peer Model	2	*	19	55.5%
Coordinated Special Education	27	51.7%	1	*
Head Start	2	*	28	35.4%

*Sample size groups smaller than 5 are not reported

Figure 20: 2012-13 Kindergarten Beginning of Year Math Scores by Pre-K Experience and Student with Disability Status

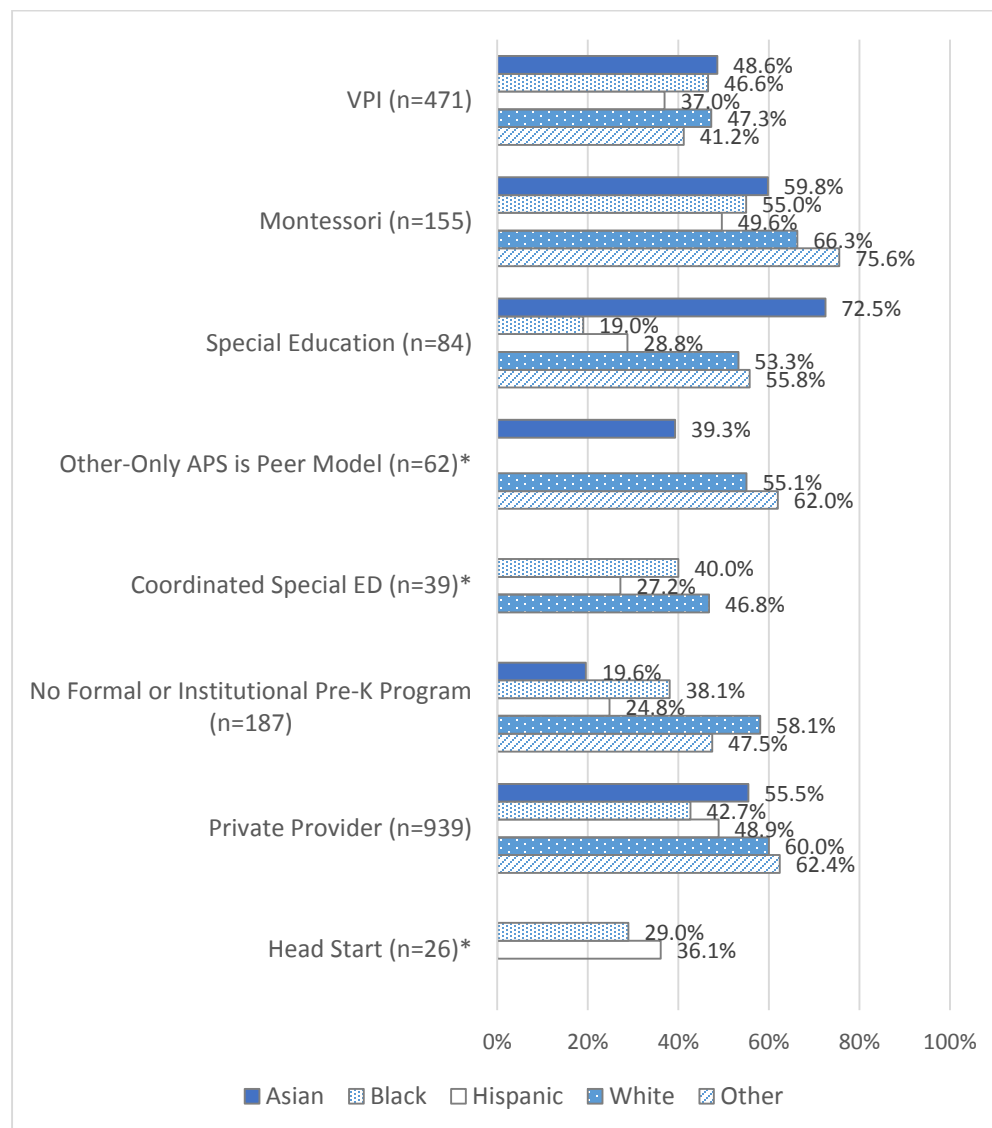


*Sample size groups smaller than 5 are not reported

Table 16: 2012-13 Kindergarten Beginning of Year Math Scores and Sample Sizes by Pre-K Experience and SWD Status

	SWD		Non-SWD	
	n	%Total Score	n	%Total Score
VPI	45	25.9%	438	38.8%
Montessori	9	29.4%	130	49.3%
Special Education	45	33.4%	18	44.2%
Other-Only APS Peer Model	13	48.5%	0	*
Coordinated Special Education	27	27.6%	10	45.5%
No Formal or Institutional Pre-K Program	10	16.0%	182	33.2%
Private Provider	31	41.6%	955	52.1%
Head Start	2	*	35	28.0%

Figure 21: 2015-16 Kindergarten Beginning of Year Math Scores by Pre-K Experience and Ethnicity



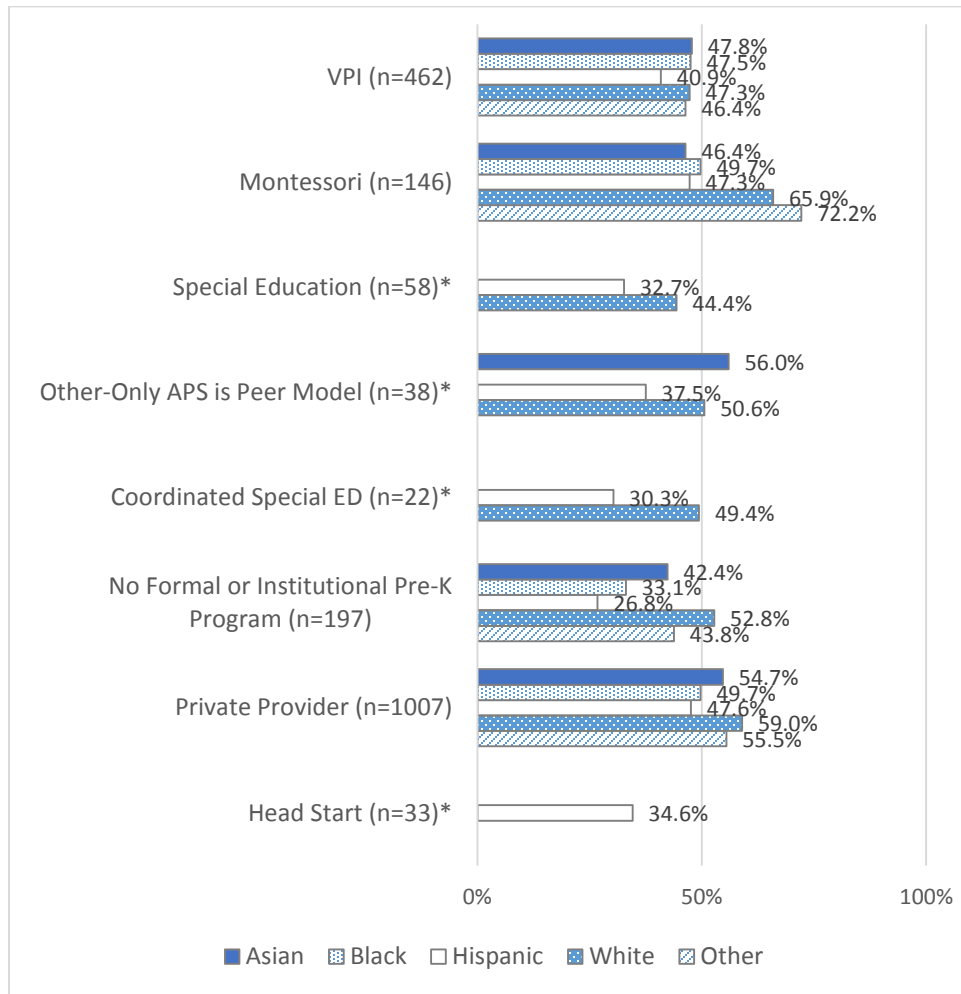
*Sample size groups smaller than 5 are not reported

Table 17: 2015-16 Kindergarten Beginning of Year Math Scores and Sample Sizes by Pre-K Experience and Ethnicity

	Asian		Black		Hispanic		White		Other	
	n	%Total Score	n	%Total Score	n	%Total Score	n	%Total Score	n	%Total Score
VPI	48	48.6%	94	46.6%	264	37.0%	52	47.3%	13	41.2%
Montessori	21	59.8%	21	55.0%	47	49.6%	58	66.3%	8	75.6%
Special Education	6	72.5%	5	19.0%	13	28.8%	54	53.3%	6	55.8%
Other-Only APS Peer Model	7	39.3%	3	*	4	*	43	55.1%	5	62.0%
Coordinated Special Education	2	*	5	40.0%	9	27.2%	19	46.8%	4	*
No Formal or Institutional Pre-K Program	24	22.7%	21	38.1%	74	24.8%	62	58.1%	6	47.5%
Private Provider	73	55.5%	30	42.7%	77	48.9%	674	60.0%	77	62.4%
Head Start	1	*	10	29.0%	14	36.1%	0		1	*

*Sample size groups smaller than 5 are not reported

Figure 22: 2014-15 Kindergarten Beginning of Year Math Scores by Pre-K Experience and Ethnicity



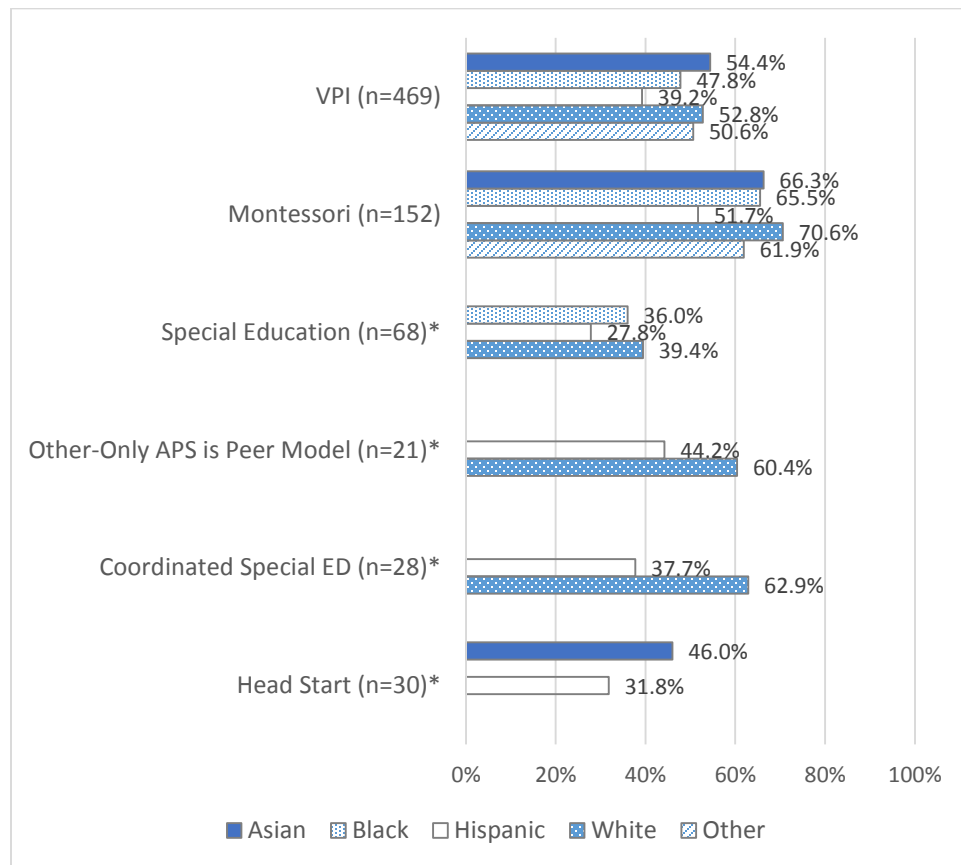
*Sample size groups smaller than 5 are not reported

Table 18: 2014-15 Kindergarten Beginning of Year Math Scores and Sample Sizes by Pre-K Experience and Ethnicity

	Asian		Black		Hispanic		White		Other	
	n	%Total Score	n	%Total Score	n	%Total Score	n	%Total Score	n	%Total Score
VPI	58	47.8%	81	47.5%	263	40.9%	49	47.3%	11	46.4%
Montessori	11	46.4%	31	49.7%	47	47.3%	48	65.9%	9	72.2%
Special Education	2	*	3	*	11	32.7%	39	44.4%	3	*
Other-Only APS Peer Model	5	56.0%	3	*	8	37.5%	18	50.6%	4	*
Coordinated Special Education	2	*	3	*	8	30.6%	8	49.4%	1	*
No Formal or Institutional Pre-K Program	19	42.4%	24	33.1%	81	26.8%	61	52.8%	12	43.8%
Private Provider	71	54.7%	29	49.7%	82	47.6%	732	59.0%	93	55.5%
Head Start	3	*	4	*	24	34.6%	1	*	1	*

*Sample size groups smaller than 5 are not reported

Figure 23: 2013-14 Kindergarten Beginning of Year Math Scores by Pre-K Experience and Ethnicity



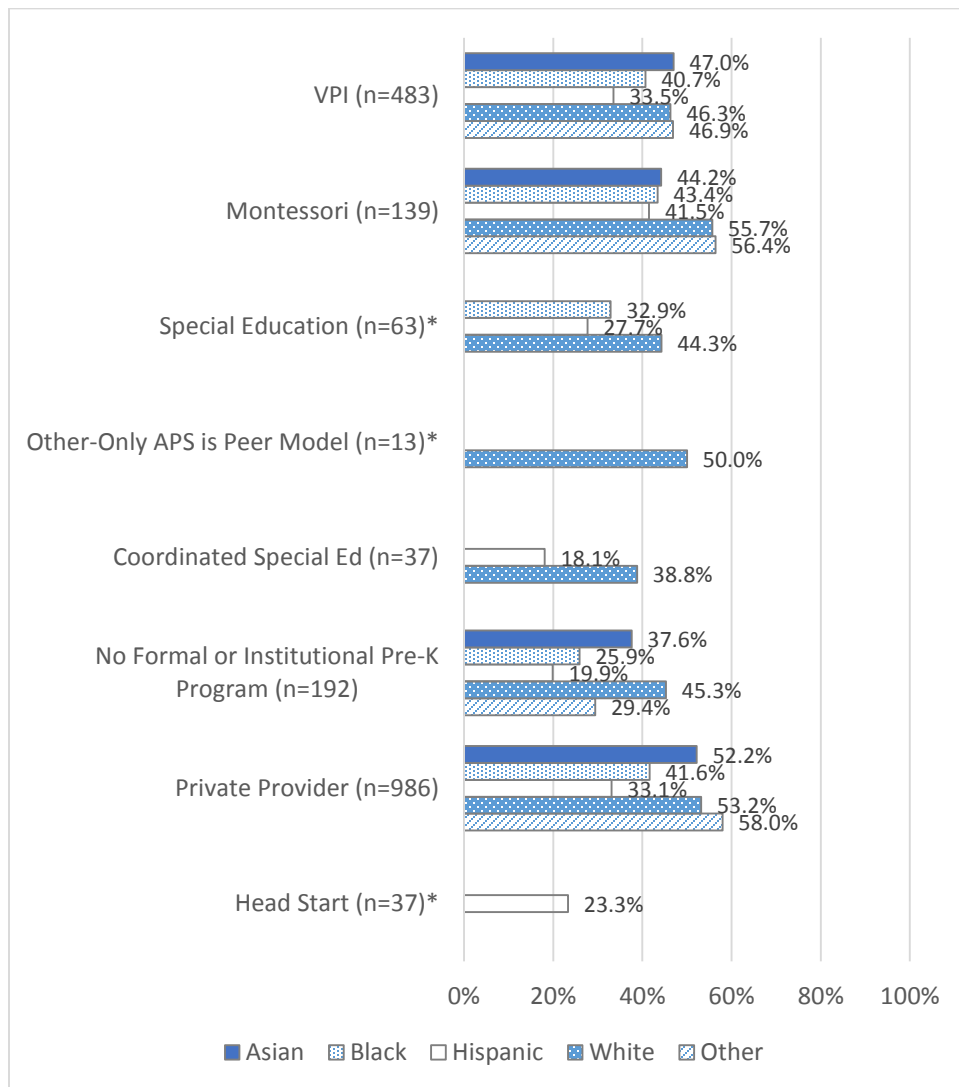
*Sample size groups smaller than 5 are not reported

Table 19: 2013-14 Kindergarten Beginning of Year Math Scores and Sample Sizes by Pre-K Experience and Ethnicity

	Asian		Black		Hispanic		White		Other	
	n	%Total Score	n	%Total Score	n	%Total Score	n	%Total Score	n	%Total Score
VPI	61	54.4%	80	47.8%	281	39.2%	39	52.8%	8	50.6%
Montessori	19	66.3%	21	65.5%	62	51.7%	42	70.6%	8	61.9%
Special Education	1	*	5	36.0%	25	27.8%	33	39.4%	4	*
Other-Only APS Peer Model	0	*	1	*	6	44.2%	12	60.4%	2	*
Coordinated Special Education	3	*	0	*	11	37.7%	12	62.9%	2	*
Head Start	5	46.0%	4	*	17	31.8%	4	*	0	*

*Sample size groups smaller than 5 are not reported

Figure 24: 2012-13 Kindergarten Beginning of Year Math Scores by Pre-K Experience and Ethnicity



*Sample size groups smaller than 5 are not reported

Table 20: 2012-13 Kindergarten Beginning of Year Math Scores and Sample Sizes by Pre-K Experience and Ethnicity

	Asian		Black		Hispanic		White		Other	
	n	%Total Score	n	%Total Score	n	%Total Score	n	%Total Score	n	%Total Score
VPI	51	47.4%	80	40.7%	297	33.5%	42	46.3%	13	46.9%
Montessori	13	44.2%	19	43.4%	49	41.5%	51	55.7%	7	56.4%
Special Education	4	*	7	32.9%	22	27.7%	28	44.3%	2	*
Other-Only APS Peer Model	0	*	1	*	4	*	0		58	50.0%
Coordinated Special Education	1	*	2	*	13	18.1%	20	38.8%	1	*
No Formal or Institutional Pre-K Program	21	37.6%	22	25.0%	70	19.9%	71	45.3%	8	29.4%
Private Provider	58	52.2%	37	41.6%	62	33.1%	759	53.2%	70	58.0%
Head Start	2	*	4	*	26	23.3%	4	*	1	*

*Sample size groups smaller than 5 are not reported

Kindergarten PALS Fall Assessment

The Phonological Awareness Literacy Screening (PALS) provides a comprehensive assessment of young children's knowledge of the important literacy fundamentals that are predictive of future reading success. PALS is the state-provided screening tool for Virginia's Early Intervention Reading Initiative (EIRI) and is used by 99% of school divisions in Virginia on a voluntary basis.

PALS consists of three instruments, PALS-PreK (for preschool students), PALS-K (for kindergartners), and PALS 1-3 (for students in Grades 1-3). PALS assessments are designed to identify students in need of additional reading instruction beyond that provided to typically developing readers. PALS also informs teachers' instruction by providing them with explicit information about their students' knowledge of literacy fundamentals. Mid-year assessment and PALS Quick Checks allow for ongoing student progress monitoring throughout the year.

This appendix includes an analysis of beginning-of-year PALS-K scores for all APS kindergartners, comparing various pre-K experiences.

Figure 1: 2015-16 Kindergarten Fall PALS Percent at or Above Benchmark, by Pre-K Experience

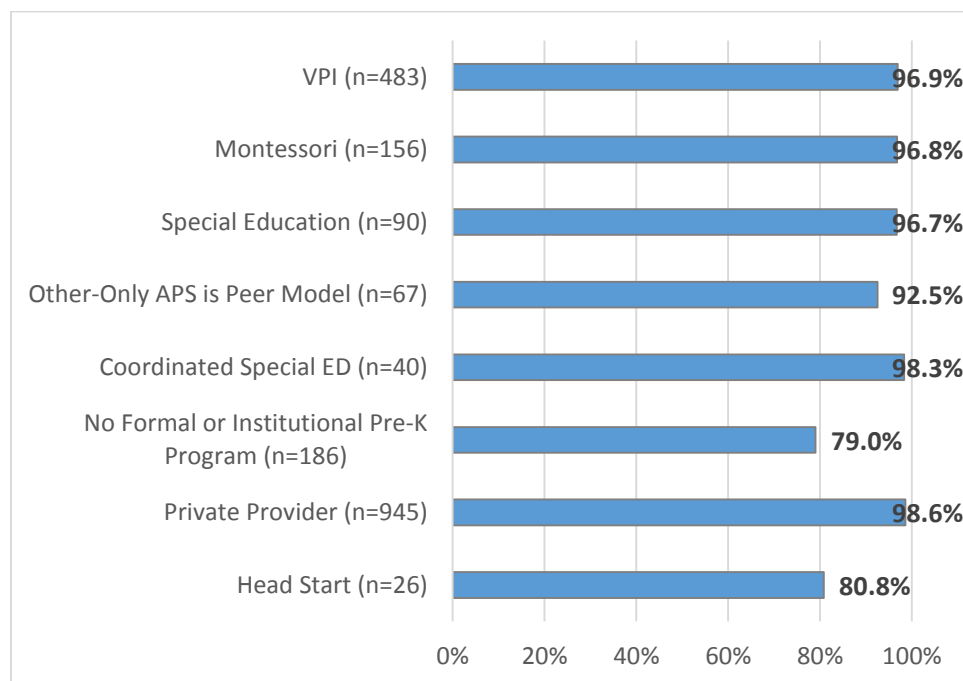


Figure 2: 2014-15 Kindergarten Fall PALS Percent at or Above Benchmark, by Pre-K Experience

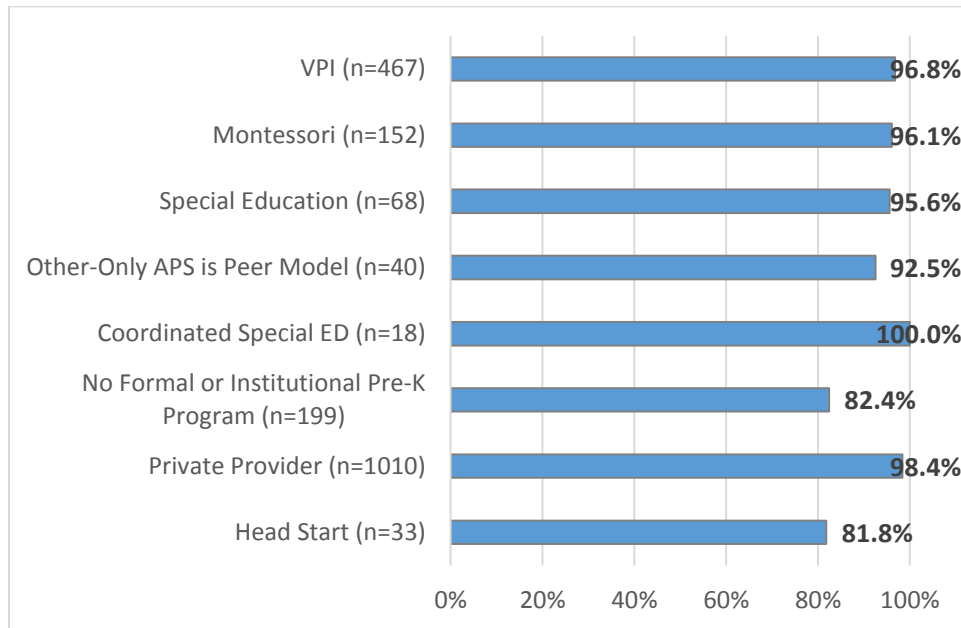
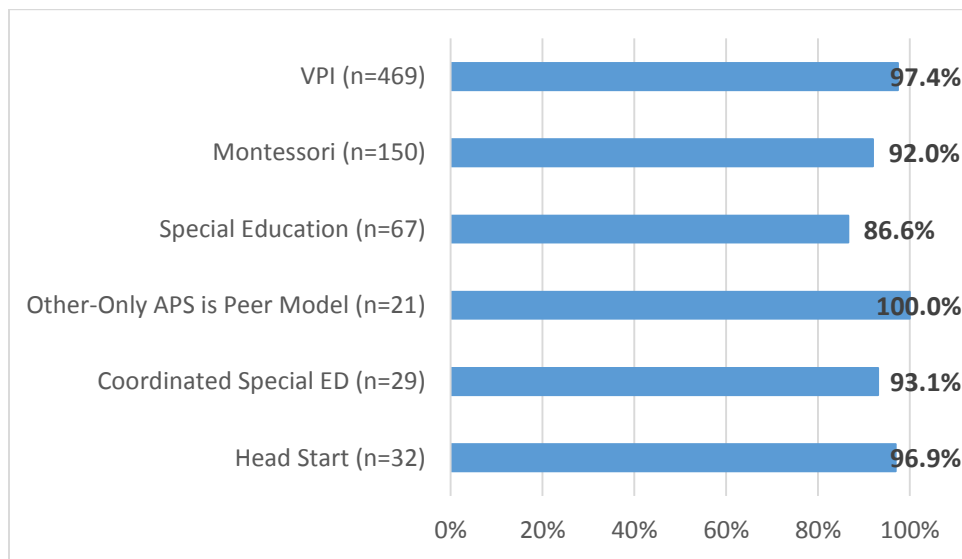


Figure 3: 2013-14 Kindergarten Fall PALS Percent at or Above Benchmark, by Pre-K Experience



Appendix F4

In the following graphs, the n is listed for all demographic groups included in the graph. For example, in **Figure 4**, there are 230 male students in VPI and 253 female students.

Figure 4: 2015-16 Kindergarten Fall PALS Percent at or Above Benchmark, by Pre-K Experience and Gender

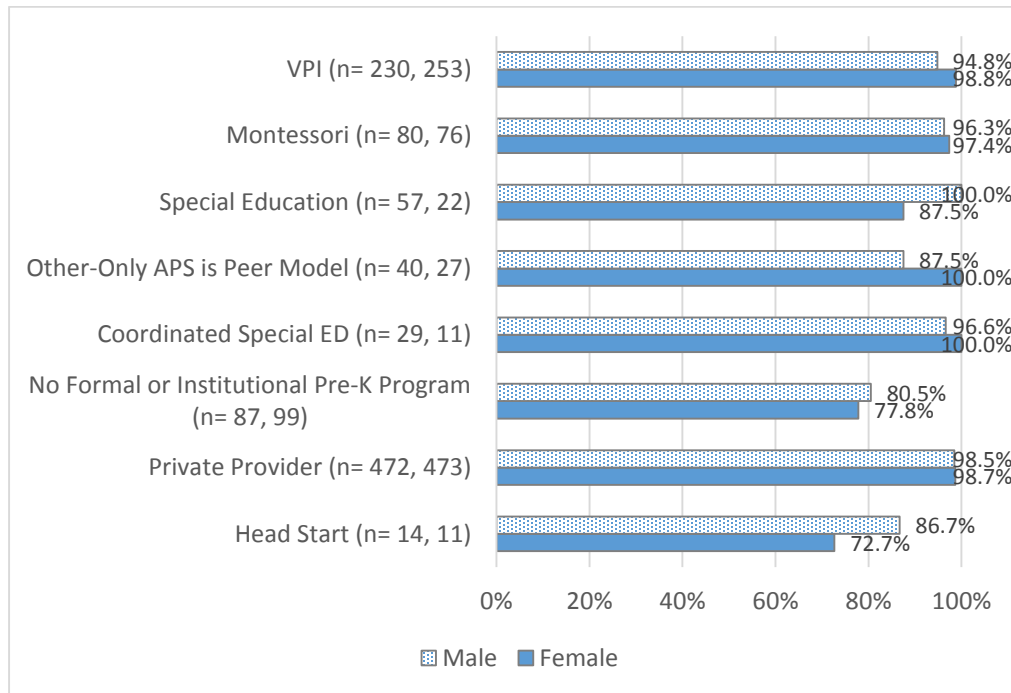


Figure 5: 2014-15 Kindergarten Fall PALS Percent at or Above Benchmark, by Pre-K Experience and Gender

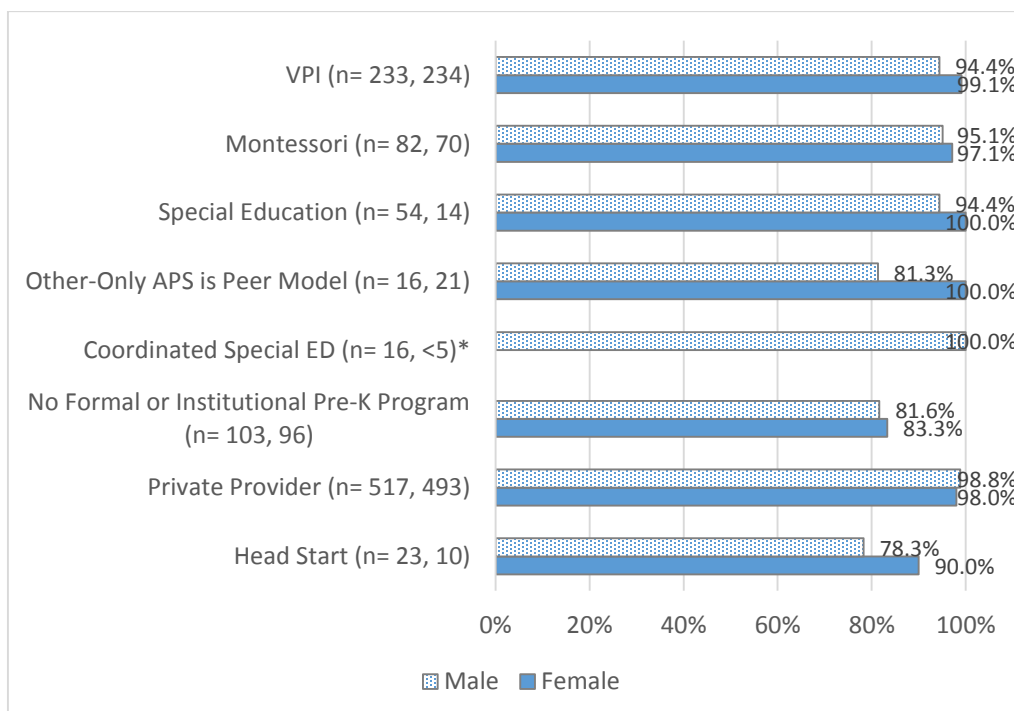


Figure 6: 2013-14 Kindergarten Fall PALS Percent at or Above Benchmark, by Pre-K Experience and Gender

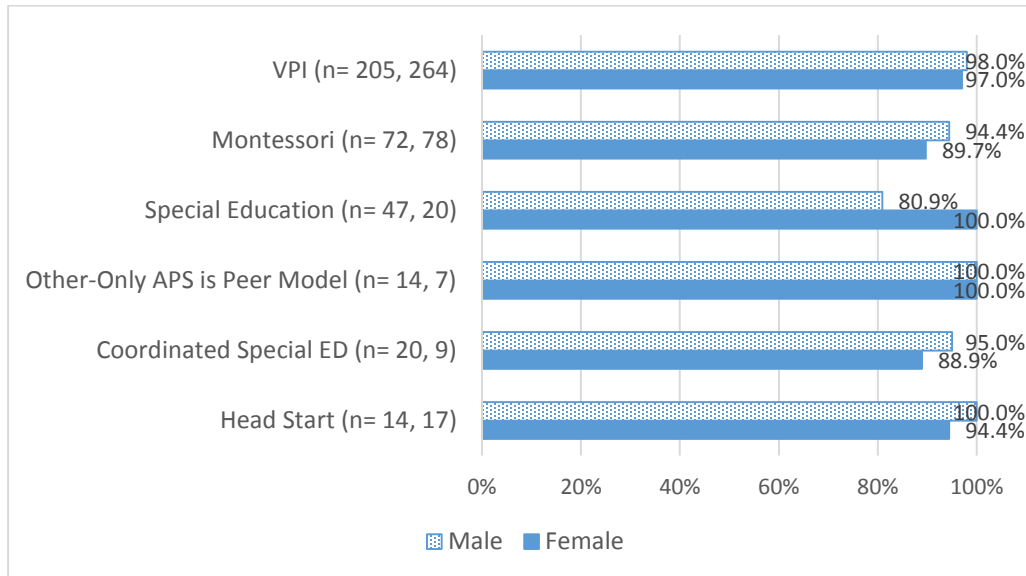


Figure 7: 2015-16 Kindergarten Fall PALS Percent at or Above Benchmark, by Pre-K Experience and LEP Status

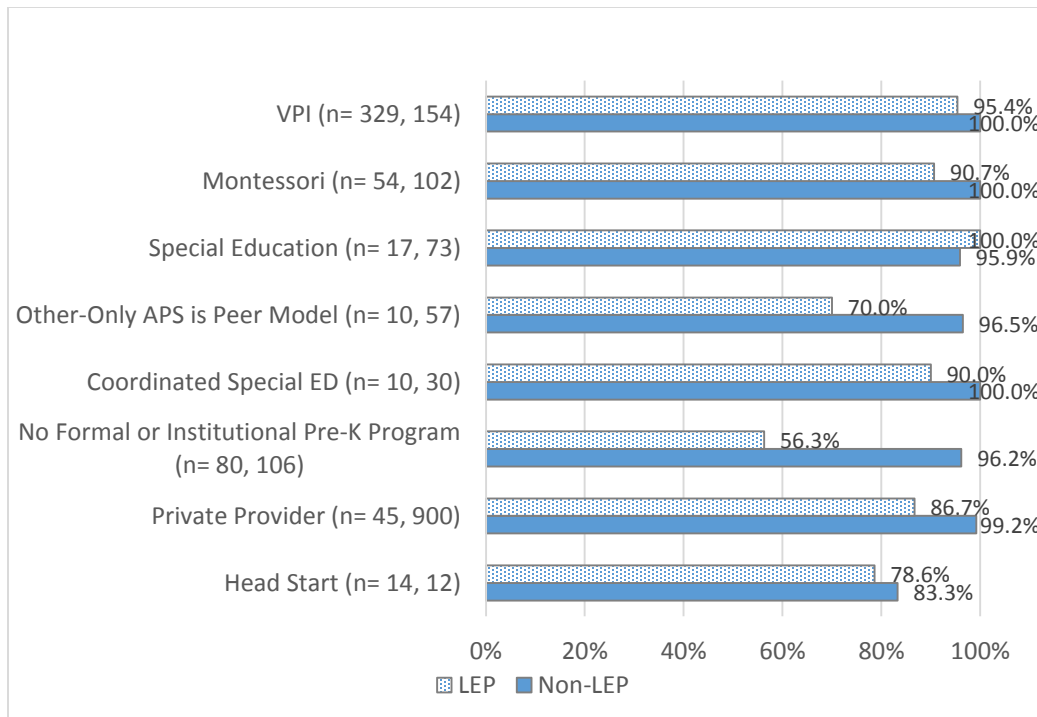


Figure 8: 2014-15 Kindergarten Fall PALS Percent at or Above Benchmark, by Pre-K Experience and LEP Status

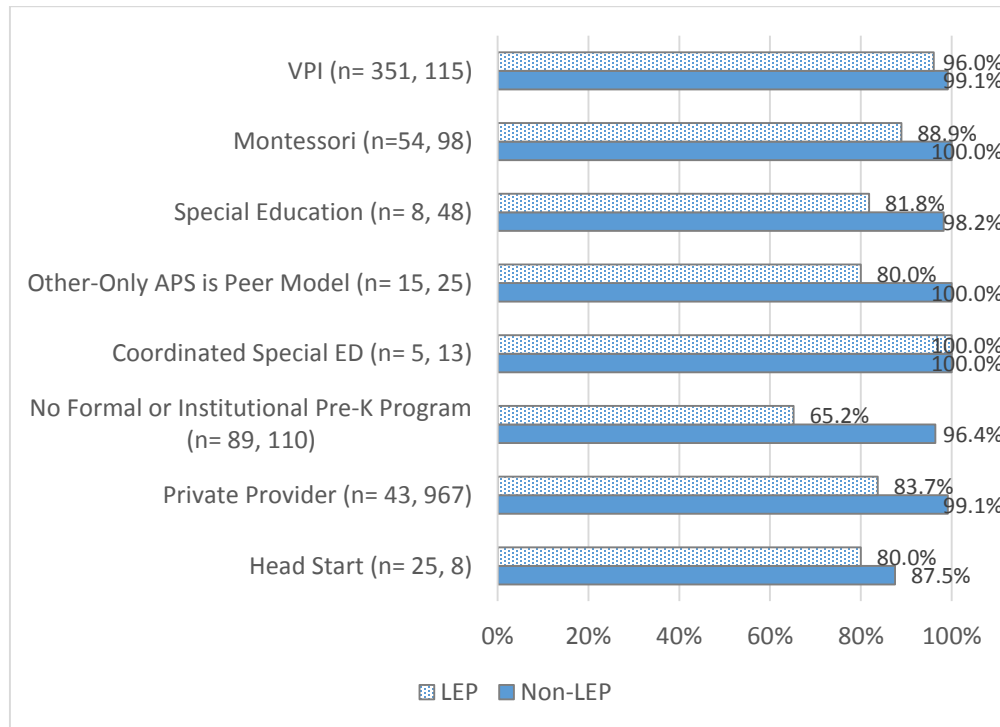


Figure 9: 2013-14 Kindergarten Fall PALS Percent at or Above Benchmark, by Pre-K Experience and LEP Status

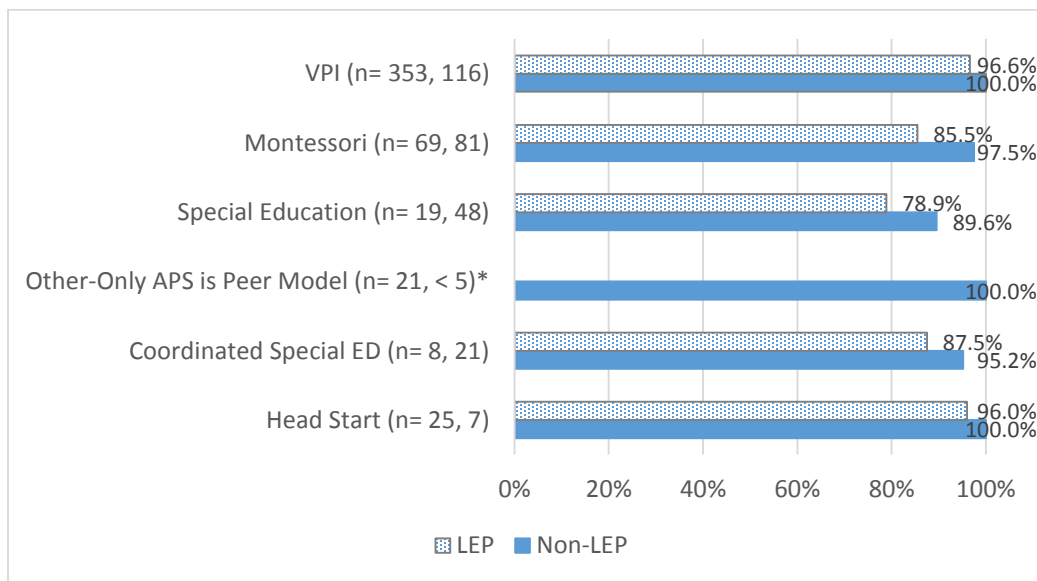


Figure 10: 2015-16 Kindergarten Fall PALS Percent at or Above Benchmark, by Pre-K Experience and Disadvantaged Status

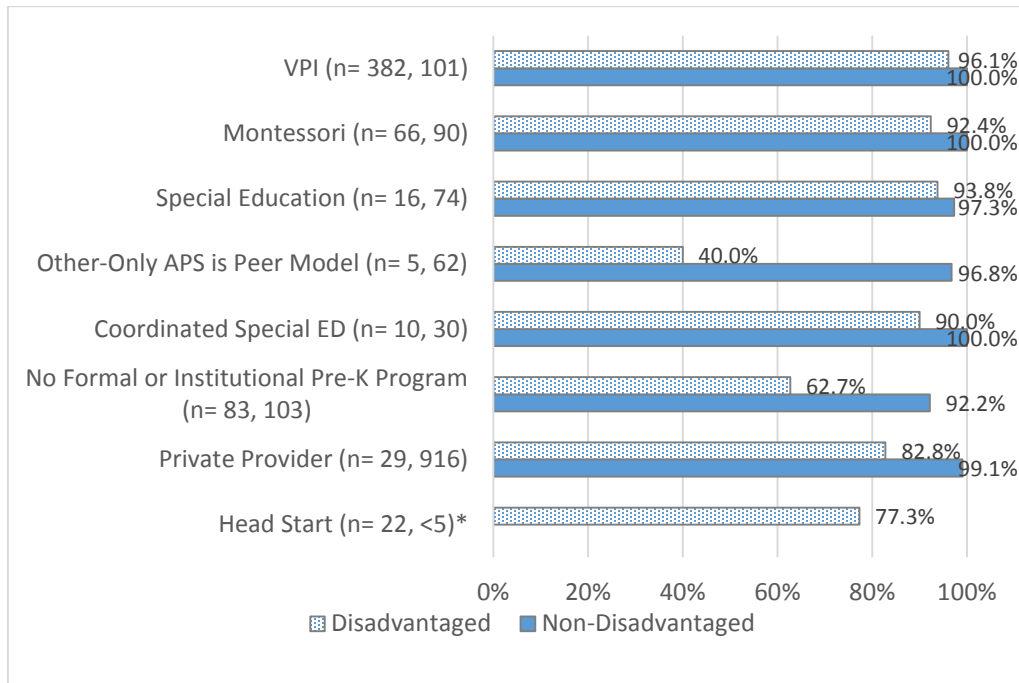


Figure 11: 2014-15 Kindergarten Fall PALS Percent at or Above Benchmark, by Pre-K Experience and Disadvantaged Status

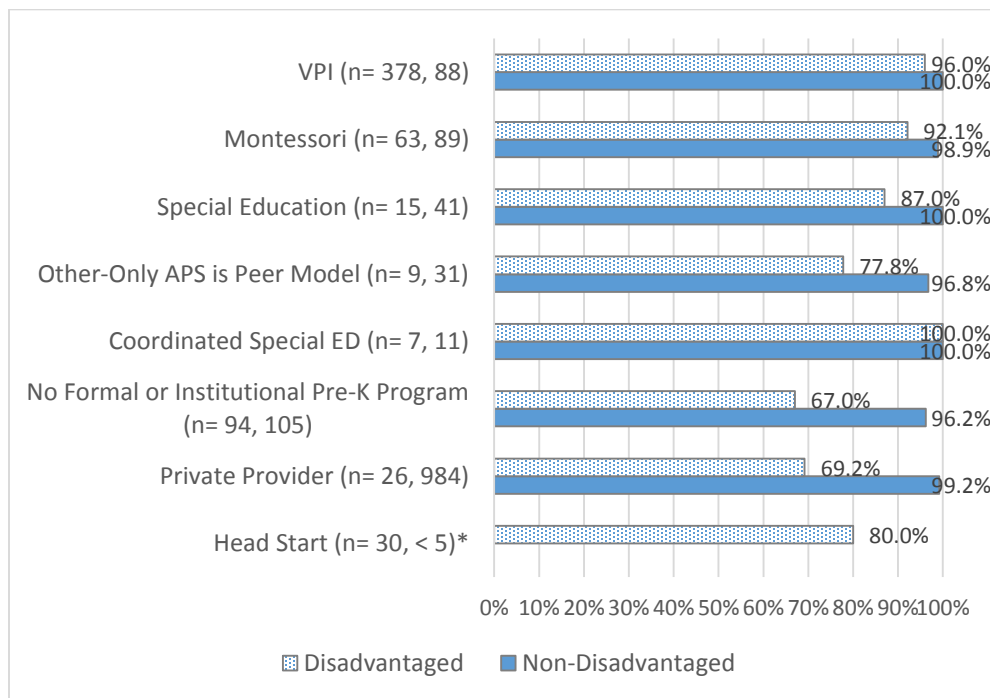


Figure 12: 2013-14 Kindergarten Fall PALS Percent at or Above Benchmark, by Pre-K Experience and Disadvantaged Status

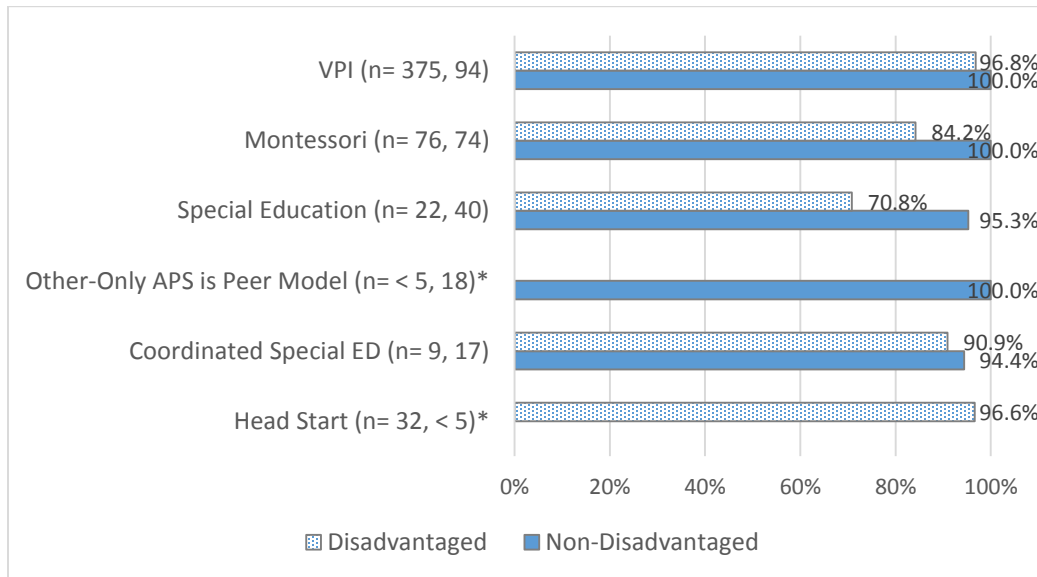


Figure 13: 2015-16 Kindergarten Fall PALS Percent at or Above Benchmark, by Pre-K Experience and Disability Status

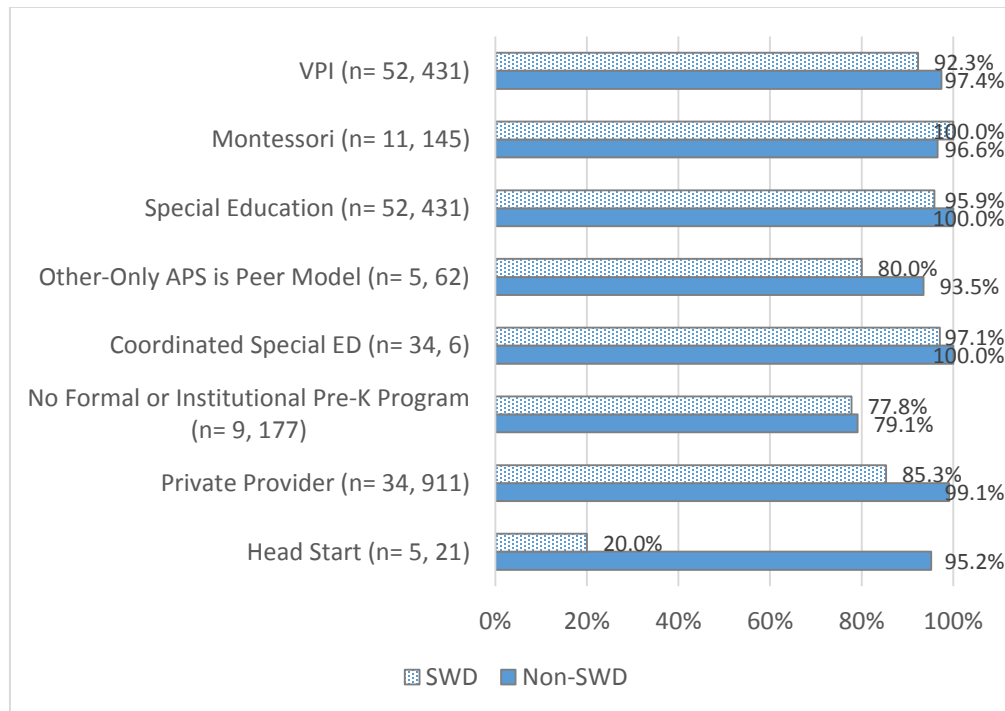


Figure 14: 2014-15 Kindergarten Fall PALS Percent at or Above Benchmark, by Pre-K Experience and Disability Status

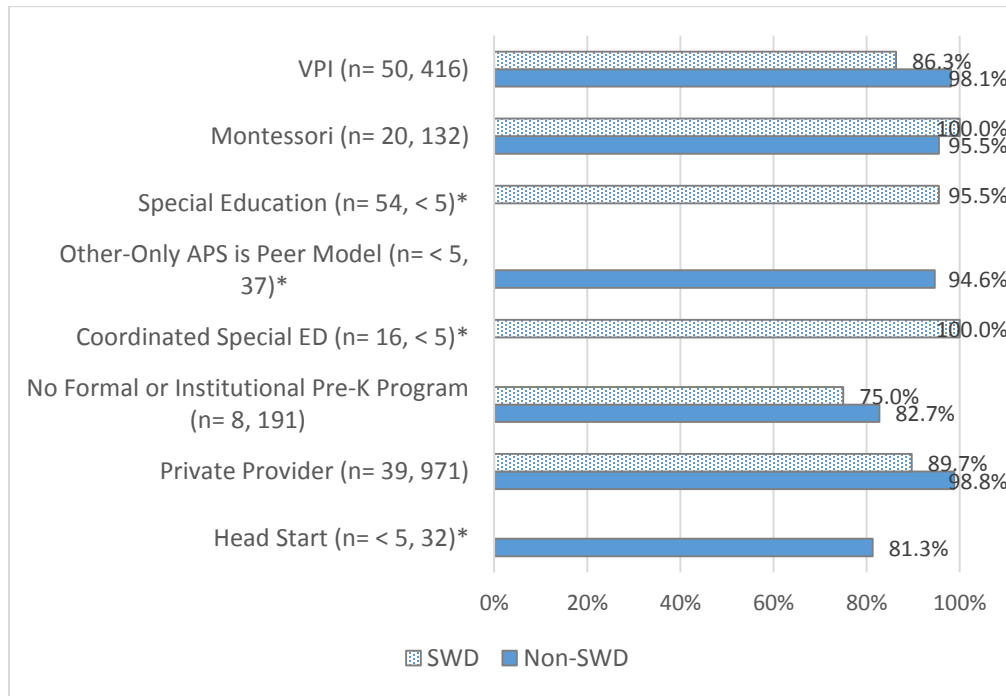


Figure 15: 2013-14 Kindergarten Fall PALS Percent at or Above Benchmark, by Pre-K Experience and Disability Status

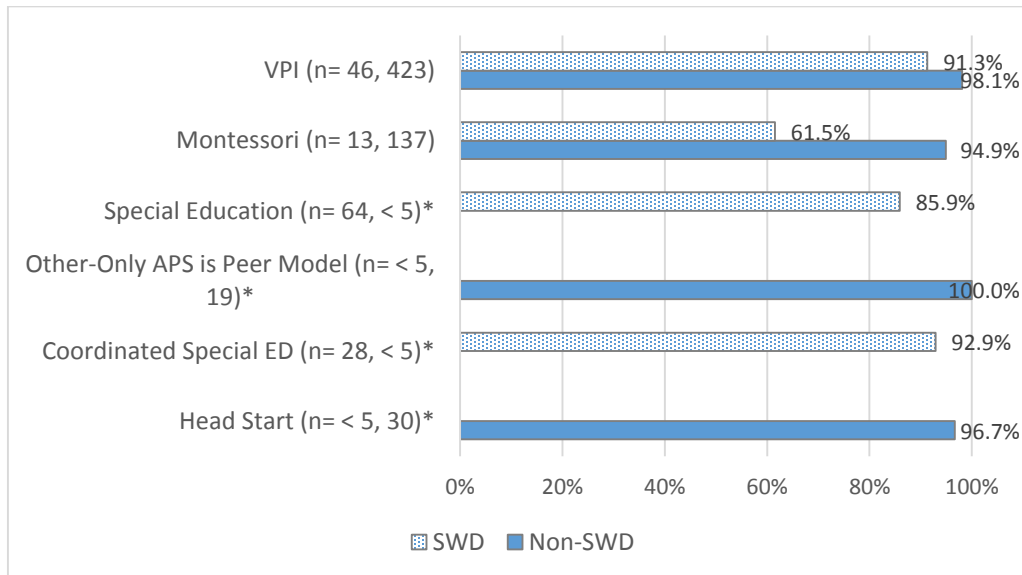


Figure 16: 2015-16 Kindergarten Fall PALS Percent at or Above Benchmark, by Pre-K Experience and Race/Ethnicity

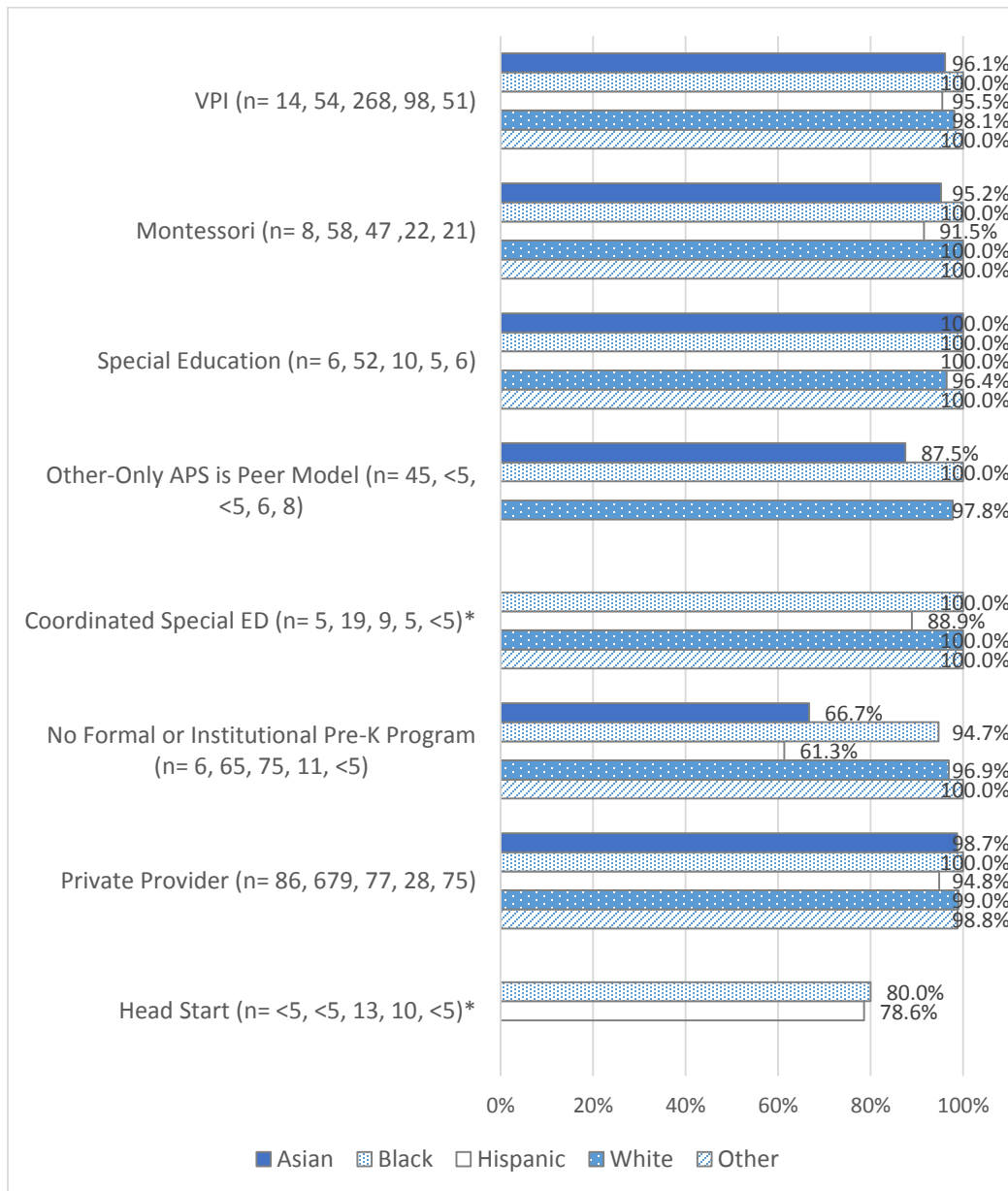


Figure 17: 2014-15 Kindergarten Fall PALS Percent at or Above Benchmark, by Pre-K Experience and Race/Ethnicity

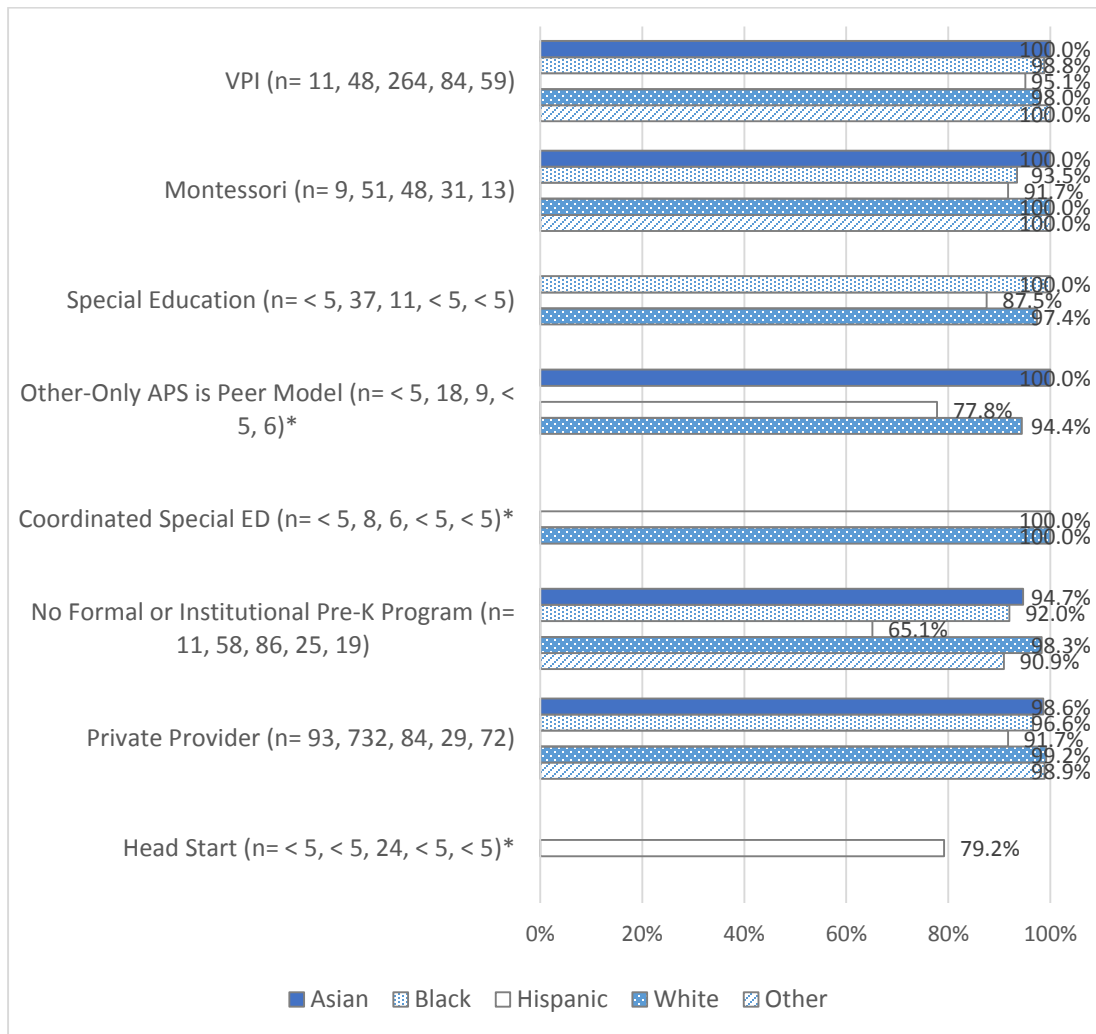
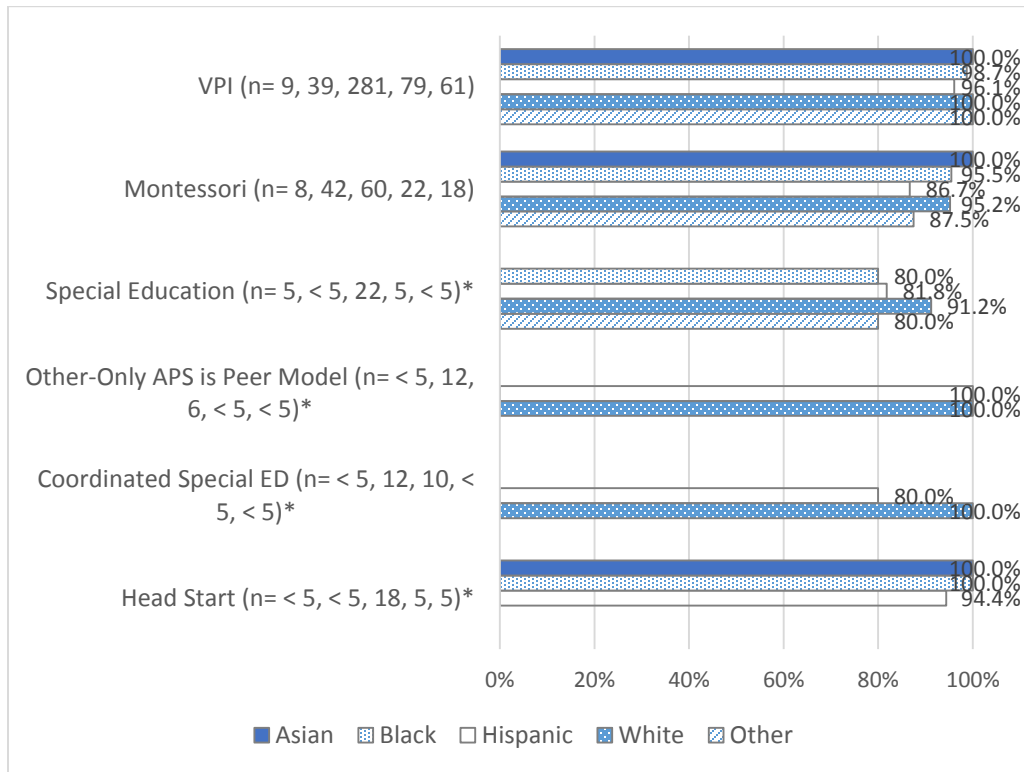


Figure 18: 2013-14 Kindergarten Fall PALS Percent at or Above Benchmark, by Pre-K Experience and Race/Ethnicity



EARLY CHILDHOOD EDUCATION LONGITUDINAL ANALYSIS

Prepared for Arlington Public Schools

December 2016



In the following report, Hanover Research analyzes academic outcomes of two cohorts of Arlington Public Schools students who participated in APS Pre-K Programs. The first cohort covers student outcomes in Grades 9-12, while the second dataset follows a different group of students in Kindergarten through Grade 8.

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EXECUTIVE SUMMARY AND KEY FINDINGS

INTRODUCTION

This report is preceded by two reports created by Hanover Research in 2008 and 2011 analyzing student performance in Kindergarten through Grade 8 after participation in Arlington Public Schools (APS) pre-kindergarten programs, focusing on the cohort of students entering kindergarten in the 2001-02 school year. In this report, Hanover Research continues analyzing performance of this same cohort of students during their high school years (Grades 9-12), as well as performance of a second cohort of students who participated in APS pre-kindergarten programs later on (entering kindergarten in the 2007-08 school year). For the second cohort we analyze performance in Kindergarten through Grade 8.

The methodology used in this report closely follows the descriptive analysis of the two previous reports. We consider different outcomes such as Standards of Learning (SOLs), Advanced Placement/International Baccalaureate credits, Degrees of Reading Power (DRP) program, Grade Point Average (GPA), Phonological Awareness Literacy Screening (PALS), Intervention Assistance Team (IAT) Referrals, attendance and Advanced Math credits.¹ Apart from analyzing overall student performance we pay special attention to those students who are identified as economically disadvantaged (ED) or having limited English proficiency (LEP).

In **Section I: Original Cohort Analysis**, we examine the high school performance of students who participated in the APS Pre-K programs with the original cohort relative to their peers who did not participate in APS Pre-K programs.² Because pre-K program type data for this cohort was obtained via a parent survey, it was less reliable than the data for the second cohort and did not allow for detailed breakdowns of students who did not attend APS Pre-K programs.

In **Section II: Second Cohort Analysis**, we study similar patterns for a subsequent cohort of students in Kindergarten through Grade 8. Due to richer data from the student information system, we are able to segment this cohort into groups of students who participated in the APS Pre-K, in a private Pre-K, in Head Start or a different kind of Pre-K program (labeled as “Other”), or did not attend any Pre-K. We compare APS Pre-K participants to their peers in the other four groups in this section.

¹ Not all of these outcomes are available for both cohorts and for all grades. Please see Figures 1.3 and 2.2 for more detailed information.

² This does not mean that the students have not participated in any other pre-K program.

KEY FINDINGS

- **In most assessments across different grades in the original cohort, APS Pre-K program participants underperform relative to their peers who did not attend an APS Preschool program.** We discuss this in more detail below.
- **In most assessments and grades in the second cohort, APS Pre-K program participants underperform relative to their peers in privately provided and Pre-K programs designated as “Other,” and outperform their peers in Head Start and those without any pre-K experience.**
- **Economically disadvantaged and LEP students that participated in APS Pre-K programs tend to outperform their peers with no Pre-K experience.** This finding holds true in most assessments and grades for both the original and second cohort.

ORIGINAL COHORT

- **SOLs:**
 - **Overall Cohort: For most assessments across all grades, non-participants have higher mean scale scores than students who attended APS Pre-K programs.** This trend supports the findings from the 2008 and 2011 reports on the same cohort. The APS Pre-K group performs better on some assessments in some grades but, with the exception of Writing, there is no consistency. Participants in APS Pre-K programs outperformed their peers in Writing in Grades 9, 10, and 12.
 - **Disadvantaged students subsample: APS Pre-K participating students on average perform better than their non-participating peers.** For all four grades, participants outperform non-participants in nine assessments. Non-participants do better on six assessments. Similar to the overall cohort analysis, Writing is the only assessment where we find consistency. **Participants in APS Pre-K programs perform better than their disadvantaged peers in Grades 10-12 on the Writing SOL.**
 - **LEP students subsample:** LEP participants of pre-K APS programs do even better relative to their peers than ED students or participants overall. **In this subsample, participants receive higher SOL scale scores on average for 12 assessments across four grades.** Conversely, non-participants outperform them on only three occasions.
- **GPA:**
 - **Overall Cohort:** We cannot say conclusively whether there is a difference in GPA between the two groups as our analysis did not identify a consistent pattern. **APS Pre-K participants outperform their peers in Grade 11, perform similarly in Grade 10, but do worse in Grades 9 and 12.**

- **Disadvantaged students subsample:** Participants consistently outperform their non-participating disadvantaged peers. The gap between two groups ranges from at least 0.13 points to at most 0.28 points. The largest gap is observed in Grade 11, which corresponds to the only grade APS Pre-K program participants did better than the overall high school cohort.
- **LEP students subsample:** While LEP students earn lower GPAs than the overall cohort, **LEP students who attended APS Pre-K programs outperform those who did not.** The largest gap in average GPA occurs in Grade 11, when the difference amounts to 0.28 points.
- **AP/IB credits:**
 - **Overall Cohort:** For Grade 9, APS Pre-K participants are shown to take more AP/IB classes than their peers; however, they are overtaken in Grade 10. In Grades 10-12, students who did not participate in APS Pre-K were more likely to take at least one AP or IB class.
 - **Disadvantaged students subsample:** Similar to the overall cohort, in the ED subsample **participants still take more AP/IB classes than their peers who did not attend an APS Pre-K program in Grade 9. In this case, the pattern also holds true for Grades 10-12.**
 - **LEP students subsample:** LEP students who participated in APS Pre-K programs take more AP/IB classes in Grades 10-12 than their LEP non-participant peers.
- **Attendance:**
 - **Overall Cohort:** In Grades 9, 10, and 12, APS Pre-K participants had higher attendance rates, but the difference between two groups does not exceed 1 percent.
 - **Disadvantaged students subsample:** Economically disadvantaged students who participated in APS Pre-K had higher attendance rates than their peers. The difference is more pronounced in this subsample, reaching roughly 2 percent in Grade 10.
 - **LEP students subsample:** LEP students had higher attendance if they participated in the APS Pre-K programs, relative to those who did not.
- **Graduation:**
 - **On Time Graduation:** All APS Pre-K participants graduated on time, while 2.1 percent of non-participants did not graduate on time in the overall sample. This holds true for ED and LEP samples, but 5.6 and 4.8 percent of non-participants did not graduate on time in these subgroups, respectively.
 - **Post-Graduation plans:** APS Pre-K participants are more likely to choose a four-year college as their post-graduation plan than non-participants. This holds true for the entire cohort, as well as the ED and LEP samples.

SECOND COHORT■ **SOLs:**

- **Overall Cohort: Across all grades, Head Start participants receive lower mean scores than APS Pre-K program participants. Students in the other three groups perform better than APS Pre-K program participants on most occasions.** The only exception is that students without any pre-k experience perform worse on the Grade 7 Math and Algebra assessments. Students who attended Pre-K programs which were privately provided or were any of the “Other”-designated programs receive similar scores to each other across grades.
- **Disadvantaged students subsample: While disadvantaged students who participated in APS Pre-K programs do better relative to their comparison group than what we found for the entire cohort, they still fall behind students in privately provided pre-K programs in terms of SOL scale scores on all occasions.** Due to the low number of observations, we cannot say how well APS Pre-K participants perform against students in “Other” Pre-K programs, but we find that they frequently outperform students in Head Start and non-participants.
- **LEP students subsample: Relative to the economically disadvantaged subgroup, LEP subgroup participant students perform similarly on SOL assessments.** In this case we are also able to draw comparisons to students in “Other” Pre-K programs, and find that those students do better on SOL assessments than participants in APS Pre-K programs.

■ **DRP:**

- **Overall Cohort: In both Grades 2 and 4, APS Pre-K participants’ performance is inferior to the performance of all comparison groups with the exception of Head Start students.** This holds true for average scores and for the percentage of students identified for remediation. The gap between APS participants and participants of privately provided Pre-K programs in terms of the latter widens between Grade 2 and Grade 4, from 10 to 28 percent.
- **Disadvantaged students subsample:** Disadvantaged students within all five groups perform very similarly to each other in terms mean scores, except that students who attended privately provided Pre-K programs have higher scores.
- **LEP students subsample: LEP students who participated in any of the APS preschool programs consistently outperform their peers in Head Start, but do worse than students in other groups.** The difference in mean DRP scores are more pronounced for this sample compared to what we saw with the economically disadvantaged sample.

■ **PALS:**

- **Overall Cohort:** Across all three grades, APS Pre-K students perform worse in terms of mean scores and below-benchmark performance compared to students who attended privately provided Pre-K programs and “Other” programs. Conversely, participants outperform students who attended Head Start or did not attend any Pre-K program in all three grades for both mean scores and performance levels.
- **Disadvantaged students subsample:** Contrary to the entire cohort, those who participated in the APS Pre-K programs perform better in Kindergarten fall semester and fall of Grade 1, while falling behind in the spring semester of Grade 1. This pattern is present in both mean scores and percentage of students who performed below benchmark in both fall and spring semesters. For instance, in the fall semester of Kindergarten only 15.5 percent of participants perform below benchmark, compared to 46.7 percent of students with no Pre-K. In comparison, in Grade 2 spring semester 18.6 percent of participants do not reach the benchmark level, while only 15.2 percent of students with no Pre-K fail to reach this level. It appears that the APS Pre-K cohort has not improved in terms of reaching the benchmark level over the course of three years, while their peers have.
- **LEP students subsample:** Similar to economically disadvantaged students, we find that **APS preschool program participants perform better on the PALS assessment in terms of mean scores relative to all groups except for students in privately provided Pre-K programs in Kindergarten and Grade 1.** However, the gap between the two groups shrinks as students progress through the grades. For instance, participants are less likely to perform below benchmark by 28 percent relative to non-participants when they are in the fall semester of Kindergarten, but they are less likely to do so by only 6 percent when they are in the spring semester of Grade 1.

■ **GPA:**

- **Overall Cohort:** Across all three grades, the GPA of APS Pre-K program participants is markedly lower than that of all other student groups except the Head Start cohort. The gap between APS Pre-K participants and privately provided Pre-K program participants in mean GPA values ranges from 0.464 points in Grade 8 to 0.542 points in Grade 7.
- **Disadvantaged students subsample:** Relative to the entire cohort, economically disadvantaged students who participated in the APS Preschool programs outperform their peers without pre-K experience and those in Head Start in Grades 6 and 7. However, by Grade 8 non-participants catch up with and ultimately pass them.
- **LEP students subsample:** APS Pre-K participants consistently earn higher GPAs than students in Head Start and students without Pre-K experience, but they are outperformed by their peers in privately provided and “Other” Pre-K programs.

■ **Advanced Math:**

- **Overall Cohort:** In all three middle school grades, **APS Pre-K participants take fewer advanced math classes than their counterparts in privately provided Pre-K and Other Pre-K programs.** The gap ranges from 8 percent in Grade 8 to 28 percent in Grade 7. Students without pre-K experience take more advanced math classes than APS Pre-K program participants in Grade 7 only.
 - **Disadvantaged students subsample:** Relative to the entire cohort, **economically disadvantaged students who participated in APS Pre-K programs perform better against their peers in terms of the number of advanced math classes taken.** While they still take fewer classes than students in privately provided and “Other” Pre-K programs in Grade 6, by Grades 7-8 the gap between APS Pre-K participants and these groups declines to the extent that participants overtake students in “Other” Pre-K programs in terms of the number of advanced math classes taken.
 - **LEP students subsample:** Similar to the economically disadvantaged subgroup, **LEP APS Pre-K participants take more advanced math classes than their peers by Grade 8.** In Grade 8, roughly 82 percent of APS preschool program participants take at least one advanced math class, while only 72 percent of Head Start and 67 percent of No Pre-K students do. Students in private Pre-K programs are still more likely to take advanced math courses, though the gap narrows by Grade 8.
- **IAT referrals:**
- In the overall cohort, **Grade 4 APS Pre-K program participants were less likely to be a new referral than their peers with no pre-K experience or privately provided Pre-K.** Due to the low number of observations, it is not possible to make firm conclusions about the differences between the groups for any of the three samples.
- **Attendance:**
- **Overall Cohort:** In Grades 1-3 students who participated in APS Pre-K programs had higher attendance rates than their Head Start and no-pre-K peers and lower attendance rates relative to students with privately provided or “Other” Pre-K experiences. In later grades the differences in attendance is very small.
 - **Disadvantaged students subsample:** **APS Pre-K participants are more likely to attend school than other groups in Grades 1, 3, and 6-8.** Among the other four groups, no clear pattern emerges when it comes to attendance of one group relative to the rest in this subsample.
 - **LEP students subsample:** Trends in attendance rates by Pre-K program type are not particularly consistent, with no group displaying a consistent advantage in attendance over the full range of grade levels. APS Pre-K participants do not have either the highest or the lowest attendance rate in any grade level among LEP students.

SECTION I: ORIGINAL COHORT ANALYSIS

In this section, Hanover Research analyzes academic outcomes of original cohort students who participated in the APS Pre-K programs relative to their non-participating peers. As the two previous reports analyzed earlier grades, here we only consider high school (Grades 9-12).

DATA AND METHODOLOGY

The data file provided by APS included both demographic and academic variables for the original cohort for 2000/01-2013/14 years. We mostly focus on academic variables in this report. The outcome variables are only available for the high school grades in 2010/11-2013/14.

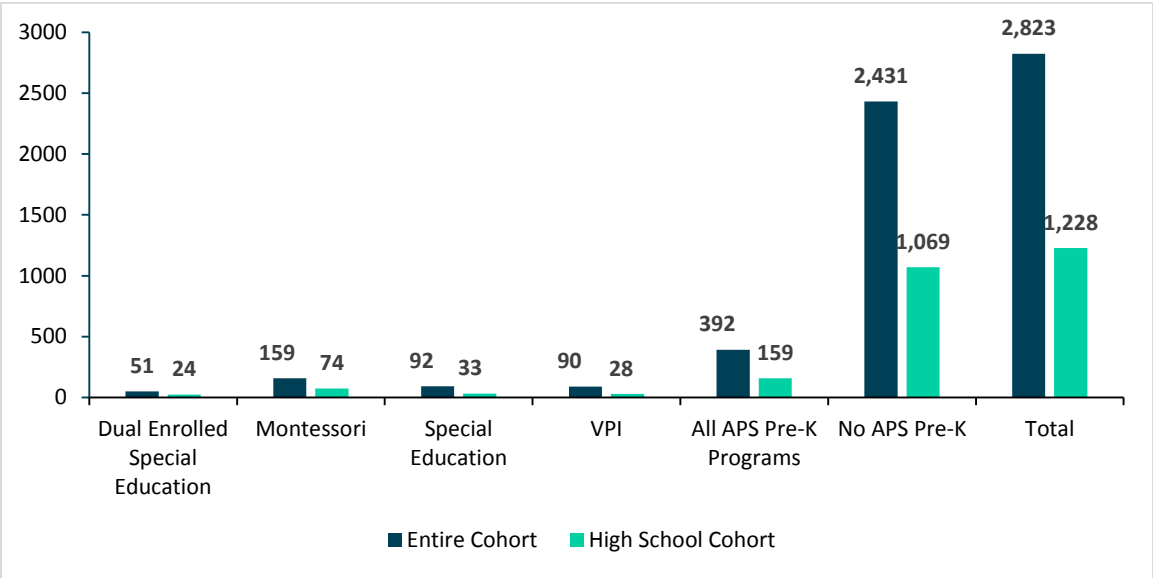
There are 2,834 students initially present in the dataset. We drop 11 observations for students who are listed as “retained in kindergarten,” following the 2011 report’s methodology. The final dataset of the entire cohort has 2,823 students. We then limit it to only those students who attended Grades 9-12 (the high school cohort): 1,228 observations remain.

Figure 1.1 compares high school enrollment of students to the initial pre-K program participation. **Relative to the middle school cohort discussed in the 2011 report, overall retention rate for APS Pre-K programs has increased by 4 percentage points**, possibly accounting for students who went to a middle school outside of the district.

Figure 1.1: Retention in High School Cohort

PROGRAM	ENTIRE COHORT		HIGH SCHOOL COHORT		PERCENT RETENTION
	N	Pct	N	Pct	
Dual Enrolled Special Education	51	1.8%	24	2.0%	47.1%
Montessori	159	5.6%	74	6.0%	46.5%
Special Education	92	3.3%	33	2.7%	35.9%
VPI	90	3.2%	28	2.3%	31.1%
All APS Pre-K Programs	392	13.9%	159	13.0%	40.6%
No APS Pre-K	2,431	86.1%	1,069	87.1%	44.0%
Total	2,823	100.0%	1,228	100.0%	43.5%

Figure 1.2: Enrollment in APS Pre-K Programs: Initial Cohort vs High School Cohort



Apart from analyzing the overall trends in the entire cohort, we also segment students by their LEP and disadvantaged statuses. We have information about students’ LEP status starting with 2004/05 (Grade 3). We use the first available instance for students who were not enrolled or do not have data for the 2004/05 year. We follow a similar procedure to construct the disadvantaged status variable, but in this case the first available data come from students’ pre-K year.

OUTCOME VARIABLES

Figure 1.3 describes available academic outcomes for every year (Grades 9-12).

Advanced Placement/International Baccalaureate credits indicate how many AP or IB designated classes a student has taken during a given grade. For this outcome, we calculate the shares of students who took no AP or IB classes, as well as the share who took one, two, or three or more AP/IB classes.³ GPA stands for the Grade Point Average and is available for all four years, similar to the AP/IB indicator and attendance percentage.

The on-time graduation outcome measures the fraction of students who graduated with their 9th grade starting cohort. We also determine the share of students whose post-graduation plans were to attend a four-year college.

The SOLs are a set of academic standards which are measured through annual SOL tests and assessments.⁴ Most of the assessments for Standards of Learning are consistent across the four years, but there are minor differences, recorded in the figure below. An analysis of scale scores and pass rates is presented in this section.

³ The maximum number of AP or IB classes taken during any grade is seven.
⁴ Testing and Standards of Learning (SOL), <http://www.doe.virginia.gov/testing/index.shtml>.

It is worth noting that students who start together in pre-K do not necessarily graduate together. Some students might fall behind and repeat a year or more, and some might jump ahead, graduating earlier. To account for these students, we reshape the data in such a way that we can analyze all students who complete a certain SOL assessment when they are in a certain grade regardless of the year in which they are enrolled in that grade level. For example, we analyze a student who completed Math 8 in Grade 9 in 2010/11 together with the students who completed the same assessment in Grade 9 in 2011/12.

Figure 1.3: Assessment by Testing Type and Year

TESTING TYPE	2010/11	2011/12	2012/13	2013/14
AP/IB Classes	X	X	X	X
GPA	X	X	X	X
Attendance	X	X	X	X
On-Time Graduation				X
Post High School Plans				X
Standards of Learning (SOL)	World Geography, World History I and II, Algebra I and II, Geometry, Math8, Reading8, Biology, Chemistry, Earth Science, Science8, Writing8	VA/US History, World Geography, World History I and II, Algebra I and II, Geometry, Math8, Reading8, Biology, Chemistry, Earth Science, Writing	VA/US History, World Geography, World History I and II, Algebra I and II, Geometry, Math8, Reading8, Reading, Biology, Chemistry, Earth Science, Writing	VA/US History, World Geography, World History I and II, Math8, Algebra I and II, Geometry, Reading, Biology, Chemistry, Earth Science, Writing

METHODOLOGY

We apply bivariate analysis to the available dataset to determine whether APS pre-K participants differ from non-participants in the listed academic outcomes. This analysis is performed on the entire cohort as well as sub-groups of economically disadvantaged and LEP students.

OVERALL COHORT ANALYSIS

STANDARDS OF LEARNING

Figures 1.4-1.15 describe the differences between APS Pre-K participants and non-participants in the High School Cohort (Entire Cohort here). Tables show the mean scale scores, number of observations and performance level, while the graphs that follow show the difference of mean scores between participants and non-participants for every assessment. Throughout this section, blank cells in tables indicate that fewer than 10 students in that group took the SOL exam in question in that grade level.⁵ In graphs, data for a test is omitted

⁵ For outcomes where we display the percentage of students in various groups (such as the SOL performance levels), the suppression of results based on small sample sizes is based on the total number of students with valid data, across all categories of the outcome, rather than the count within each level of the outcome. So, for example, we

if either group (APS Pre-K participants or non-participants) includes fewer than 10 students who took the test.

For most assessments across all grades, non-participants have higher mean scale scores than students who attended APS Pre-K programs. This trend supports the findings from the 2008 and 2011 reports on the same cohort. The APS Pre-K group performs better on some assessments in some grades, but there is no consistency with the exception of Writing. **Participants in the APS Pre-K program outperformed their peers in Writing in Grades 9, 10 and 12.**

Figure 1.4: Grade 9 Standards of Learning Mean Scores⁶

COURSE	No APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean
World Geography	33	373.7	--	--	39.00	375.7
World History I	13	414.4	--	--	14	414.6
World History II	910	463.1	132	458.1	1042	462.5
Math 8	39	318.1	--	--	45.00	318.6
Algebra I	353	464.3	51	457.4	404	463.4
Algebra II	107	527.6	13	518.8	120	526.6
Geometry	408	498.4	66	489.4	474.00	497.1
Biology	916	475.6	133	472.2	1049	475.2
Earth Science	13	441.1	--	--	16	446.8
Writing	47	508.6	15	509.7	62.00	508.9
Reading 8	38	375.8	--	--	45	379.2

display full data for the "No APS Pre-K" group on the World Geography exam in Grade 9 because 33 students took that exam, even though only one scored at the "Advanced" level.

⁶ Due to a low number of observations US/VA History, Chemistry and Reading are omitted from Figures 1.4 and 1.5.

Figure 1.5: Grade 9 Standards of Learning Performance Levels

	NO APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct
World Geography						
Fail	23	69.7%	--	--	27	69.2%
Proficient	9	27.3%	--	--	11	28.2%
Advanced	1	3.0%	--	--	1	2.6%
World History I						
Fail	6	46.2%	--	--	6	42.9%
Proficient	7	53.8%	--	--	8	57.1%
Advanced	0	0	--	--	0	0
World History II						
Fail	126	13.8%	18	13.6%	144	13.8%
Proficient	527	57.9%	76	57.6%	603	57.9%
Advanced	257	28.2%	38	28.8%	295	28.3%
Math 8						
Fail	37	94.9%	--	--	43	95.6%
Proficient	2	5.1%	--	--	2	4.4%
Advanced	0	0	--	--	0	0
Algebra I						
Fail	19	5.4%	1	2.0%	20	5.0%
Proficient	275	77.9%	45	88.2%	320	79.2%
Advanced	59	16.7%	5	9.8%	64	15.8%
Algebra II						
Fail	0	0	0	0	0	0
Proficient	32	29.9%	4	30.8%	36	30.0%
Advanced	75	70.1%	9	69.2%	84	70.0%
Geometry						
Fail	4	1.0%	1	1.5%	5	1.1%
Proficient	189	46.3%	33	50.0%	222	46.8%
Advanced	215	52.7%	32	48.5%	247	52.1%
Biology						
Fail	53	5.8%	4	3.0%	57	5.4%
Proficient	566	61.8%	95	71.4%	661	63.0%
Advanced	297	32.4%	34	25.6%	331	31.6%
Earth Science						
Fail	3	23.1%	--	--	4	25.0%
Proficient	9	69.2%	--	--	10	62.5%
Advanced	1	7.7%	--	--	2	12.5%
Writing						
Fail	1	2.1%	1	6.7%	2	3.2%
Proficient	20	42.6%	6	40.0%	26	41.9%
Advanced	26	55.3%	8	53.3%	34	54.8%
Reading 8						
Fail	31	81.6%	--	--	35	77.8%
Proficient	7	18.4%	--	--	10	22.2%
Advanced	0	0	--	--	0	0

**Figure 1.6: Difference in Grade 9 Standards of Learning Mean Scores
(APS Pre-K – No APS Pre-K)**

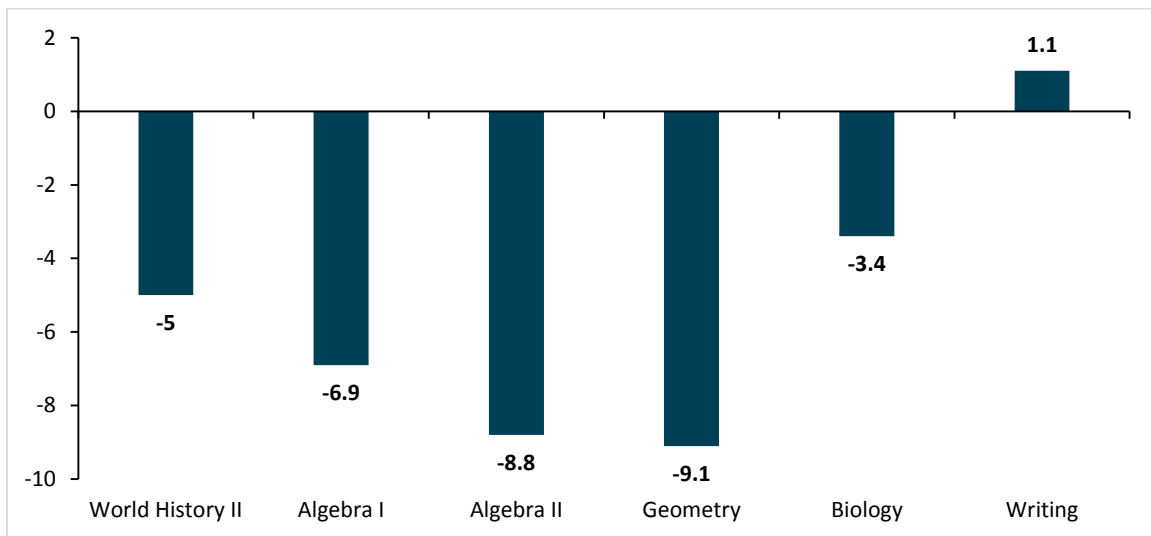


Figure 1.7: Grade 10 Standards of Learning Mean Scores⁷

COURSE	No APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean
US/VA History	19	419.4	--	--	21.00	399.2
World History I	229	445.6	35	450.2	264	446.2
World History II	67	389.1	10	351.6	77	384.3
Math 8	25	323.3	--	--	30.00	330.0
Algebra I	80	396.3	--	--	89	395.0
Algebra II	404	462.4	65	452.0	469	460.9
Geometry	324	423.5	40	419.4	364.00	423.0
Biology	47	401.3	--	--	52	402.8
Chemistry	539	486.3	78	479.2	617	485.4
Earth Science	323	457.7	43	445.2	366.00	456.2
Writing	211	490.8	127	505.6	338	496.4
Reading 8	25	377.4	--	--	25	377.4
Reading	16	433.3	--	--	17.00	433.4

Figure 1.8 Grade 10 Standards of Learning Performance Levels

	No APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct
US/VA History						
Fail	6	31.6%	--	--	7	33.3%
Proficient	12	63.2%	--	--	13	61.9%
Advanced	1	5.3%	--	--	1	4.8%

⁷ Due to a low number of observations World Geography is omitted from Figures 1.7 and 1.8.

	No APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct
World History I						
Fail	29	12.7%	2	5.7%	31	11.7%
Proficient	176	76.9%	28	80.0%	204	77.3%
Advanced	24	10.5%	5	14.3%	29	11.0%
World History II						
Fail	47	70.1%	5	50.0%	52	67.5%
Proficient	18	26.9%	5	50.0%	23	29.9%
Advanced	2	3.0%	0	0	2	2.6%
Math 8						
Fail	23	92.0%	--	--	27	90.0%
Proficient	2	8.0%	--	--	3	10.0%
Advanced	0	0	--	--	0	0
Algebra I						
Fail	37	46.3%	--	--	44	49.4%
Proficient	41	51.2%	--	--	43	48.3%
Advanced	2	2.5%	--	--	2	2.2%
Algebra II						
Fail	14	3.5%	6	9.2%	20	4.3%
Proficient	311	77.0%	49	75.4%	360	76.8%
Advanced	79	19.6%	10	15.4%	89	19.0%
Geometry						
Fail	68	21.0%	10	25.0%	78	21.4%
Proficient	239	73.8%	30	75.0%	269	73.9%
Advanced	17	5.2%	0	0	17	4.7%
Biology						
Fail	18	38.3%	--	--	20	38.5%
Proficient	28	59.6%	--	--	31	59.6%
Advanced	1	2.1%	--	--	1	1.9%
Chemistry						
Fail	13	2.4%	3	3.8%	16	2.6%
Proficient	321	59.6%	51	65.4%	372	60.3%
Advanced	205	38.0%	24	30.8%	229	37.1%
Earth Science						
Fail	29	9.0%	6	14.0%	35	9.6%
Proficient	231	71.5%	27	62.8%	258	70.5%
Advanced	63	19.5%	10	23.3%	73	19.9%
Writing						
Fail	15	7.1%	3	2.4%	18	5.3%
Proficient	108	51.2%	52	40.9%	160	47.3%
Advanced	88	41.7%	72	56.7%	160	47.3%
Reading 8						
Fail	20	80.0%	--	--	20	80.0%
Proficient	4	16.0%	--	--	4	16.0%
Advanced	1	4.0%	--	--	1	4.0%
Reading						
Fail	4	25.0%	--	--	4	23.5%
Proficient	10	62.5%	--	--	11	64.7%

	No APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct
Advanced	2	12.5%	--	--	2	11.8%

**Figure 1.9: Difference in Grade 10 Standards of Learning Mean Scores
(APS Pre-K – No APS Pre-K)**

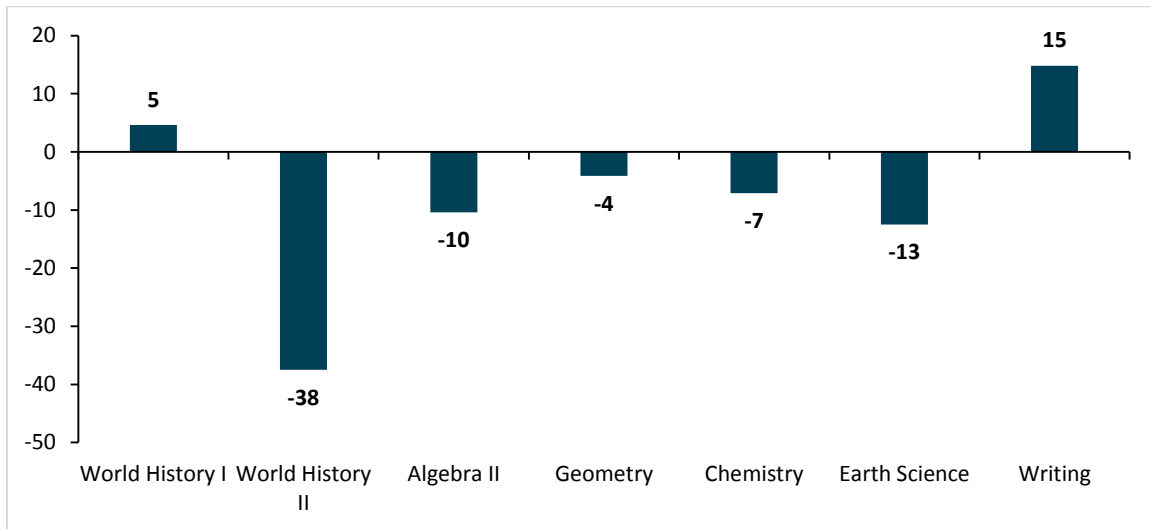


Figure 1.10: Grade 11 Standards of Learning Mean Scores⁸

COURSE	No APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean
US/VA History	872	449.3	127	443	999	448.5
World Geography	10	363	--	--	11	367.7
World History I	17	432.2	--	--	17	432.2
World History II	22	376.1	--	--	22	376.1
Math 8	13	301.9	--	--	15	299.5
Algebra I	42	376.6	--	--	46	375.5
Algebra II	232	418.1	30	420.2	262	418.3
Geometry	105	392.2	14	383.2	119	391.1
Biology	18	413.4	--	--	19	413.2
Chemistry	175	412.6	19	423.2	194	413.6
Earth Science	65	430.6	10	434.5	75	431.1
Writing	885	490.1	124	485.6	1009	489.6
Reading	887	452.6	127	448.7	1014	452.1

⁸ Due to a low number of observations Reading 8 is omitted from Figures 1.10 and 1.11.

Figure 1.11: Grade 11 Standards of Learning Performance Levels

	NO APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct
US/VA History						
Fail	95	10.9%	13	10.2%	108	10.8%
Proficient	665	76.3%	104	81.9%	769	77.0%
Advanced	112	12.8%	10	7.9%	122	12.2%
World Geography						
Fail	9	90.0%	--	--	9	81.8%
Proficient	1	10.0%	--	--	2	18.2%
Advanced	0	0	--	--	0	0
World History I						
Fail	6	35.3%	--	--	6	35.3%
Proficient	9	52.9%	--	--	9	52.9%
Advanced	2	11.8%	--	--	2	11.8%
World History II						
Fail	19	86.4%	--	--	19	86.4%
Proficient	3	13.6%	--	--	3	13.6%
Advanced	0	0	--	--	0	0
Math 8						
Fail	13	100.0%	--	--	15	100.0%
Proficient	0	0	--	--	0	0
Advanced	0	0	--	--	0	0
Algebra I						
Fail	28	66.7%	--	--	32	69.6%
Proficient	14	33.3%	--	--	14	30.4%
Advanced	0	0	--	--	0	0
Algebra II						
Fail	63	27.2%	5	16.7%	68	26.0%
Proficient	161	69.4%	25	83.3%	186	71.0%
Advanced	8	3.4%	0	0	8	3.1%
Geometry						
Fail	63	60.0%	8	57.1%	71	59.7%
Proficient	41	39.0%	6	42.9%	47	39.5%
Advanced	1	1.0%	0	0	1	0.8%
Biology						
Fail	9	50.0%	--	--	9	47.4%
Proficient	8	44.4%	--	--	9	47.4%
Advanced	1	5.6%	--	--	1	5.3%
Chemistry						
Fail	64	36.6%	5	26.3%	69	35.6%
Proficient	107	61.1%	12	63.2%	119	61.3%
Advanced	4	2.3%	2	10.5%	6	3.1%
Earth Science						
Fail	20	30.8%	2	20.0%	22	29.3%
Proficient	39	60.0%	7	70.0%	46	61.3%
Advanced	6	9.2%	1	10.0%	7	9.3%

	No APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct
Writing						
Fail	279	31.5%	32	25.8%	311	30.8%
Proficient	412	46.6%	62	50.0%	474	47.0%
Advanced	194	21.9%	30	24.2%	224	22.2%
Reading						
Fail	76	8.6%	10	7.9%	86	8.5%
Proficient	735	82.9%	107	84.3%	842	83.0%
Advanced	76	8.6%	10	7.9%	86	8.5%

**Figure 1.12: Difference in Grade 11 Standards of Learning Mean Scores
(APS Pre-K – No APS Pre-K)**

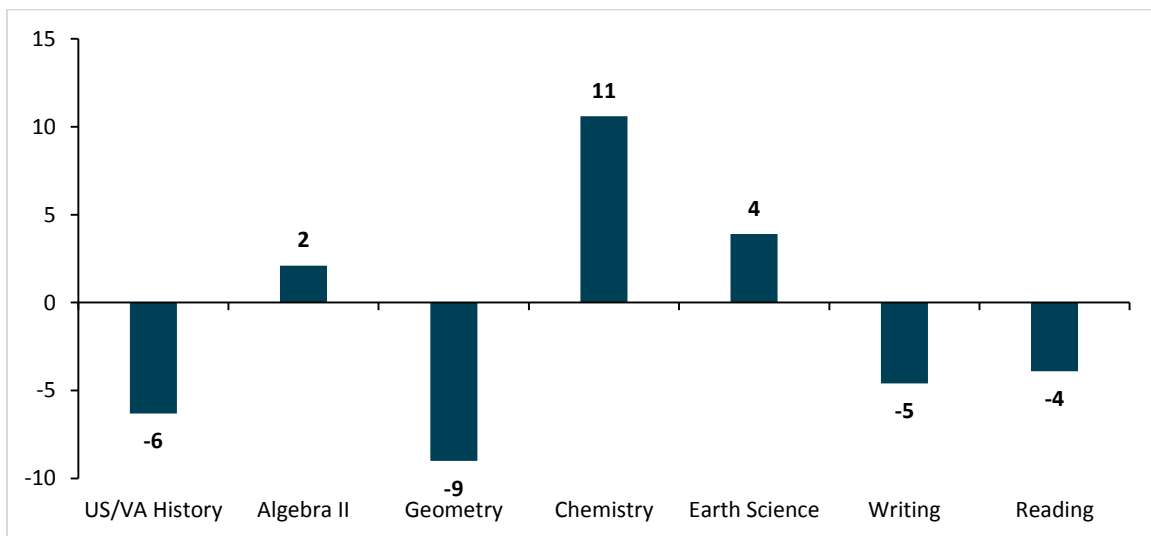


Figure 1.13: Grade 12 Standards of Learning Mean Scores⁹

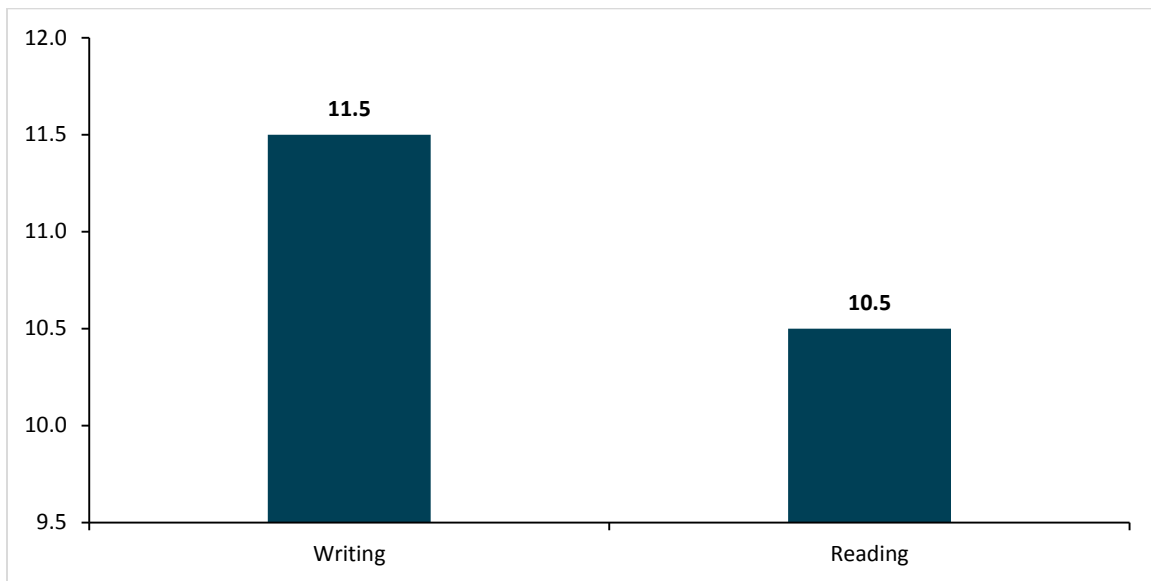
COURSE	No APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean
US/VA History	52	387.5	--	--	59	382.7
World History II	11	338.4	--	--	14	351.8
Algebra I	17	392.8	--	--	20	391.9
Algebra II	92	383.6	--	--	101	380.5
Geometry	23	375.8	--	--	28	376.9
Biology	14	401.2	--	--	14	401.2
Chemistry	53	401.3	--	--	57	402.1
Earth Science	62	441.9	--	--	71	443.5
Writing	70	416.2	14	427.7	84	418.1
Reading	77	408.6	11	419.1	88	409.9

⁹ Due to a low number of observations World Geography, World History I, Math 8 and Reading 8 are omitted from Figures 1.13 and 1.14.

Figure 1.14: Grade 12 Standards of Learning Performance Levels

	NO APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct
US/VA History						
Fail	31	59.6%	--	--	35	59.3%
Proficient	19	36.5%	--	--	22	37.3%
Advanced	2	3.8%	--	--	2	3.4%
World History II						
Fail	11	100.0%	--	--	12	85.7%
Proficient	0	0	--	--	2	14.3%
Advanced	0	0	--	--	0	0
Algebra I						
Fail	6	35.3%	--	--	9	45.0%
Proficient	11	64.7%	--	--	11	55.0%
Advanced	0	0	--	--	0	0
Algebra II						
Fail	55	59.8%	--	--	61	60.4%
Proficient	36	39.1%	--	--	39	38.6%
Advanced	1	1.1%	--	--	1	1.0%
Geometry						
Fail	19	82.6%	--	--	23	82.1%
Proficient	4	17.4%	--	--	5	17.9%
Advanced	0	0	--	--	0	0
Biology						
Fail	6	42.9%	--	--	6	42.9%
Proficient	8	57.1%	--	--	8	57.1%
Advanced	0	0	--	--	0	0
Chemistry						
Fail	22	41.5%	--	--	23	40.4%
Proficient	30	56.6%	--	--	33	57.9%
Advanced	1	1.9%	--	--	1	1.8%
Earth Science						
Fail	11	17.7%	--	--	12	16.9%
Proficient	45	72.6%	--	--	53	74.6%
Advanced	6	9.7%	--	--	6	8.5%
Writing						
Fail	19	27.1%	1	7.1%	20	23.8%
Proficient	50	71.4%	12	85.7%	62	73.8%
Advanced	1	1.4%	1	7.1%	2	2.4%
Reading						
Fail	25	32.5%	2	18.2%	27	30.7%
Proficient	50	64.9%	9	81.8%	59	67.0%
Advanced	2	2.6%	0	0	2	2.3%

**Figure 1.15: Difference in Grade 12 Standards of Learning Mean Scores
(APS Pre-K – No APS Pre-K)**



GRADE POINT AVERAGE

We cannot say conclusively whether there is a difference in GPA between the two groups as there is no consistent pattern in favor of either of the groups. APS Pre-K participants outperform their peers in Grade 11 and tie in Grade 10, but do worse in Grades 9 and 12, and all differences are less than a tenth of a point.

Figure 1.16: Mean GPA Values by Program Status and Grade

GROUP	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
	N	Mean	N	Mean	N	Mean	N	Mean
APS Pre-K	151	2.99	141	3.13	138	3.18	127	3.00
No APS Pre-K	1,002	3.02	980	3.13	927	3.13	848	3.06
Total	1,153	3.02	1,121	3.13	1,065	3.14	975	3.05

ADVANCED PLACEMENT/INTERNATIONAL BACCALAUREATE CREDITS

Figure 1.17 shows the fraction of students who took one, two, three and more or no AP or IB classes depending on their Pre-K program status. **In Grade 9, APS Pre-K participants take more AP/IB classes than their peers; however, they are overtaken in Grade 10. In Grades 10-12 students who did not participate in APS Pre-K were more likely to take at least one AP or IB class.**

Figure 1.17: Share of Students Taking AP/IB Classes by Program Status and Grade

NUMBER OF AP/IB CLASSES	GRADE 9				GRADE 10				GRADE 11				GRADE 12			
	No APS Pre-K		APS Pre-K		No APS Pre-K		APS Pre-K		No APS Pre-K		APS Pre-K		No APS Pre-K		APS Pre-K	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
0	969	95.9%	144	93.5%	480	48.6%	77	53.1%	309	32.2%	55	38.5%	216	25.1%	33	25.8%
1	40	4.0%	8	5.2%	419	42.4%	53	36.6%	122	12.7%	17	11.9%	114	13.2%	24	18.8%
2	1	0.1%	2	1.3%	71	7.2%	12	8.3%	158	16.5%	20	14.0%	94	10.9%	10	7.8%
3 or more	--	--	--	--	18	1.8%	3	2.1%	370	38.6%	51	35.7%	438	50.8%	61	47.7%
Total	1,010	100%	154	100%	988	100%	145	100%	959	100%	143	100%	862	100%	128	100%

ATTENDANCE

Figure 1.18 describes the mean levels of attendance across grades and program status. Attendance is measured as a percentage of time a student was present in school. **In Grades 9, 10 and 12 APS Pre-K participants had higher attendance rates, but the difference between two groups does not exceed 1 percent.**

Figure 1.18: Attendance Means Across Grades and Program Status

GROUP	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
	N	Mean	N	Mean	N	Mean	N	Mean
APS Pre-K	154	94.82	145	93.83	143	92.45	128	95.52
No APS Pre-K	1,010	94.1	988	92.88	959	92.51	862	95.22
Entire Cohort	1,164	94.19	1,133	93	1,102	92.5	990	95.26

ON-TIME GRADUATION

Figure 1.20 shows the graduation rates for students who graduated on time. **All APS Pre-K participants graduated on time, while 2.1 percent of non-participants did not graduate on time.**

Figure 1.19: On-Time Graduation Rates by Program Status

	DID NOT GRADUATE ON TIME		GRADUATED ON TIME	
	N	Pct	N	Pct
APS Pre-K	0	0	121	100.0%
No APS Pre-K	18	2.1%	826	97.9%
Entire Cohort	18	1.9%	947	98.1%

POST HIGH SCHOOL PLANS

Students in this cohort were surveyed regarding their plans after graduation, which included four-year college, two-year college, work, military and more. Due to the low number of observations for the majority of subgroups, Hanover chose to create a binary measure indicating whether a student planned to go to a four-year college, or favored any other option. Comparing these two groups of students to each other based on program participation, **we find that the responses only differ by 1 percent, with APS Pre-K**

participants marginally more likely to indicate four-year college as their post-graduation plan.

Figure 1.20: Post High School Plans by Program Status

	4-YEAR COLLEGE		OTHER PLANS	
	N	Pct	N	Pct
APS Pre-K	94	78.3%	26	21.7%
No APS Pre-K	621	77.2%	183	22.8%
Entire Cohort	715	77.4%	209	22.6%

ECONOMICALLY DISADVANTAGED STUDENTS

In this subsection, we focus on economically disadvantaged (ED) students, dropping non-disadvantaged students from the dataset.

STANDARDS OF LEARNING

Disadvantaged APS Pre-K participating students on average perform better in those cases when both groups have at least 10 observations available. For all four grades, participants outperform non-participants in nine assessments. Non-participants do better on six assessments. For the remainder of assessments, the two groups either tie or we cannot establish the outcome with certainty due to insufficient observations.

Similar to the overall cohort analysis, Writing is the only assessment where we find consistency. **Participants of APS Pre-K programs perform better than their disadvantaged peers in Grades 10-12.**

Figure 1.21: Grade 9 Standards of Learning Mean Scores (ED Students)¹⁰

COURSE	NO APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean
World Geography	23	363.9	--	--	27	365.1
World History II	305	423.1	63	423.1	368	423.1
Math 8	29	315.9	--	--	33	318.9
Algebra I	190	454.8	32	453	222	454.6
Algebra II	14	498.9	--	--	16	493.6
Geometry	76	482.8	26	465.6	102	478.4
Biology	306	443.3	63	451	369	444.6
Writing	21	497.4	--	--	26	487.9
Reading 8	30	369.3	--	--	32	370.5

¹⁰ Due to a low number of observations US/VA History, World History I, Chemistry, Earth Science and Reading are omitted from Figures 1.21 and 1.22.

Figure 1.22: Grade 9 Standards of Learning Performance Levels (ED Students)

	NO APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct
World Geography						
Fail	18	78.3%	--	--	21	77.8%
Proficient	5	21.7%	--	--	6	22.2%
Advanced	0	0	--	--	0	0
World History II						
Fail	100	32.8%	15	23.8%	115	31.3%
Proficient	179	58.7%	42	66.7%	221	60.1%
Advanced	26	8.5%	6	9.5%	32	8.7%
Math 8						
Fail	28	96.6%	--	--	32	97.0%
Proficient	1	3.4%	--	--	1	3.0%
Advanced	0	0	--	--	0	0
Algebra I						
Fail	15	7.9%	0	0.0%	15	6.8%
Proficient	154	81.1%	30	93.8%	184	82.9%
Advanced	21	11.1%	2	6.3%	23	10.4%
Algebra II						
Fail	0	0	--	--	0	0
Proficient	7	50.0%	--	--	9	56.3%
Advanced	7	50.0%	--	--	7	43.8%
Geometry						
Fail	3	3.9%	1	3.8%	4	3.9%
Proficient	42	55.3%	14	53.8%	56	54.9%
Advanced	31	40.8%	11	42.3%	42	41.2%
Biology						
Fail	44	14.4%	3	4.8%	47	12.7%
Proficient	229	74.8%	52	82.5%	281	76.2%
Advanced	33	10.8%	8	12.7%	41	11.1%
Writing						
Fail	1	4.8%	--	--	1	3.8%
Proficient	10	47.6%	--	--	14	53.8%
Advanced	10	47.6%	--	--	11	42.3%
Reading 8						
Fail	26	86.7%	--	--	28	87.5%
Proficient	4	13.3%	--	--	4	12.5%
Advanced	0	0	--	--	0	0

Figure 1.23: Grade 10 Standards of Learning Mean Scores (ED Students)¹¹

COURSE	NO APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean
US/VA History	13	397.9	--	--	15	372.5
World History I	113	425.5	21	433.3	134	426.7
World History II	48	379.5	10	351.6	58	374.7
Math 8	20	320.4	--	--	22	324
Algebra I	50	388.1	--	--	56	386.7
Algebra II	79	448.1	26	424.3	105	442.2
Geometry	162	414.1	27	413.6	189	414
Biology	32	388	--	--	37	392
Chemistry	110	463.2	26	457.4	136	462.1
Earth Science	171	441.3	29	434.3	200	440.3
Writing	102	481.7	65	510.3	167	492.8
Reading 8	19	368.6	--	--	19	368.6
Reading	13	420.1	--	--	14	421.2

Figure 1.24: Grade 10 Standards of Learning Performance Levels (ED Students)

	NO APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct
US/VA History						
Fail	6	46.2%	--	--	7	46.7%
Proficient	7	53.8%	--	--	8	53.3%
Advanced	0	0	--	--	0	0
World History I						
Fail	24	21.2%	2	9.5%	26	19.4%
Proficient	85	75.2%	18	85.7%	103	76.9%
Advanced	4	3.5%	1	4.8%	5	3.7%
World History II						
Fail	37	77.1%	5	50.0%	42	72.4%
Proficient	10	20.8%	5	50.0%	15	25.9%
Advanced	1	2.1%	0	0	1	1.7%
Math 8						
Fail	19	95.0%	--	--	21	95.5%
Proficient	1	5.0%	--	--	1	4.5%
Advanced	0	0	--	--	0	0
Algebra I						
Fail	24	48.0%	--	--	29	51.8%
Proficient	26	52.0%	--	--	27	48.2%
Advanced	0	0	--	--	0	0
Algebra II						
Fail	3	3.8%	5	19.2%	8	7.6%
Proficient	72	91.1%	19	73.1%	91	86.7%
Advanced	4	5.1%	2	7.7%	6	5.7%

¹¹ Due to a low number of observations World Geography is omitted from Figures 1.23 and 1.24.

	No APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct
Geometry						
Fail	46	28.4%	8	29.6%	54	28.6%
Proficient	111	68.5%	19	70.4%	130	68.8%
Advanced	5	3.1%	0	0	5	2.6%
Biology						
Fail	14	43.8%	--	--	16	43.2%
Proficient	18	56.3%	--	--	21	56.8%
Advanced	0	0	--	--	0	0
Chemistry						
Fail	8	7.3%	1	3.8%	9	6.6%
Proficient	74	67.3%	22	84.6%	96	70.6%
Advanced	28	25.5%	3	11.5%	31	22.8%
Earth Science						
Fail	21	12.3%	5	17.2%	26	13.0%
Proficient	134	78.4%	18	62.1%	152	76.0%
Advanced	16	9.4%	6	20.7%	22	11.0%
Writing						
Fail	8	7.8%	2	3.1%	10	6.0%
Proficient	58	56.9%	24	36.9%	82	49.1%
Advanced	36	35.3%	39	60.0%	75	44.9%
Reading 8						
Fail	17	89.5%	--	--	17	89.5%
Proficient	2	10.5%	--	--	2	10.5%
Advanced	0	0	--	--	0	0
Reading						
Fail	4	30.8%	--	--	4	28.6%
Proficient	8	61.5%	--	--	9	64.3%
Advanced	1	7.7%	--	--	1	7.1%

Figure 1.25: Grade 11 Standards of Learning Mean Scores (ED Students)¹²

COURSE	No APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean
US/VA History	293	420.8	58	422.9	351	421.1
World History II	18	375	--	--	18	375
Math 8	10	297.5	--	--	10	297.5
Algebra I	28	368.5	--	--	31	368
Algebra II	100	415	19	417.6	119	415.4
Geometry	69	386.3	10	385.7	79	386.2
Biology	12	397.4	--	--	13	398.4
Chemistry	90	398.3	12	422.7	102	401.2
Earth Science	39	408.1	--	--	47	409.8
Writing	289	444.8	56	455.9	345	446.6

¹² Due to a low number of observations World Geography, World History I and Reading 8 are omitted from Figures 1.25 and 1.26.

COURSE	NO APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean
Reading	291	423.9	58	429.2	349	424.8

Figure 1.26: Grade 11 Standards of Learning Performance Levels (ED Students)

	NO APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct
US/VA History						
Fail	73	24.9%	8	13.8%	81	23.1%
Proficient	213	72.7%	49	84.5%	262	74.6%
Advanced	7	2.4%	1	1.7%	8	2.3%
World History II						
Fail	17	94.4%	--	--	17	94.4%
Proficient	1	5.6%	--	--	1	5.6%
Advanced	0	0	--	--	0	0
Math 8						
Fail	10	100.0%	--	--	10	100.0%
Proficient	0	0	--	--	0	0
Advanced	0	0	--	--	0	0
Algebra I						
Fail	20	71.4%	--	--	23	74.2%
Proficient	8	28.6%	--	--	8	25.8%
Advanced	0	0	--	--	0	0
Algebra II						
Fail	27	27.0%	4	21.1%	31	26.1%
Proficient	71	71.0%	15	78.9%	86	72.3%
Advanced	2	2.0%	0	0	2	1.7%
Geometry						
Fail	46	66.7%	6	60.0%	52	65.8%
Proficient	23	33.3%	4	40.0%	27	34.2%
Advanced	0	0	0	0	0	0
Biology						
Fail	7	58.3%	--	--	7	53.8%
Proficient	5	41.7%	--	--	6	46.2%
Advanced	0	0	--	--	0	0
Chemistry						
Fail	48	53.3%	3	25.0%	51	50.0%
Proficient	41	45.6%	7	58.3%	48	47.1%
Advanced	1	1.1%	2	16.7%	3	2.9%
Earth Science						
Fail	18	46.2%	--	--	20	42.6%
Proficient	20	51.3%	--	--	26	55.3%
Advanced	1	2.6%	--	--	1	2.1%
Writing						
Fail	68	23.5%	13	23.2%	81	23.5%
Proficient	185	64.0%	35	62.5%	220	63.8%
Advanced	36	12.5%	8	14.3%	44	12.8%
Reading						

	No APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct
Fail	57	19.6%	7	12.1%	64	18.3%
Proficient	230	79.0%	50	86.2%	280	80.2%
Advanced	4	1.4%	1	1.7%	5	1.4%

Figure 1.27: Grade 12 Standards of Learning Mean Scores (ED Students)¹³

COURSE	No APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean
US/VA History	37	372.6	--	--	41	364.8
Algebra I	10	367.2	--	--	13	371.7
Algebra II	53	377.8	--	--	60	372.4
Geometry	19	372.5	--	--	24	374.5
Biology	12	397.1	--	--	12	397.1
Chemistry	34	392.6	--	--	37	395.5
Earth Science	26	410.6	--	--	30	412.6
Writing	49	412.3	11	422.8	60	414.2
Reading	56	399.6	--	--	63	401.8

Figure 1.28: Grade 12 Standards of Learning Performance Levels (ED Students)

	No APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct
US/VA History						
Fail	26	70.3%	--	--	29	70.7%
Proficient	11	29.7%	--	--	12	29.3%
Advanced	0	0	--	--	0	0
Algebra I						
Fail	5	50.0%	--	--	8	61.5%
Proficient	5	50.0%	--	--	5	38.5%
Advanced	0	0	--	--	0	0
Algebra II						
Fail	34	64.2%	--	--	39	65.0%
Proficient	19	35.8%	--	--	21	35.0%
Advanced	0	0	--	--	0	0
Geometry						
Fail	16	84.2%	--	--	20	83.3%
Proficient	3	15.8%	--	--	4	16.7%
Advanced	0	0	--	--	0	0
Biology						
Fail	5	41.7%	--	--	5	41.7%
Proficient	7	58.3%	--	--	7	58.3%
Advanced	0	0	--	--	0	0
Chemistry						
Fail	16	47.1%	--	--	16	43.2%
Proficient	18	52.9%	--	--	21	56.8%

¹³ Due to a low number of observations World Geography, World History I and II, Math 8 and Reading 8 are omitted from Figures 1.27 and 1.28.

	No APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct
Advanced	0	0	--	--	0	0
Earth Science						
Fail	10	38.5%	--	--	11	36.7%
Proficient	16	61.5%	--	--	19	63.3%
Advanced	0	0	--	--	0	0
Writing						
Fail	13	26.5%	0	0	13	21.7%
Proficient	36	73.5%	11	100.0%	47	78.3%
Advanced	0	0	0	0	0	0
Reading						
Fail	19	33.9%	--	--	20	31.7%
Proficient	37	66.1%	--	--	43	68.3%
Advanced	0	0	--	--	0	0

GRADE POINT AVERAGE

When it comes to GPA, participants consistently outperform their disadvantaged peers. The gap between two groups ranges from at least 0.13 points to at most 0.28 points. The largest gap is observed in Grade 11, which corresponds to the only grade where APS Pre-K program participants did better in the overall high school cohort.

Figure 1.29: Mean GPA Values by Program Status and Grade (ED Students)

GROUP	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
	N	Mean	N	Mean	N	Mean	N	Mean
APS Pre-K	76	2.64	70	2.81	65	2.93	64	2.75
No APS Pre-K	358	2.45	351	2.68	317	2.65	286	2.53
Total	434	2.48	421	2.70	382	2.70	350	2.57

ADVANCED PLACEMENT/INTERNATIONAL BACCALAUREATE CREDITS

Similar to the overall cohort, in the ED subsample in Grade 9 participants take more AP/IB classes than their peers who did not attend an APS Pre-K program. In this case, participants continue to take more AP/IB courses in Grades 10-12, whereas participants are overtaken by non-participants in these grades among the entire high school cohort.

Figure 1.30: Share of Students Taking AP/IB Classes by Program Status and Grade (ED Students)

NUMBER OF AP/IB CLASSES	GRADE 9				GRADE 10				GRADE 11				GRADE 12			
	No APS Pre-K		APS Pre-K		No APS Pre-K		APS Pre-K		No APS Pre-K		APS Pre-K		No APS Pre-K		APS Pre-K	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
0	352	97.8%	75	97.4%	256	72.1%	48	66.7%	176	53.8%	35	52.2%	116	40.6%	20	31.3%
1	8	2.2%	1	1.3%	78	22.0%	20	27.8%	61	18.7%	9	13.4%	70	24.5%	19	29.7%
2	0	0.0%	1	1.3%	17	4.8%	3	4.2%	36	11.0%	7	10.4%	31	10.8%	8	12.5%

NUMBER OF AP/IB CLASSES	GRADE 9				GRADE 10				GRADE 11				GRADE 12			
	No APS Pre-K		APS Pre-K		No APS Pre-K		APS Pre-K		No APS Pre-K		APS Pre-K		No APS Pre-K		APS Pre-K	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
3 or more	--	--	--	--	--	--	1	1.4%	54	16.6%	16	23.9%	69	24.0%	17	26.6%
Total	360	100.0%	77	100.0%	355	100.0%	72	100.0%	327	100.0%	67	100.0%	286	100.0%	64	100.0%

ATTENDANCE

Just as in the case of the entire cohort, economically disadvantaged students who participated in APS Pre-K had higher attendance rates than their peers. **The difference is more pronounced in this subsample, reaching roughly 2 percent in Grade 10.**

Figure 1.31: Attendance Means Across Grades and Program Status (ED Students)

GROUP	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
	N	Mean	N	Mean	N	Mean	N	Mean
APS Pre-K	77	93.81	72	92.69	67	90.8	64	95.11
No APS Pre-K	360	92.08	355	90.5	327	90.74	286	94.69
Entire Cohort	437	92.38	427	90.87	394	90.75	350	94.76

ON-TIME GRADUATION

All APS Pre-K participants graduated on time, while 5.6 percent of non-participants did not graduate on time, which is a larger fraction in comparison to the entire sample.

Figure 1.32: On-Time Graduation Rates by Program Status (ED Students)

	DID NOT GRADUATE ON TIME		GRADUATED ON TIME	
	N	Pct	N	Pct
APS Pre-K	0	0.0%	59	100.0%
No APS Pre-K	16	5.6%	269	94.4%
Entire Cohort	16	4.7%	328	95.3%

POST HIGH SCHOOL PLANS

Relative to the overall cohort, economically disadvantaged students who participated in APS Pre-K are more likely to indicate four-year college as their post-graduation plans. The difference between two groups by program status is roughly 20 percent compared to the 1 percent difference in the overall cohort.

Figure 1.33: Post High School Plans by Program Status (ED Students)

	4-YEAR COLLEGE		OTHER PLANS	
	N	Pct	N	Pct
APS Pre-K	42	71.2%	17	28.8%
No APS Pre-K	135	51.1%	129	48.9%
Entire Cohort	177	54.8%	146	45.2%

STUDENTS WITH LIMITED ENGLISH PROFICIENCY

In this subsection, Hanover Research only analyzes the subset of students who are designated as LEP, or Limited English Proficiency in the earliest grade for which data is available.

STANDARDS OF LEARNING

LEP participants in pre-K APS programs do even better relative to their peers than ED students or average participants. **In this subsample, participants receive higher SOL scale scores on average for 12 assessments across four grades.** Conversely, non-participants outperform them on only three occasions. It is not possible to compare the results of participants and non-participants on 41 assessments due to the small numbers of students who took them in a given year.

Figure 1.34: Grade 9 Standards of Learning Mean Scores (LEP Students)¹⁴

COURSE	No APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean
World Geography	17	362.2	--	--	19	361.3
World History II	269	426	56	430.2	325	426.7
Math 8	25	304.8	--	--	28	307
Algebra I	162	459.5	25	462.6	187	459.9
Algebra II	12	497.5	--	--	15	497.7
Geometry	78	490.1	27	464	105	483.4
Biology	268	444	56	455.1	324	445.9
Writing	15	486.1	--	--	19	479.3
Reading 8	28	374.4	--	--	30	375.4

Figure 1.35: Grade 9 Standards of Learning Performance Levels (LEP Students)

	No APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct
World Geography						
Fail	14	82.4%	--	--	16	84.2%
Proficient	3	17.6%	--	--	3	15.8%
Advanced	0	0	--	--	0	0
World History II						
Fail	78	29.0%	12	21.4%	90	27.7%
Proficient	166	61.7%	36	64.3%	202	62.2%
Advanced	25	9.3%	8	14.3%	33	10.2%
Math 8						
Fail	25	100.0%	--	--	28	100.0%
Proficient	0	0	--	--	0	0
Advanced	0	0	--	--	0	0

¹⁴ Due to a low number of observations US/VA History, World History I, Chemistry, Earth Science and Reading are omitted from Figures 1.32 and 1.33.

	No APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct
Algebra I						
Fail	12	7.4%	0	0	12	6.4%
Proficient	131	80.9%	22	88.0%	153	81.8%
Advanced	19	11.7%	3	12.0%	22	11.8%
Algebra II						
Fail	0	0	--	--	0	0
Proficient	5	41.7%	--	--	7	46.7%
Advanced	7	58.3%	--	--	8	53.3%
Geometry						
Fail	2	2.6%	1	3.7%	3	2.9%
Proficient	42	53.8%	16	59.3%	58	55.2%
Advanced	34	43.6%	10	37.0%	44	41.9%
Biology						
Fail	38	14.2%	2	3.6%	40	12.3%
Proficient	199	74.3%	45	80.4%	244	75.3%
Advanced	31	11.6%	9	16.1%	40	12.3%
Writing						
Fail	1	6.7%	--	--	1	5.3%
Proficient	10	66.7%	--	--	13	68.4%
Advanced	4	26.7%	--	--	5	26.3%
Reading 8						
Fail	23	82.1%	--	--	25	83.3%
Proficient	5	17.9%	--	--	5	16.7%
Advanced	0	0%	--	--	0	0%

Figure 1.36: Grade 10 Standards of Learning Mean Scores (LEP Students)¹⁵

COURSE	No APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean
World History I	101	426.5	22	434.4	123	427.9
World History II	32	384.7	--	--	40	376
Math 8	19	325.1	--	--	21	328.4
Algebra I	43	390.5	--	--	47	389.6
Algebra II	82	449	26	427	108	443.7
Geometry	138	416.3	21	421	159	416.9
Biology	26	386.4	--	--	29	389.1
Chemistry	98	465.9	26	468.7	124	466.5
Earth Science	144	442.8	24	426.5	168	440.5
Writing	84	481.4	53	511.6	137	493.1
Reading 8	20	371.7	--	--	20	371.7

¹⁵ Due to a low number of observations US/VA History, World Geography and Reading are omitted from Figures 1.34 and 1.35.

Figure 1.37: Grade 10 Standards of Learning Performance Levels (LEP Students)

	NO APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct
World History I						
Fail	18	17.8%	2	9.1%	20	16.3%
Proficient	78	77.2%	18	81.8%	96	78.0%
Advanced	5	5.0%	2	9.1%	7	5.7%
World History II						
Fail	22	68.8%	--	--	26	65.0%
Proficient	9	28.1%	--	--	13	32.5%
Advanced	1	3.1%	--	--	1	2.5%
Math 8						
Fail	17	89.5%	--	--	19	90.5%
Proficient	2	10.5%	--	--	2	9.5%
Advanced	0	0	--	--	0	0
Algebra I						
Fail	17	39.5%	--	--	20	42.6%
Proficient	26	60.5%	--	--	27	57.4%
Advanced	0	0	--	--	0	0
Algebra II						
Fail	3	3.7%	4	15.4%	7	6.5%
Proficient	73	89.0%	20	76.9%	93	86.1%
Advanced	6	7.3%	2	7.7%	8	7.4%
Geometry						
Fail	37	26.8%	6	28.6%	43	27.0%
Proficient	96	69.6%	15	71.4%	111	69.8%
Advanced	5	3.6%	0	0	5	3.1%
Biology						
Fail	12	46.2%	--	--	14	48.3%
Proficient	14	53.8%	--	--	15	51.7%
Advanced	0	0%	--	--	0	0%
Chemistry						
Fail	6	6.1%	1	3.8%	7	5.6%
Proficient	67	68.4%	21	80.8%	88	71.0%
Advanced	25	25.5%	4	15.4%	29	23.4%
Earth Science						
Fail	17	11.8%	5	20.8%	22	13.1%
Proficient	113	78.5%	15	62.5%	128	76.2%
Advanced	14	9.7%	4	16.7%	18	10.7%
Writing						
Fail	5	6.0%	2	3.8%	7	5.1%
Proficient	51	60.7%	18	34.0%	69	50.4%
Advanced	28	33.3%	33	62.3%	61	44.5%
Reading 8						
Fail	17	85.0%	--	--	17	85.0%
Proficient	3	15.0%	--	--	3	15.0%
Advanced	0	0	--	--	0	0

Figure 1.38: Grade 11 Standards of Learning Mean Scores (LEP Students)¹⁶

COURSE	NO APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean
US/VA History	258	422.1	51	425.6	309	422.6
World History II	15	374.9	--	--	15	374.9
Algebra I	20	364.6	--	--	21	364.8
Algebra II	94	416.9	16	427.4	110	418.4
Geometry	56	387.4	--	--	64	386.9
Biology	11	396	--	--	12	397.2
Chemistry	83	399.1	14	424.8	97	402.8
Earth Science	29	401.4	--	--	33	403.2
Writing	257	447.9	49	468	306	451.1
Reading	259	423.8	51	436.2	310	425.8

Figure 1.39: Grade 11 Standards of Learning Performance Levels (LEP Students)

	NO APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct
US/VA History						
Fail	62	24.0%	7	13.7%	69	22.3%
Proficient	190	73.6%	43	84.3%	233	75.4%
Advanced	6	2.3%	1	2.0%	7	2.3%
World History II						
Fail	13	86.7%	--	--	13	86.7%
Proficient	2	13.3%	--	--	2	13.3%
Advanced	0	0	--	--	0	0
Algebra I						
Fail	13	65.0%	--	--	14	66.7%
Proficient	7	35.0%	--	--	7	33.3%
Advanced	0	0	--	--	0	0
Algebra II						
Fail	26	27.7%	2	12.5%	28	25.5%
Proficient	65	69.1%	14	87.5%	79	71.8%
Advanced	3	3.2%	0	0.0%	3	2.7%
Geometry						
Fail	37	66.1%	--	--	42	65.6%
Proficient	19	33.9%	--	--	22	34.4%
Advanced	0	0	--	--	0	0
Biology						
Fail	7	63.6%	--	--	7	58.3%
Proficient	4	36.4%	--	--	5	41.7%
Advanced	0	0	--	--	0	0
Chemistry						
Fail	43	51.8%	3	21.4%	46	47.4%
Proficient	39	47.0%	9	64.3%	48	49.5%
Advanced	1	1.2%	2	14.3%	3	3.1%

¹⁶ Due to a low number of observations World Geography, World History I, Math 8 and Reading 8 are omitted from Figures 1.36 and 1.37.

	No APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct
Earth Science						
Fail	15	51.7%	--	--	16	48.5%
Proficient	14	48.3%	--	--	17	51.5%
Advanced	0	0	--	--	0	0
Writing						
Fail	66	25.7%	8	16.3%	74	24.2%
Proficient	161	62.6%	31	63.3%	192	62.7%
Advanced	30	11.7%	10	20.4%	40	13.1%
Reading						
Fail	47	18.1%	5	9.8%	52	16.8%
Proficient	209	80.7%	45	88.2%	254	81.9%
Advanced	3	1.2%	1	2.0%	4	1.3%

Figure 1.40: Grade 12 Standards of Learning Mean Scores (LEP Students)¹⁷

COURSE	No APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean
US/VA History	32	373.5	--	--	36	363.9
Algebra II	42	380.1	--	--	48	373.4
Geometry	14	371.1	--	--	17	372.9
Biology	11	394.6	--	--	11	394.6
Chemistry	32	394	--	--	35	395.4
Earth Science	27	420	--	--	30	421.7
Writing	43	413	--	--	49	414
Reading	46	399.2	--	--	51	402.2

Figure 1.41: Grade 12 Standards of Learning Performance Levels (LEP Students)

	No APS PRE-K		APS PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct
US/VA History						
Fail	21	65.6%	--	--	25	69.4%
Proficient	11	34.4%	--	--	11	30.6%
Advanced	0	0	--	--	0	0
Algebra II						
Fail	27	64.3%	--	--	31	64.6%
Proficient	15	35.7%	--	--	17	35.4%
Advanced	0	0	--	--	0	0
Geometry						
Fail	12	85.7%	--	--	14	82.4%
Proficient	2	14.3%	--	--	3	17.6%
Advanced	0	0	--	--	0	0

¹⁷ Due to a low number of observations World Geography, World History I and II, Math 8, Algebra I, and Reading 8 are omitted from Figures 1.38 and 1.39.

	No APS Pre-K		APS Pre-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct
Biology						
Fail	5	45.5%	--	--	5	45.5%
Proficient	6	54.5%	--	--	6	54.5%
Advanced	0	0	--	--	0	0
Chemistry						
Fail	15	46.9%	--	--	16	45.7%
Proficient	17	53.1%	--	--	19	54.3%
Advanced	0	0	--	--	0	0
Earth Science						
Fail	8	29.6%	--	--	8	26.7%
Proficient	18	66.7%	--	--	21	70.0%
Advanced	1	3.7%	--	--	1	3.3%
Writing						
Fail	11	25.6%	--	--	11	22.4%
Proficient	32	74.4%	--	--	38	77.6%
Advanced	0	0	--	--	0	0
Reading						
Fail	15	32.6%	--	--	15	29.4%
Proficient	31	67.4%	--	--	36	70.6%
Advanced	0	0	--	--	0	0

GRADE POINT AVERAGE

While LEP students have lower GPAs than the overall cohort, LEP students who attended APS Pre-K programs outperform those who did not. The largest gap in average GPA occurs in Grade 11 when the difference amounts to 0.28 points.

Figure 1.42: Mean GPA Values by Program Status and Grade (LEP Students)

GROUP	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
	N	Mean	N	Mean	N	Mean	N	Mean
APS Pre-K	64	2.69	58	2.88	55	3.04	55	2.80
No APS Pre-K	318	2.52	302	2.77	278	2.76	255	2.64
Total	382	2.55	360	2.78	333	2.80	310	2.67

ADVANCED PLACEMENT/INTERNATIONAL BACCALAUREATE CREDITS

As Figure 1.43 shows, LEP students who participated in APS Pre-K programs take more AP/IB classes in Grades 10-12 than their LEP non-participant peers.

Figure 1.43: Share of Students Taking AP/IB Classes by Program Status and Grade (LEP Students)

NUMBER OF AP/IB CLASSES	GRADE 9				GRADE 10				GRADE 11				GRADE 12			
	No APS Pre-K		APS Pre-K		No APS Pre-K		APS Pre-K		No APS Pre-K		APS Pre-K		No APS Pre-K		APS Pre-K	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
0	308	96.9%	62	96.9%	206	67.8%	33	56.9%	144	50.2%	26	46.4%	94	36.7%	13	23.6%
1	10	3.1%	2	3.1%	76	25.0%	21	36.2%	55	19.2%	8	14.3%	61	23.8%	14	25.5%
2	--	--	--	--	18	5.9%	4	6.9%	35	12.2%	6	10.7%	33	12.9%	8	14.5%
3 or more	--	--	--	--	--	--	--	--	53	18.4%	16	28.6%	68	26.6%	20	36.4%
Total	318	100.0%	64	100.0%	304	100.0%	58	100.0%	287	100.0%	56	100.0%	256	100.0%	55	100.0%

ATTENDANCE

Following the pattern established by the main cohort and economically disadvantaged student subsample, LEP students also have higher attendance rates if they have participated in the APS Pre-K programs, relative to those who have not.

Figure 1.44: Attendance Means Across Grades and Program Status (LEP Students)

GROUP	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
	N	Mean	N	Mean	N	Mean	N	Mean
APS Pre-K	64	94.45	58	93.29	56	91.45	55	96.29
No APS Pre-K	318	92.89	304	92.03	287	91.89	256	95.25
Entire Cohort	382	93.15	362	92.23	343	91.82	311	95.44

ON-TIME GRADUATION

Figure 1.45 shows the on-time graduation rates for students in both groups. **All APS Pre-K participants graduated on time, while 4.8 percent of non-participants did not graduate on time, which is a larger fraction than in the overall cohort but smaller than in the economically disadvantaged subsample.**

Figure 1.45: On-Time Graduation Rates by Program Status (LEP Students)

	DID NOT GRADUATE ON TIME		GRADUATED ON TIME	
	N	Pct	N	Pct
APS Pre-K	0	0	52	100.0%
No APS Pre-K	12	4.8%	237	95.2%
Entire Cohort	12	4.0%	289	96.0%

POST HIGH SCHOOL PLANS

Similar to economically disadvantaged students, the difference between LEP students by program status regarding their post-graduation plans reaches almost 20 percent. APS Pre-K students are more likely to choose four-year college over other alternatives than their non-participant peers.

Figure 1.46: Post High School Plans by Program Status (LEP Students)

	4-YEAR COLLEGE		OTHER PLANS	
	N	Pct	N	Pct
APS Pre-K	38	74.5%	13	25.5%
No APS Pre-K	128	55.4%	103	44.6%
Entire Cohort	166	58.9%	116	41.1%

SECTION II: SECOND COHORT ANALYSIS

In this section, Hanover Research analyzes academic outcomes of a second cohort of students who participated in the APS Pre-K programs relative to four groups of students who either participated in a different type of Pre-K program or did not have any pre-K experience. These students entered Kindergarten in 2007/08 and finished Grade 8 in 2015/16 (if they did not repeat or skip grades). We study a range of academic outcomes covering all of these years.

DATA AND METHODOLOGY

The data file provided by APS included both demographic and academic variables for the second cohort for the 2007/08-2015/16 school years. We mostly focus on academic variables in this report. The dataset contains observations for 1,533 students.

Figure 2.1 shows enrollment by Pre-K program. Relative to the original cohort, we have more detailed information for this group of students. Out of the available programs, we code VPI (Virginia Preschool Initiative) and Montessori as APS Pre-K programs. Students who attended an APS Pre-K program make up 31.5 percent of the cohort. We single out privately provided Pre-K programs and Head Start as separate comparison groups. The remaining Pre-K programs (Coordinated funds, Other – Only APS program is Peer Model, Licensed Family Home Provider) are coded as “Other.” Lastly, we identify a group of students who did not participate in any Pre-K program.¹⁸

Figure 2.1: Program Participants

PROGRAM	ENTIRE COHORT	
	N	Pct
Private Provider	625	40.8%
VPI	326	21.3%
Montessori	156	10.2%
APS Pre-K	482	31.5%
Coordinated Funds	135	8.8%
Other - Only APS program is Peer Model	31	2.0%
Licensed Family Home Provider	2	0.1%
Other	168	10.9%
Head Start	46	3.0%
No Formal or Institutional PK Program	212	13.8%
Total	1,533	100.0%

¹⁸ Originally, “Special Education only” and “Coordinated Special Education” programs were included in the dataset, but were dropped due to an issue with data collection per request from APS. Another dropped category, coded as “Unknown,” contained 2 student observations.

Just as with the original cohort, apart from analyzing the overall trends in the entire cohort, we also segment students by their LEP and disadvantaged statuses. We have information about students' LEP and ED status starting in 2007/08 (Pre-K). We use the first available instance for students who were not enrolled in that year.

OUTCOME VARIABLES

Figure 2.2 describes the available academic outcomes for every year.

As with the original cohort, we use GPA, attendance, and SOL assessments as outcomes of interest. While the particular SOL assessments are different as they correspond to different grade levels, the methodological approach is the same as described in Section I. Available SOLs cover Grades 3-8.

The Degrees of Reading Power (DRP) by Questar Assessment, Inc., measure how well students understand the meaning of text.¹⁹ The data sample contains DRP data for APS Grade 2 and 4 students. An analysis of raw scores is presented, as is a DRP identification of whether a student was identified for remediation.

Phonological Awareness Literacy Screening (PALS) measures basic tools necessary for developing literacy in Kindergarten and early grades.²⁰ We have PALS scores and a below-benchmark-performance indicator for Kindergarten and Grades 1 and 2 for both fall and spring semesters.

IAT referrals are available for Grades 4-7 and indicate whether a student needed to be referred to the Intervention Assistance Team due to academic or social difficulties. In the dataset, students can have up to three IAT referrals. As the number of students referred to IAT is low, and we would not be able to extract additional information by treating this outcome variable as continuous, we transform it to be binary; i.e., it becomes an indicator variable denoting whether a student has been referred to IAT for a particular reason. Percentages represent the percent of students with an IAT referral who received a referral in each category.

The Advanced Math outcome indicates whether a student has taken advanced math classes in any particular grade.

¹⁹ Degrees of Reading Power Assessment Brochure, https://www.questarai.com/wp-content/uploads/sites/2/2015/02/61001_DRP_Brochure_v04-01.pdf.

²⁰ PALS-K assessment, <https://pals.virginia.edu/tools-k.html>.

Figure 2.2: Assessment by Testing Type and Grade

TESTING TYPE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
DRP			X		X				
PALS	Fall, Spring	Fall, Spring	Fall, Spring						
IAT Referrals					X	X	X	X	
Advanced Math							X	X	X
GPA							X	X	X
Attendance		X	X	X	X	X	X	X	X
Standards of Learning				Math3, Reading3, History3, Science3	Math4, Reading4, VA Studies4	Math5, Reading5, Writing5, Science5	Math6, Math7, US History I, Reading6	Math7, Math8, Algebra I, Reading7	Math8, Algebra I, Geometry, Reading8, Writing8, World Geography, Science8

METHODOLOGY

We apply bivariate analysis to the available dataset to determine whether APS Pre-K participants differ from other student groups in the listed academic outcomes. This analysis is performed on the entire cohort as well as sub-groups of economically disadvantaged and LEP students.

OVERALL COHORT ANALYSIS

PHONOLOGICAL AWARENESS LITERACY SCREENING

Figures 2.3-2.11 show performance on the PALS by program status. Across all three grades, **APS Pre-K students perform worse in terms of mean scores and below-benchmark performance compared to students who attended privately provided Pre-K programs and “Other” programs. Conversely, participants outperform students who attended Head Start or did not attend any Pre-K program in all three grades for both mean scores and performance levels.** It is worth noting that the PALS cohort in Grade 2 fall semester is different than the rest. It appears that most of the students represented were the ones who performed below benchmark, and the overall number of observations is lower than in other semesters.

Figure 2.3: Kindergarten PALS Mean Scores and Below Benchmark Performance

GROUP	FALL					SPRING				
	Average PALS Score			Percentage Performed below Benchmark		Average PALS Score			Percentage Performed below Benchmark	
	N	Mean	Standard Deviation	N	Pct	N	Mean	Standard Deviation	N	Pct
APS Pre-K	481	63.56	25.8	58	12.1%	482	91.71	14.01	63	13.1%
Private Provider	604	74.96	19.63	12	2.0%	619	96.94	7.86	22	3.6%
Head Start	43	46.74	26.38	12	27.9%	43	90.84	11.04	7	16.3%
Other Pre-K	154	70.56	22.09	10	6.5%	166	95.4	11.4	5	3.0%
No Pre-K	183	51.66	30.36	49	26.8%	204	88	17.3	43	21.1%
Entire Cohort	1465	67.01	25.2	141	9.6%	1514	93.73	12.48	140	9.2%

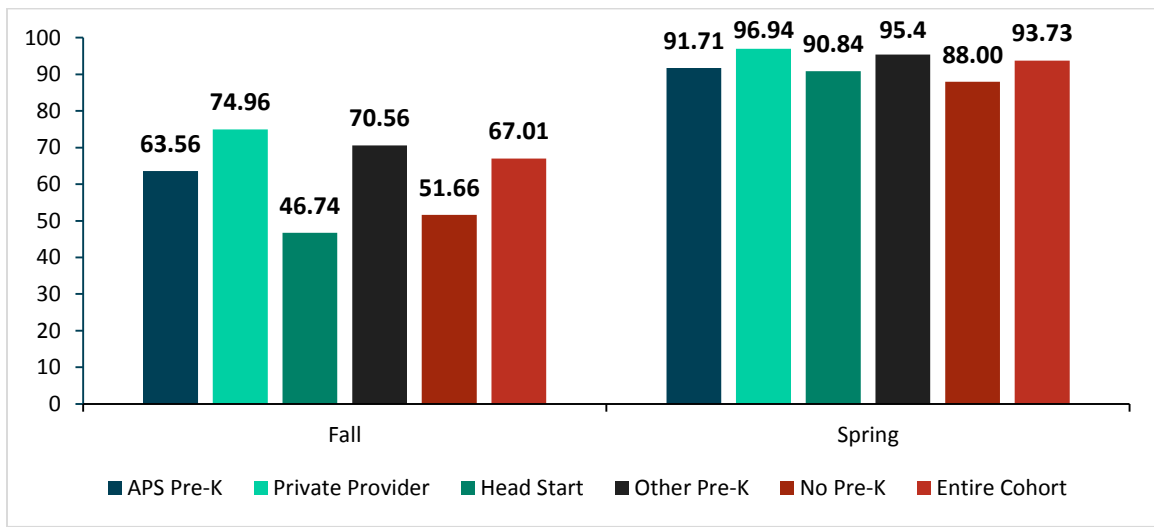
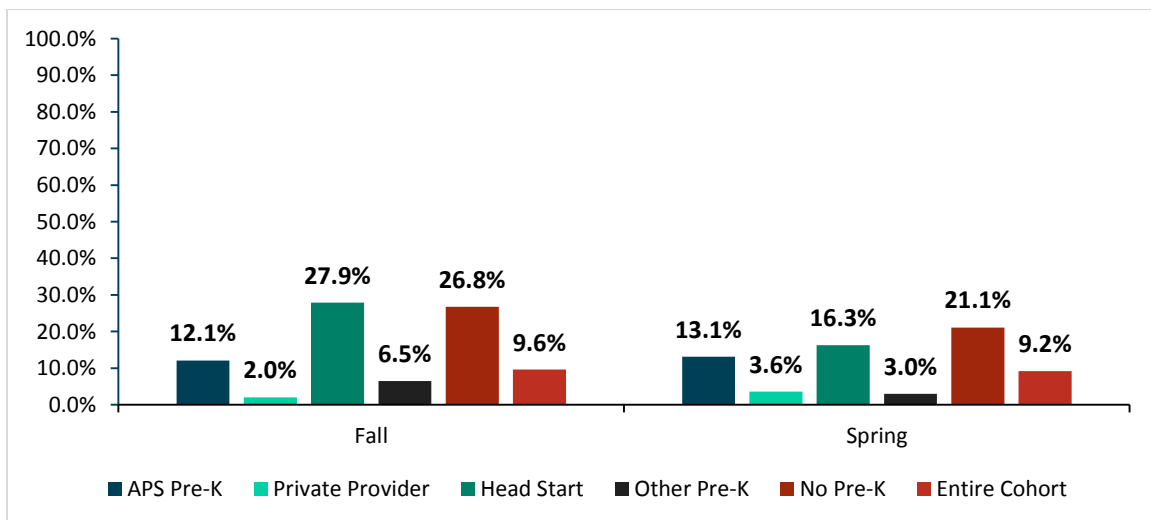
Figure 2.4: Kindergarten PALS Mean Scores by Program Status**Figure 2.5: Percent of Students Performing Below Benchmark (Kindergarten)**

Figure 2.6: Grade 1 PALS Mean Scores and Below Benchmark Performance

GROUP	FALL					SPRING				
	Average PALS Score			Percentage Performed below Benchmark		Average PALS Score			Percentage Performed below Benchmark	
	N	Mean	Standard Deviation	N	Pct	N	Mean	Standard Deviation	N	Pct
APS Pre-K	271	56.04	19.54	48	17.7%	381	46.94	16	81	21.3%
Private Provider	344	64.9	15.43	23	6.7%	494	54.87	12.43	34	6.9%
Head Start	30	54.73	17.01	7	23.3%	37	43.78	15.56	9	24.3%
Other Pre-K	60	64.78	18.4	5	8.3%	115	53.64	14.25	10	8.7%
No Pre-K	95	54.89	19.96	24	25.3%	149	46.03	17.04	31	20.8%
Entire Cohort	800	60.32	18.3	107	13.4%	1176	50.71	15.11	165	14.0%

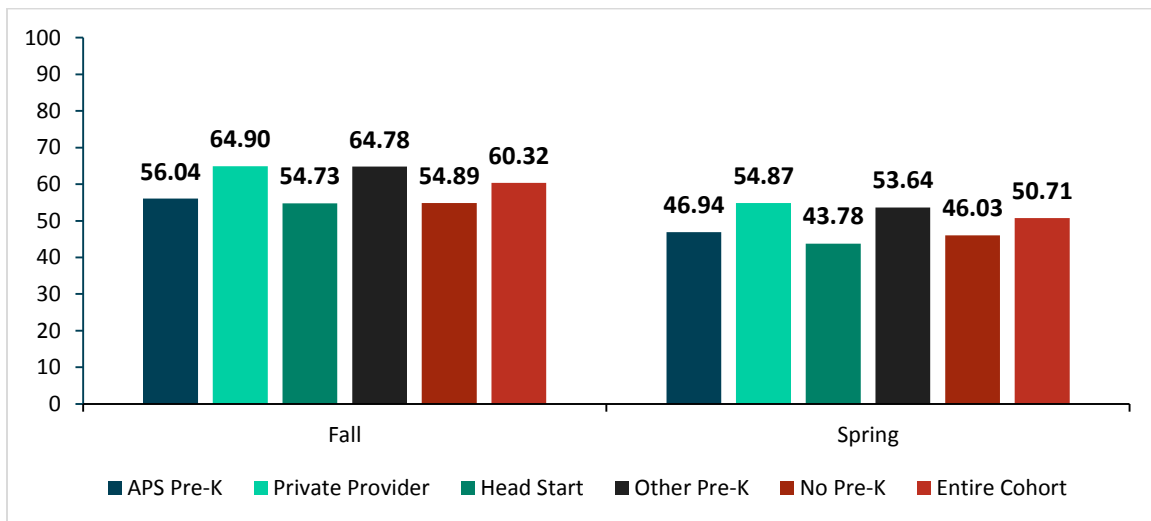
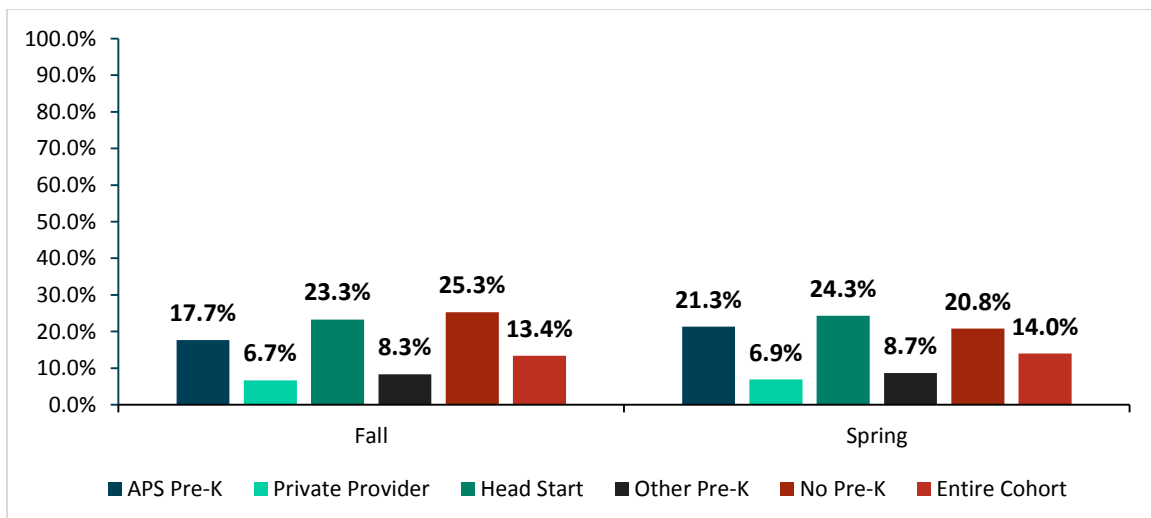
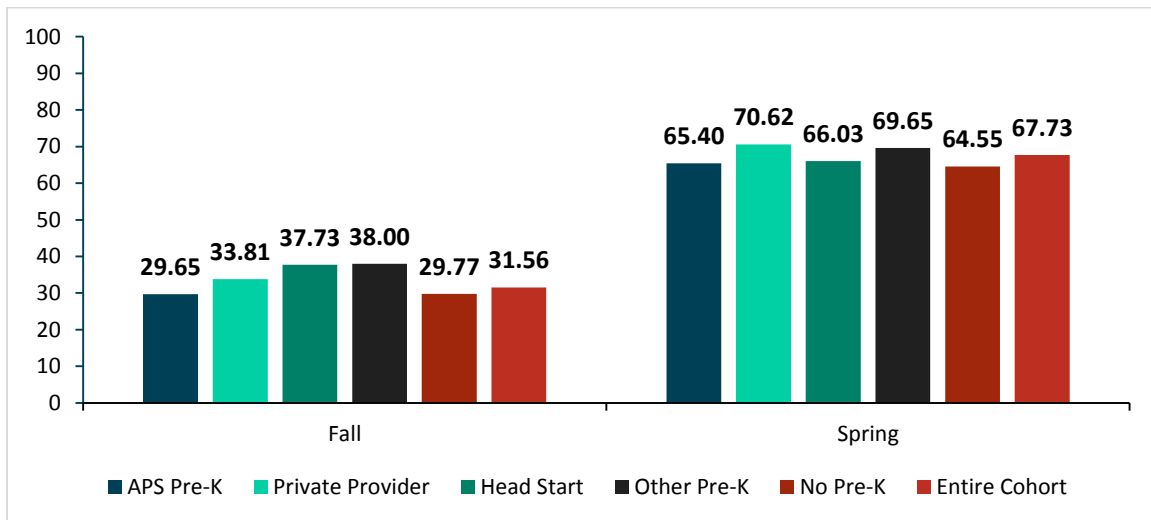
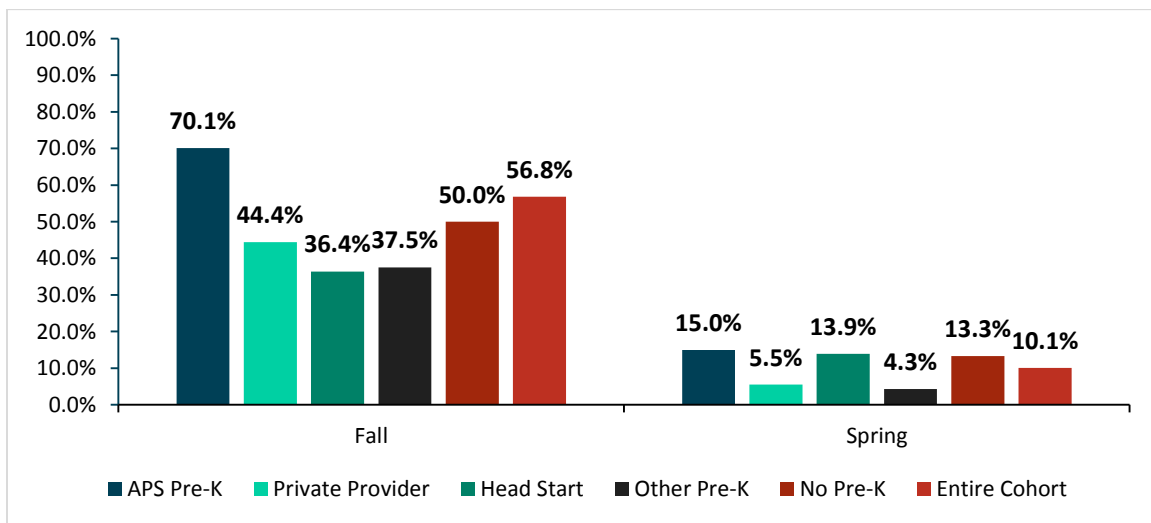
Figure 2.7: Grade 1 Kindergarten Mean PALS Scores by Program Status**Figure 2.8: Percent of Students Performing Below Benchmark (Grade 1)**

Figure 2.9: Grade 2 PALS Mean Scores and Below Benchmark Performance

GROUP	FALL					SPRING				
	Average PALS Score			Percentage Performed below Benchmark		Average PALS Score			Percentage Performed below Benchmark	
	N	Mean	Standard Deviation	N	Pct	N	Mean	Standard Deviation	N	Pct
APS Pre-K	77	29.65	16.03	54	70.1%	307	65.4	13.83	46	15.0%
Private Provider	36	33.81	12.16	16	44.4%	348	70.62	8.45	19	5.5%
Head Start	11	37.73	16.01	4	36.4%	36	66.03	13.83	5	13.9%
Other Pre-K	8	38	13.17	3	37.5%	69	69.65	7.82	3	4.3%
No Pre-K	30	29.77	16.91	15	50.0%	113	64.55	17.18	15	13.3%
Entire Cohort	162	31.56	15.38	92	56.8%	873	67.73	12.36	88	10.1%

Figure 2.10: Grade 2 Kindergarten Mean PALS Scores by Program Status**Figure 2.11: Percent of Students Performing Below Benchmark (Grade 2)**

DEGREES OF READING POWER

Figures 2.12-2.14 describe student performance on DRP assessments in Grades 2 and 4. **Across both grades, APS Pre-K participants' performance is inferior to the performance of all comparison groups with the exception of Head Start students.** This holds true both for average scores and for the percentage of students identified for remediation. The gap between APS participants and participants in privately provided Pre-K programs in terms of the latter widens between Grade 2 and Grade 4, from 10 to 28 percent.

Figure 2.12: Degrees of Reading Power – Mean Scores and Remediation

GROUP	GRADE 2					GRADE 4				
	Average DRP Score			Percentage Identified for Remediation		Average DRP Score			Percentage Identified for Remediation	
	N	Mean	Standard Deviation	N	Pct	N	Mean	Standard Deviation	N	Pct
APS Pre-K	314	28.95	9.24	44	14.0%	326	33.76	11	116	35.6%
Private Provider	549	35.88	7.28	21	3.8%	522	43.92	8.61	40	7.7%
Head Start	34	24.62	9.6	9	26.5%	31	31.35	8.92	15	48.4%
Other Pre-K	119	35.24	8.02	4	3.4%	110	43.12	9.86	12	10.9%
No APS Pre-K	123	30.24	9.54	11	8.9%	117	37.21	11.19	35	29.9%
Entire Cohort	1,139	32.96	8.95	89	7.8%	1,106	39.78	10.86	218	19.7%

Figure 2.13: Mean DRP Scores by Program Status

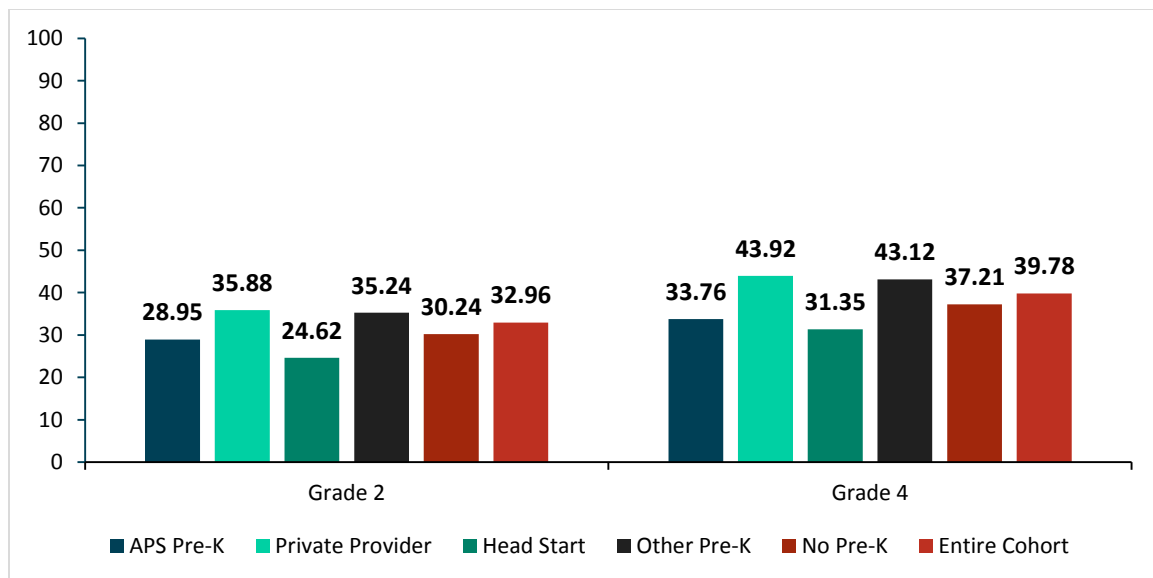
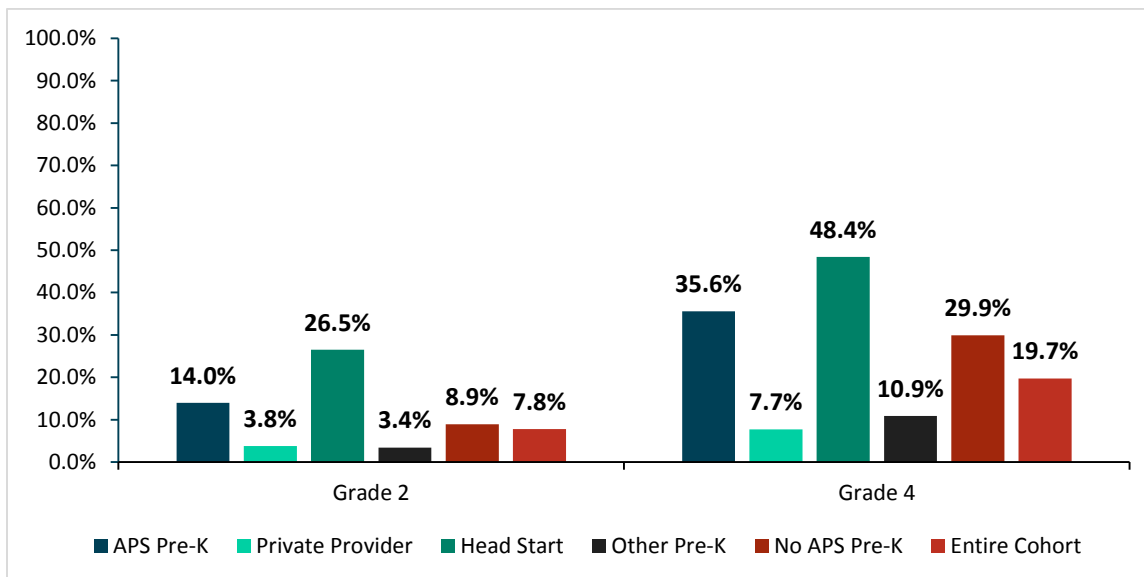


Figure 2.14: Percent of Students Identified for Remediation

STANDARDS OF LEARNING

Figures 2.15-2.32 show the differences between APS Pre-K program participants and other groups with respect to SOL assessments in Grades 3-8. **Across all grades, Head Start participants receive lower mean scores than APS Pre-K program participants. Students in the other three groups perform better than APS Pre-K program participants on most occasions.** The only exception is that students without any Pre-K experience perform worse on the Grade 7 Math and Algebra assessments. Students who attended Pre-K programs which were privately provided or were any of the “Other”-designated programs receive similar scores to each other across grades.

Figure 2.15: Grade 3 Standards of Learning – Mean Scores

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
History 3	317	464.4	541	521	30	440.6	110	522	126	467.9	1124	497
Math 3	353	509	541	546.7	35	496.5	112	550.7	133	512.2	1174	530.4
Reading 3	353	442.3	542	515.2	35	433.3	112	513	133	456.4	1175	484
Science 3	290	474.2	541	527.7	28	467.5	110	522.7	116	485	1085	506.8

Figure 2.16: Grade 3 Standards of Learning – Performance Levels

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
History 3												
Fail	64	20.2%	20	3.7%	10	33.3%	3	2.7%	23	18.3%	120	10.7%
Proficient	151	47.6%	168	31.1%	15	50.0%	36	32.7%	55	43.7%	425	37.8%
Advanced	102	32.2%	353	65.2%	5	16.7%	71	64.5%	48	38.1%	579	51.5%
Math 3												
Fail	33	9.3%	9	1.7%	3	8.6%	2	1.8%	11	8.3%	58	4.9%
Proficient	106	30.0%	88	16.3%	14	40.0%	18	16.1%	39	29.3%	265	22.6%
Advanced	214	60.6%	444	82.1%	18	51.4%	92	82.1%	83	62.4%	851	72.5%
Reading 3												
Fail	69	19.5%	25	4.6%	14	40.0%	10	8.9%	24	18.0%	142	12.1%
Proficient	164	46.5%	176	32.5%	11	31.4%	31	27.7%	52	39.1%	434	36.9%
Advanced	120	34.0%	341	62.9%	10	28.6%	71	63.4%	57	42.9%	599	51.0%
Science 3												
Fail	35	12.1%	11	2.0%	5	17.9%	2	1.8%	16	13.8%	69	6.4%
Proficient	144	49.7%	149	27.5%	15	53.6%	29	26.4%	53	45.7%	390	35.9%
Advanced	111	38.3%	381	70.4%	8	28.6%	79	71.8%	47	40.5%	626	57.7%

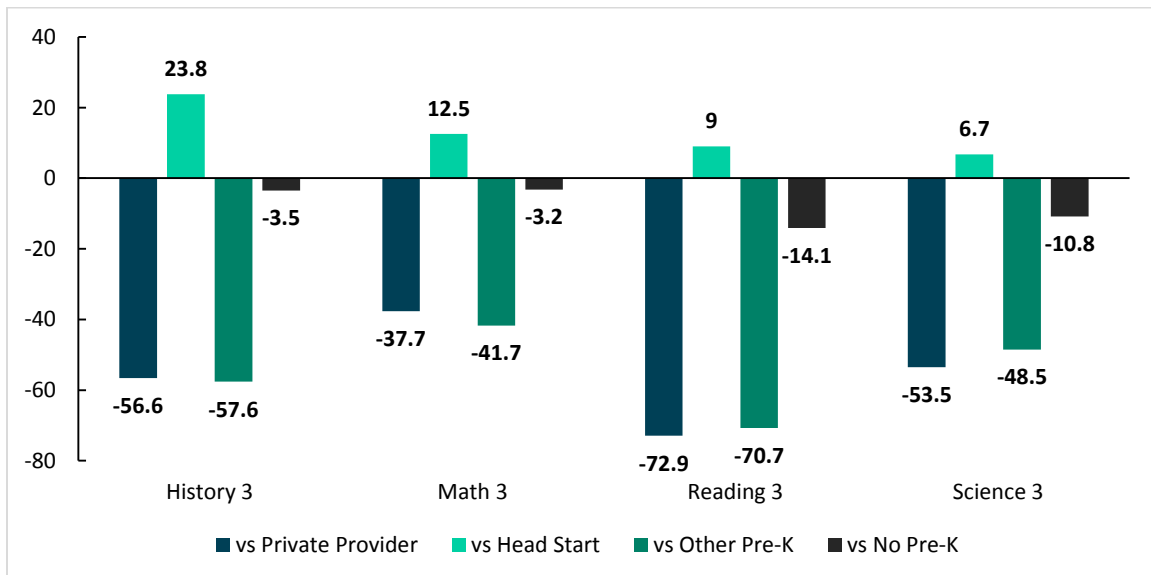
**Figure 2.17: Difference in Grade 3 Standards of Learning Mean Scores
(APS Pre-K – Other Groups)**

Figure 2.18: Grade 4 Standards of Learning – Mean Scores

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
US/VA Studies 4	298	484.6	524	544.2	28	469.4	109	537.5	109	511.2	1068	521.5
Math 4	336	430.2	525	478.6	33	425.6	109	482.2	124	443.4	1127	459.1
Reading 4	335	466	525	532.7	33	436.2	110	527.5	122	489	1125	504.8
Science 5	13	464.3	--	--	--	--	--	--	--	--	31	467.2

Figure 2.19: Grade 4 Standards of Learning – Performance Levels

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
US/VA Studies 4												
Fail	47	15.8%	10	1.9%	5	17.9%	4	3.7%	7	6.4%	73	6.8%
Proficient	119	39.9%	114	21.8%	12	42.9%	20	18.3%	40	36.7%	305	28.6%
Advanced	132	44.3%	400	76.3%	11	39.3%	85	78.0%	62	56.9%	690	64.6%
Math 4												
Fail	102	30.4%	49	9.3%	12	36.4%	11	10.1%	26	21.0%	200	17.7%
Proficient	186	55.4%	273	52.0%	18	54.5%	54	49.5%	65	52.4%	596	52.9%
Advanced	48	14.3%	203	38.7%	3	9.1%	44	40.4%	33	26.6%	331	29.4%
Reading 4												
Fail	56	16.7%	15	2.9%	8	24.2%	6	5.5%	13	10.7%	98	8.7%
Proficient	165	49.3%	139	26.5%	17	51.5%	28	25.5%	57	46.7%	406	36.1%
Advanced	114	34.0%	371	70.7%	8	24.2%	76	69.1%	52	42.6%	621	55.2%
Science 5												
Fail	3	23.1%	--	--	--	--	--	--	--	--	4	12.9%
Proficient	6	46.2%	--	--	--	--	--	--	--	--	19	61.3%
Advanced	4	30.8%	--	--	--	--	--	--	--	--	8	25.8%

**Figure 2.20: Difference in Grade 4 Standards of Learning Mean Scores
(APS Pre-K – Other Groups)**

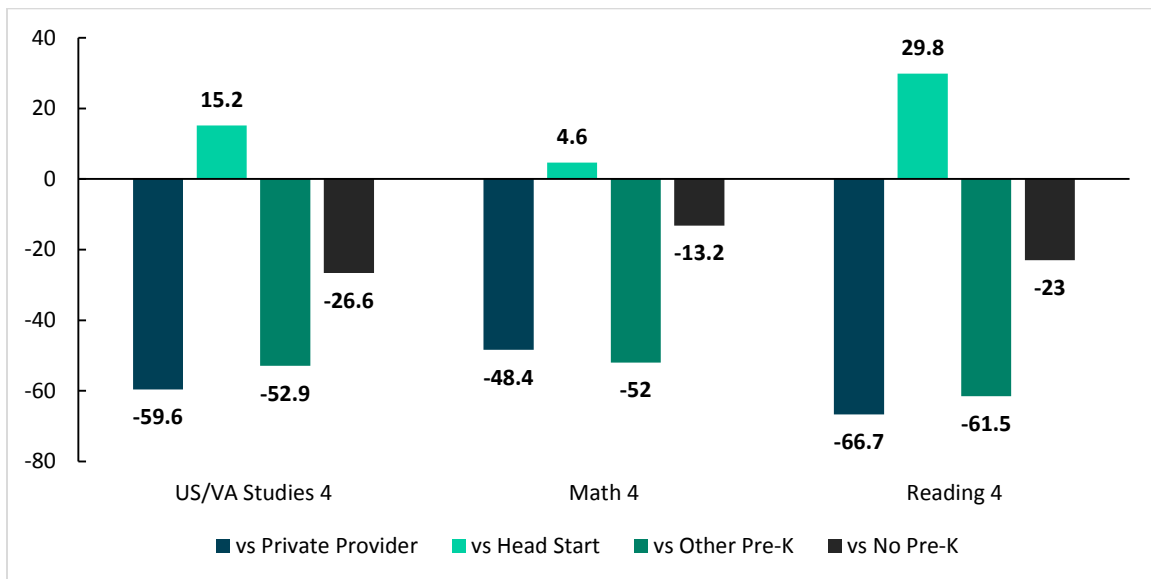


Figure 2.21: Grade 5 Standards of Learning – Mean Scores

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Math 5	330	445.1	497	493.8	29	433.4	107	506.5	117	465.6	1080	475.5
Reading 5	330	423.9	497	480.4	29	412.5	107	479.5	117	444.1	1080	457.3
Science 5	329	433.3	476	457.6	27	474.3	101	462.8	98	443.9	1031	449.5
Writing 5	279	446.1	495	507.4	26	423.8	104	508.1	99	476.5	1003	485.2

Figure 2.22: Grade 5 Standards of Learning – Performance Levels

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
Math 5												
Fail	83	25.2%	34	6.8%	9	31.0%	10	9.3%	18	15.4%	154	14.3%
Proficient	185	56.1%	235	47.3%	17	58.6%	35	32.7%	62	53.0%	534	49.4%
Advanced	62	18.8%	228	45.9%	3	10.3%	62	57.9%	37	31.6%	392	36.3%
Reading 5												
Fail	104	31.5%	34	6.8%	13	44.8%	12	11.2%	27	23.1%	190	17.6%
Proficient	189	57.3%	284	57.1%	15	51.7%	49	45.8%	62	53.0%	599	55.5%
Advanced	37	11.2%	179	36.0%	1	3.4%	46	43.0%	28	23.9%	291	26.9%
Science 5												
Fail	81	24.6%	77	16.2%	5	18.5%	17	16.8%	21	21.4%	201	19.5%
Proficient	164	49.8%	241	50.6%	11	40.7%	49	48.5%	52	53.1%	517	50.1%
Advanced	84	25.5%	158	33.2%	11	40.7%	35	34.7%	25	25.5%	313	30.4%

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
Writing 5												
Fail	80	28.7%	28	5.7%	12	46.2%	9	8.7%	21	21.2%	150	15.0%
Proficient	131	47.0%	187	37.8%	10	38.5%	39	37.5%	36	36.4%	403	40.2%
Advanced	68	24.4%	280	56.6%	4	15.4%	56	53.8%	42	42.4%	450	44.9%

**Figure 2.23: Difference in Grade 5 Standards of Learning Mean Scores
(APS Pre-K – Other Groups)**

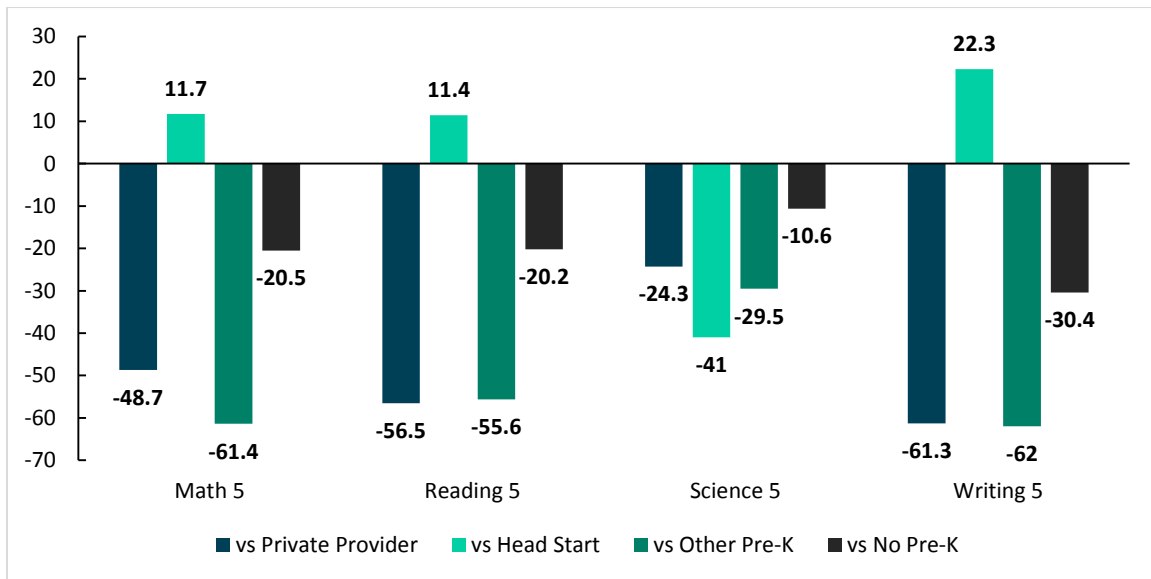


Figure 2.24: Grade 6 Standards of Learning – Mean Scores

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
US History I	310	445.4	484	509.8	28	428.7	104	513.3	105	462.2	1031	483.7
Math 6	272	439.3	338	478.2	26	428.2	66	468.1	94	444.7	796	458.5
Math 7	38	510.3	144	520.5	--	--	37	519.9	13	524.1	234	519
Reading 6	313	429.5	483	474.2	28	408.3	104	473.3	107	431.9	1035	454.4

Figure 2.25: Grade 6 Standards of Learning – Performance Levels

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
US History I												
Fail	85	27.4%	23	4.8%	11	39.3%	6	5.8%	25	23.8%	150	14.5%
Proficient	153	49.4%	182	37.6%	13	46.4%	39	37.5%	44	41.9%	431	41.8%
Advanced	72	23.2%	279	57.6%	4	14.3%	59	56.7%	36	34.3%	450	43.6%
Math 6												
Fail	56	20.6%	19	5.6%	3	11.5%	5	7.6%	15	16.0%	98	12.3%
Proficient	192	70.6%	216	63.9%	23	88.5%	47	71.2%	57	60.6%	535	67.2%
Advanced	24	8.8%	103	30.5%	0	0	14	21.2%	22	23.4%	163	20.5%
Math 7												
Fail	0	0	0	0	--	--	0	0	0	0	0	0
Proficient	21	55.3%	45	31.3%	--	--	11	29.7%	4	30.8%	81	34.6%
Advanced	17	44.7%	99	68.8%	--	--	26	70.3%	9	69.2%	153	65.4%
Reading 6												
Fail	93	29.7%	28	5.8%	12	42.9%	10	9.6%	28	26.2%	171	16.5%
Proficient	181	57.8%	306	63.4%	16	57.1%	60	57.7%	59	55.1%	622	60.1%
Advanced	39	12.5%	149	30.8%	0	0	34	32.7%	20	18.7%	242	23.4%

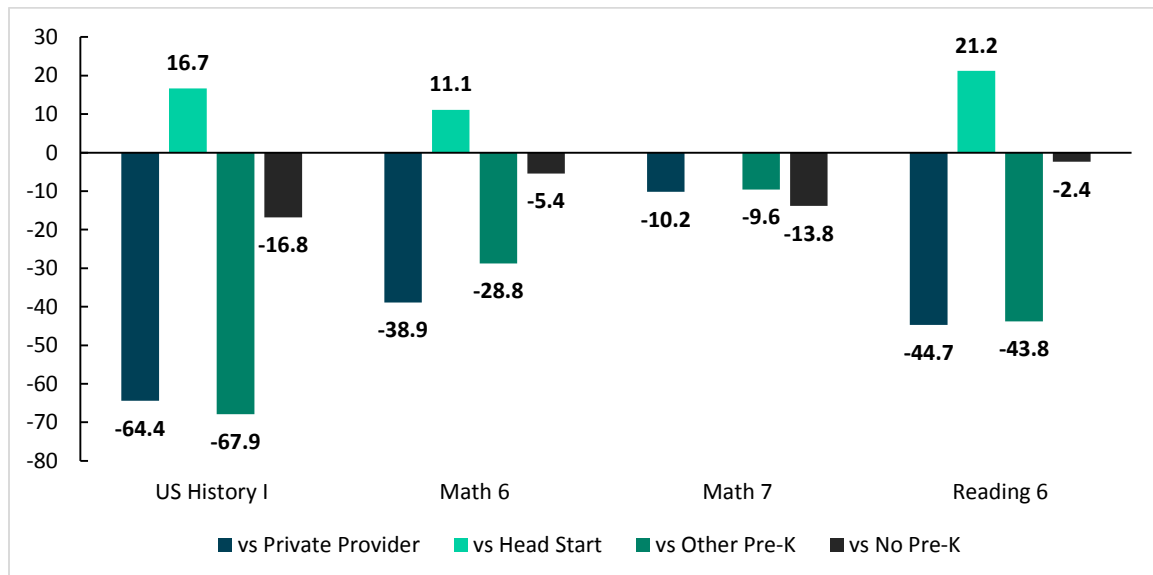
**Figure 2.26: Difference in Grade 6 Standards of Learning Mean Scores
(APS Pre-K – Other Groups)**

Figure 2.27: Grade 7 Standards of Learning – Mean Scores

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Math 7	183	410.4	163	432.9	23	415.1	36	417.1	54	393.1	459	417.1
Math 8	82	459.2	181	477.4	--	--	33	486.1	45	462.8	344	471.6
Algebra I	34	501.5	130	502.6	--	--	33	502.9	11	499.1	209	502.2
Reading 7	299	434.6	476	483.6	27	417.3	104	477.1	110	450	1016	463.1

Figure 2.28: Grade 7 Standards of Learning – Performance Levels

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
Math 7												
Fail	51	27.9%	32	19.6%	6	26.1%	10	27.8%	22	40.7%	121	26.4%
Proficient	124	67.8%	115	70.6%	17	73.9%	26	72.2%	27	50.0%	309	67.3%
Advanced	8	4.4%	16	9.8%	0	0	0	0	5	9.3%	29	6.3%
Math 8												
Fail	1	1.2%	0	0	--	--	0	0	2	4.4%	3	0.9%
Proficient	71	86.6%	135	74.6%	--	--	20	60.6%	35	77.8%	264	76.7%
Advanced	10	12.2%	46	25.4%	--	--	13	39.4%	8	17.8%	77	22.4%
Algebra I												
Fail	0	0	0	0	--	--	0	0	0	0	0	0
Proficient	18	52.9%	77	59.2%	--	--	18	54.5%	7	63.6%	121	57.9%
Advanced	16	47.1%	53	40.8%	--	--	15	45.5%	4	36.4%	88	42.1%
Reading 7												
Fail	61	20.4%	17	3.6%	10	37.0%	6	5.8%	12	10.9%	106	10.4%
Proficient	201	67.2%	292	61.3%	16	59.3%	62	59.6%	75	68.2%	646	63.6%
Advanced	37	12.4%	167	35.1%	1	3.7%	36	34.6%	23	20.9%	264	26.0%

**Figure 2.29: Difference in Grade 7 Standards of Learning Mean Scores
(APS Pre-K – Other Groups)**

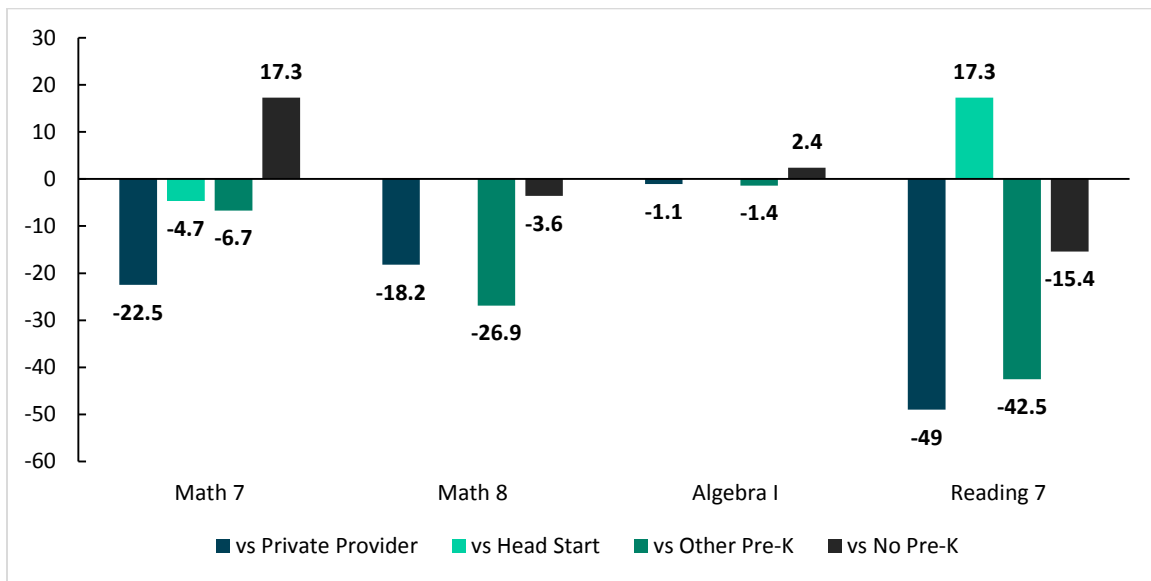


Figure 2.30: Grade 8 Standards of Learning – Mean Scores

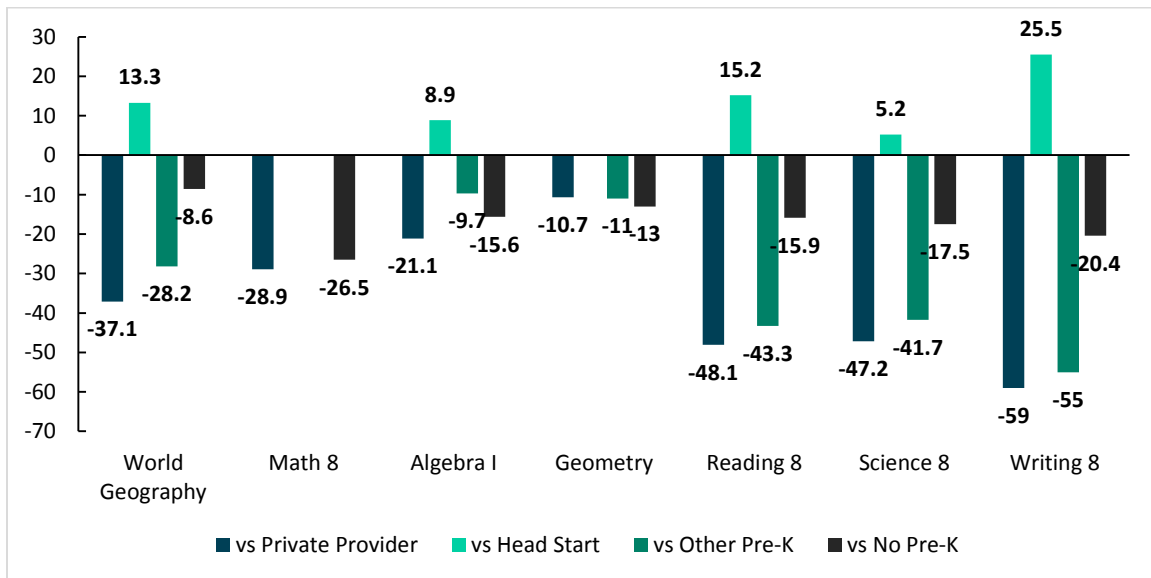
COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
World Geography	286	439.7	472	476.8	28	426.4	106	467.9	102	448.3	994	460.8
Math 8	48	390.1	30	419	--	--	--	--	21	416.6	116	405.2
Algebra I	203	431.2	314	452.3	18	422.3	63	440.9	71	446.8	669	443.4
Geometry	35	507.9	125	518.6	--	--	32	518.9	10	520.9	203	516.8
Reading 8	287	429.1	472	477.2	28	413.9	106	472.4	102	445	995	457.7
Science 8	287	437.2	470	484.4	28	432	106	478.9	102	454.7	993	465.6
Writing 8	278	443.4	470	502.4	26	417.9	104	498.4	99	463.8	977	479

Figure 2.31: Grade 8 Standards of Learning – Performance Levels

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
World Geography												
Fail	46	16.1%	6	1.3%	5	17.9%	7	6.6%	11	10.8%	75	7.5%
Proficient	214	74.8%	336	71.2%	22	78.6%	73	68.9%	82	80.4%	727	73.1%
Advanced	26	9.1%	130	27.5%	1	3.6%	26	24.5%	9	8.8%	192	19.3%
Math 8												
Fail	25	52.1%	8	26.7%	--	--	--	--	5	23.8%	43	37.1%
Proficient	23	47.9%	21	70.0%	--	--	--	--	16	76.2%	72	62.1%
Advanced	0	0.0%	1	3.3%	--	--	--	--	0	0	1	0.9%

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
Algebra I												
Fail	31	15.3%	16	5.1%	2	11.1%	8	12.7%	5	7.0%	62	9.3%
Proficient	162	79.8%	241	76.8%	16	88.9%	48	76.2%	61	85.9%	528	78.9%
Advanced	10	4.9%	57	18.2%	0	0.0%	7	11.1%	5	7.0%	79	11.8%
Geometry												
Fail	0	0.0%	2	1.6%	--	--	0	0	0	0	2	1.0%
Proficient	16	45.7%	41	32.8%	--	--	13	40.6%	3	30.0%	74	36.5%
Advanced	19	54.3%	82	65.6%	--	--	19	59.4%	7	70.0%	127	62.6%
Reading 8												
Fail	79	27.5%	23	4.9%	9	32.1%	10	9.4%	18	17.6%	139	14.0%
Proficient	175	61.0%	309	65.5%	18	64.3%	62	58.5%	67	65.7%	631	63.4%
Advanced	33	11.5%	140	29.7%	1	3.6%	34	32.1%	17	16.7%	225	22.6%
Science 8												
Fail	57	19.9%	8	1.7%	6	21.4%	8	7.5%	13	12.7%	92	9.3%
Proficient	194	67.6%	291	61.9%	21	75.0%	56	52.8%	74	72.5%	636	64.0%
Advanced	36	12.5%	171	36.4%	1	3.6%	42	39.6%	15	14.7%	265	26.7%
Writing 8												
Fail	77	27.7%	23	4.9%	11	42.3%	11	10.6%	26	26.3%	148	15.1%
Proficient	144	51.8%	201	42.8%	14	53.8%	36	34.6%	41	41.4%	436	44.6%
Advanced	57	20.5%	246	52.3%	1	3.8%	57	54.8%	32	32.3%	393	40.2%

**Figure 2.32: Difference in Grade 8 Standards of Learning Mean Scores
(APS Pre-K – Other Groups)**



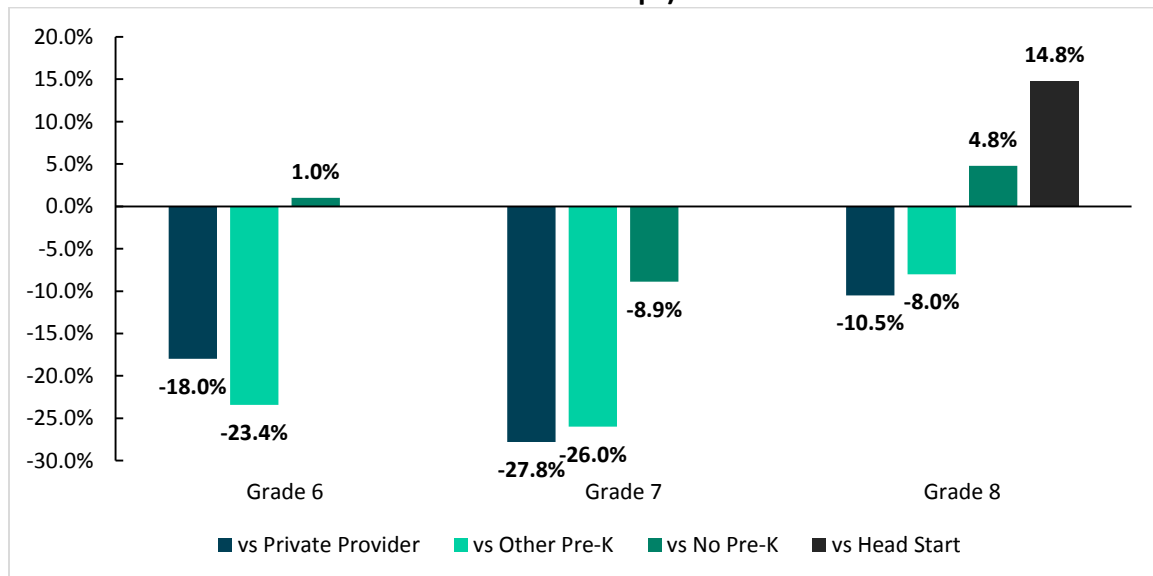
ADVANCED MATH CREDITS

Across all grade levels, APS Pre-K participants take fewer advanced math classes than their counterparts in privately provided Pre-K and Other Pre-K programs. The gap ranges from 8 percent in Grade 8 to 28 percent in Grade 7. Students without Pre-K experience take more advanced math classes than APS Pre-K program participants in Grade 7 only.

Figure 2.33: Advanced Math Course Enrollment

GROUP	GRADE 6		GRADE 7		GRADE 8	
	N	Pct	N	Pct	N	Pct
APS Pre-K	38	11.7%	117	37.4%	239	82.7%
Private Provider	146	29.7%	315	65.2%	442	93.2%
Head Start	2	6.7%	4	13.8%	19	67.9%
Other Pre-K	39	35.1%	71	63.4%	98	90.7%
No Pre-K	13	10.7%	57	46.3%	81	77.9%
Entire Cohort	238	22.1%	564	53.2%	879	87.6%

Figure 2.34: Difference in Percent Enrollment in Advanced Math Courses (APS Pre-K – Other Groups)



GRADE POINT AVERAGE

APS has provided data on GPA for Grades 6-8, which is described by Figure 2.35 below. **In all three grades, the GPA of APS Pre-K program participants is markedly lower than that of all other student groups except the Head Start cohort.** The gap between APS Pre-K participants and privately provided Pre-K program participants in mean GPA values ranges from 0.464 points in Grade 8 to 0.542 points in Grade 7. The difference for these grades is more pronounced than what we found for Grades 9-12 for the original cohort in Section I.

Figure 2.35: Mean GPA Values by Program Status and Grade

GROUP	GRADE 6		GRADE 7		GRADE 8	
	N	Mean	N	Mean	N	Mean
APS Pre-K	322	3.226	310	3.186	289	3.144
Private Provider	491	3.738	483	3.728	474	3.608
Head Start	30	3.092	29	2.989	28	2.904
Other Pre-K	109	3.648	111	3.64	107	3.535
No Pre-K	120	3.34	122	3.301	104	3.341
Entire Cohort	1,072	3.512	1,055	3.49	1,002	3.419

IAT REFERRALS

Figure 2.36 shows IAT referrals for Grades 4-7 for different categories. Due to the low number of observations, it is not possible to make firm conclusions about the differences between two groups in many cases. **In Grade 4, APS Pre-K program participants were less likely to be a new referral than their peers with no pre-K experience or privately provided Pre-K.**

Figure 2.36: IAT Referrals

GROUP	ACADEMIC IAT REFERRAL		BEHAVIOR IAT REFERRAL		BEHAVIOR AND ACADEMIC IAT REFERRAL		NEW IAT REFERRAL		REVISIT IAT REFERRAL		TOTAL IAT REFERRAL	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
Grade 4												
APS Pre-K	11	57.9%	4	21.1%	4	21.1%	16	84.2%	8	42.1%	19	100.0%
Private Provider	6	31.6%	3	15.8%	9	47.4%	19	100.0%	6	31.6%	19	100.0%
Head Start	3	100.0%	0	0.0%	2	66.7%	3	100.0%	2	66.7%	3	100.0%
Other Pre-K	3	75.0%	1	25.0%	0	0.0%	3	75.0%	2	50.0%	4	100.0%
No Pre-K	8	57.1%	1	7.1%	4	28.6%	13	92.9%	4	28.6%	14	100.0%
Entire Cohort	31	52.5%	9	15.3%	19	32.2%	54	91.5%	22	37.3%	59	100.0%
Grade 5												
APS Pre-K	5	41.7%	3	25.0%	4	33.3%	9	75.0%	5	41.7%	12	100.0%
Private Provider	6	54.5%	2	18.2%	2	18.2%	9	81.8%	5	45.5%	11	100.0%
Head Start	2	100.0%	0	0.0%	0	0.0%	2	100.0%	0	0.0%	2	100.0%
Other Pre-K	4	80.0%	1	20.0%	0	0.0%	5	100.0%	1	20.0%	5	100.0%
No Pre-K	1	20.0%	1	20.0%	2	40.0%	4	80.0%	2	40.0%	5	100.0%
Entire Cohort	18	51.4%	7	20.0%	8	22.9%	29	82.9%	13	37.1%	35	100.0%

GROUP	ACADEMIC IAT REFERRAL		BEHAVIOR IAT REFERRAL		BEHAVIOR AND ACADEMIC IAT REFERRAL		NEW IAT REFERRAL		REVISIT IAT REFERRAL		TOTAL IAT REFERRAL	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
Grade 6												
APS Pre-K	6	50.0%	0	0.0%	3	25.0%	12	100.0%	1	8.3%	12	100.0%
Private Provider	3	42.9%	0	0.0%	4	57.1%	7	100.0%	0	0.0%	7	100.0%
Head Start	1	100.0%	0	0.0%	0	0.0%	1	100.0%	0	0.0%	1	100.0%
Other Pre-K	1	100.0%	0	0.0%	0	0.0%	1	100.0%	0	0.0%	1	100.0%
No Pre-K	2	100.0%	0	0.0%	0	0.0%	2	100.0%	2	100.0%	2	100.0%
Entire Cohort	13	56.5%	0	0.0%	7	30.4%	23	100.0%	3	13.0%	23	100.0%
Grade 7												
APS Pre-K	0	0.0%	0	0.0%	2	100.0%	2	100.0%	0	0.0%	2	100.0%
Private Provider	1	33.3%	0	0.0%	1	33.3%	3	100.0%	1	33.3%	3	100.0%
Head Start	2	100.0%	0	0.0%	0	0.0%	2	100.0%	2	100.0%	2	100.0%
Other Pre-K	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
No Pre-K	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Entire Cohort	3	42.9%	0	0.0%	3	42.9%	7	100.0%	3	42.9%	7	100.0%

ATTENDANCE

In Grades 1-3, students who participated in APS Pre-K programs have higher attendance rates than their Head Start and no Pre-K peers and lower attendance relative to students with privately provided or Other Pre-K experience. In later grades the differences in attendance is very small.

Figure 2.37: Attendance Across Grades and Program Status

GROUP	GRADE 1		GRADE 2		GRADE 3		GRADE 4		GRADE 5		GRADE 6		GRADE 7		GRADE 8	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
APS Pre-K	431	92.19	396	93.04	371	93.5	351	94.67	344	94.49	325	97.13	313	96.56	289	97.1
Private Provider	592	93.12	562	93.7	549	94.07	531	94.78	503	94.78	492	97.13	483	96.43	474	96.53
Head Start	43	91.15	41	92.61	37	92.75	35	94.99	31	95.47	30	97.07	29	96.08	28	95.83
Other Pre-K	138	93.48	127	93.39	117	93.39	114	94.22	112	94.02	111	97.13	112	96.3	108	96.6
No Pre-K	186	91.44	163	93.38	154	93.1	140	94.67	132	95.37	121	97.21	123	96.62	104	97.02
Entire Cohort	1390	92.58	1289	93.39	1228	93.67	1171	94.69	1122	94.71	1079	97.14	1060	96.47	1003	96.73

ECONOMICALLY DISADVANTAGED STUDENTS

In this subsection, we focus on economically disadvantaged (ED) students, dropping non-disadvantaged peers from the dataset.

PHONOLOGICAL AWARENESS LITERACY SCREENING

Contrary to the entire cohort, when we limit the sample to economically disadvantaged students, those who participated in the APS Pre-K programs perform better in Kindergarten fall semester and fall of Grade 1, while falling behind in the spring semester of Grade 1. This pattern is present in both mean scores and percentage of students who performed below benchmark in both fall and spring semesters. For instance, in the fall semester of Kindergarten only 15.5 percent of APS Pre-K participants perform below benchmark, compared to 46.7 percent of students with no Pre-K. In comparison, in Grade 2 spring semester 18.6 percent of participants do not reach the benchmark level, while only 15.2 percent of students with no Pre-K fail to reach this level. It appears that the APS Pre-K cohort has not improved in terms of reaching the benchmark level over the course of three years, while their peers have.

Figure 2.38: Kindergarten PALS Mean Scores and Below Benchmark Performance (ED Students)

GROUP	FALL					SPRING				
	Average PALS Score			Percentage Performed below Benchmark		Average PALS Score			Percentage Performed below Benchmark	
	N	Mean	Standard Deviation	N	Pct	N	Mean	Standard Deviation	N	Pct
APS Pre-K	328	57.4	24.58	51	15.5%	330	89.78	14.89	51	15.5%
Private Provider	27	54.89	26.3	5	18.5%	33	90.3	12.3	6	18.2%
Head Start	36	43.81	25.63	12	33.3%	36	90.19	11.53	6	16.7%
Other Pre-K	18	49.67	22.49	5	27.8%	24	86.13	17.14	2	8.3%
No Pre-K	90	33.6	23.04	42	46.7%	105	80.05	19.15	36	34.3%
Entire Cohort	499	51.71	26.02	115	23.0%	528	87.74	16.03	101	19.1%

Figure 2.39: Grade 1 PALS Mean Scores and Below Benchmark Performance (ED Students)

GROUP	FALL					SPRING				
	Average PALS Score			Percentage Performed below Benchmark		Average PALS Score			Percentage Performed below Benchmark	
	N	Mean	Standard Deviation	N	Pct	N	Mean	Standard Deviation	N	Pct
APS Pre-K	204	52.46	19.32	44	21.6%	263	44.07	16.27	68	25.9%
Private Provider	17	52.29	18.79	4	23.5%	26	49.65	14.54	4	15.4%
Head Start	24	53	16.79	6	25.0%	30	43.5	15.64	8	26.7%
Other Pre-K	7	41.29	20.55	3	42.9%	12	39	19.29	2	16.7%
No Pre-K	60	49.82	18.57	19	31.7%	75	40.53	16.2	22	29.3%
Entire Cohort	312	51.73	18.97	76	24.4%	406	43.58	16.27	104	25.6%

Figure 2.40: Grade 2 PALS Mean Scores and Below Benchmark Performance (ED Students)

GROUP	FALL					SPRING				
	Average PALS Score			Percentage Performed below Benchmark		Average PALS Score			Percentage Performed below Benchmark	
	N	Mean	Standard Deviation	N	Pct	N	Mean	Standard Deviation	N	Pct
APS Pre-K	62	27.94	16.23	46	74.2%	221	63.93	14.91	41	18.6%
Private Provider	4	26	11.22	3	75.0%	16	68.81	11.69	2	12.5%
Head Start	10	36.4	16.23	4	40.0%	31	66.06	13.03	4	12.9%
Other Pre-K	1	62	--	0	0.0%	7	67.29	8.44	0	0.0%
No Pre-K	19	31.47	16.85	8	42.1%	66	63.53	17.16	10	15.2%
Entire Cohort	96	29.79	16.46	61	63.5%	341	64.35	14.97	57	16.7%

DEGREES OF READING POWER

All five groups perform very similarly to each other in terms of mean scores in this subsample, with the exception of the small but higher-performing Private Provider group. This is contrary to our findings for the entire cohort, where APS Pre-K program participants did not do as well as their peers who participated in privately provided or “Other” pre-K programs. Due to a low number of observations it is not possible to compare shares of students identified for remediation across groups in this case.

Figure 2.41: Degrees of Reading Power – Mean Scores and Remediation (ED Students)

GROUP	GRADE 2					GRADE 4				
	Average DRP Score			Percentage Identified for Remediation		Average DRP Score			Percentage Identified for Remediation	
	N	Mean	Standard Deviation	N	Pct	N	Mean	Standard Deviation	N	Pct
APS Pre-K	196	26.02	8.75	37	18.9%	221	30.25	9.94	106	48.0%
Private Provider	20	32.05	8.86	2	10.0%	18	36.28	8.82	5	27.8%
Head Start	28	23.89	9.02	8	28.6%	26	29.31	7.87	15	57.7%
Other Pre-K	6	24.67	12.09	2	33.3%	8	29.5	11.12	4	50.0%
No Pre-K	55	24.44	8.08	7	12.7%	53	30.53	8.92	28	52.8%
Entire Cohort	305	25.9	8.86	56	18.4%	326	30.54	9.65	158	48.5%

STANDARDS OF LEARNING

While disadvantaged students who participated in APS Pre-K programs do better relative to their comparison group than what we found for the entire cohort, they still fall behind students in privately provided pre-K programs in terms of SOL scale scores on all occasions. Due to the low number of observations, we cannot say how well APS Pre-K participants perform against students in “Other” Pre-K programs, but we find that they frequently outperform students in Head Start and non-participants.

Figure 2.42: Grade 3 Standards of Learning – Mean Scores (ED Students)

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
History 3	207	440.4	21	473	25	426	--	--	60	424.1	318	438.1
Math 3	242	495.5	22	512.7	30	485.8	--	--	66	485.5	367	493.3
Reading 3	242	414.2	22	477	30	419.5	--	--	66	410.2	367	417.7
Science 3	183	454.1	21	487.9	23	451.7	--	--	53	441.2	285	454

Figure 2.43: Grade 3 Standards of Learning – Performance Levels (ED Students)

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
History 3												
Fail	56	27.1%	3	14.3%	10	40.0%	--	--	19	31.7%	90	28.3%
Proficient	112	54.1%	10	47.6%	12	48.0%	--	--	34	56.7%	171	53.8%
Advanced	39	18.8%	8	38.1%	3	12.0%	--	--	7	11.7%	57	17.9%
Math 3												
Fail	29	12.0%	2	9.1%	3	10.0%	--	--	8	12.1%	44	12.0%
Proficient	81	33.5%	7	31.8%	13	43.3%	--	--	27	40.9%	130	35.4%
Advanced	132	54.5%	13	59.1%	14	46.7%	--	--	31	47.0%	193	52.6%
Reading 3												
Fail	61	25.2%	1	4.5%	13	43.3%	--	--	20	30.3%	98	26.7%
Proficient	120	49.6%	12	54.5%	10	33.3%	--	--	31	47.0%	176	48.0%
Advanced	61	25.2%	9	40.9%	7	23.3%	--	--	15	22.7%	93	25.3%
Science 3												
Fail	31	16.9%	2	9.5%	5	21.7%	--	--	15	28.3%	53	18.6%
Proficient	103	56.3%	10	47.6%	13	56.5%	--	--	30	56.6%	160	56.1%
Advanced	49	26.8%	9	42.9%	5	21.7%	--	--	8	15.1%	72	25.3%

Figure 2.44: Grade 4 Standards of Learning – Mean Scores (ED Students)

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
US/VA Studies 4	198	462.6	18	494.9	23	452.8	--	--	46	475.2	293	465.1
Math 4	231	414.7	19	443.5	28	414.5	--	--	59	406.5	345	414.6
Reading 4	230	444.6	19	490.1	28	420.9	--	--	57	439.8	342	444.6
Science 5	13	464.3	--	--	--	--	--	--	--	--	24	468.6

Figure 2.45: Grade 4 Standards of Learning – Performance Levels (ED Students)

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
US/VA Studies 4												
Fail	41	20.7%	1	5.6%	5	21.7%	--	--	5	10.9%	54	18.4%
Proficient	95	48.0%	9	50.0%	11	47.8%	--	--	24	52.2%	142	48.5%
Advanced	62	31.3%	8	44.4%	7	30.4%	--	--	17	37.0%	97	33.1%
Math 5												
Fail	91	39.4%	7	36.8%	12	42.9%	--	--	21	35.6%	136	39.4%
Proficient	119	51.5%	9	47.4%	15	53.6%	--	--	28	47.5%	174	50.4%
Advanced	21	9.1%	3	15.8%	1	3.6%	--	--	10	16.9%	35	10.1%
Reading 4												
Fail	53	23.0%	2	10.5%	8	28.6%	--	--	10	17.5%	76	22.2%
Proficient	122	53.0%	8	42.1%	15	53.6%	--	--	38	66.7%	186	54.4%
Advanced	55	23.9%	9	47.4%	5	17.9%	--	--	9	15.8%	80	23.4%
Science 5												
Fail	3	23.1%	--	--	--	--	--	--	--	--	4	16.7%
Proficient	6	46.2%	--	--	--	--	--	--	--	--	13	54.2%
Advanced	4	30.8%	--	--	--	--	--	--	--	--	7	29.2%

Figure 2.46: Grade 5 Standards of Learning – Mean Scores (ED Students)

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Math 5	226	429.2	18	450.3	25	424.4	--	--	56	426.3	334	429.4
Reading 5	226	404.4	18	444.8	25	402.4	--	--	56	405.1	334	406.6
Science 5	226	432.1	16	480	24	479.1	--	--	43	446.7	317	440.6
Writing 5	177	425.8	16	471.6	22	407.7	--	--	41	415.8	262	425.8

Figure 2.47: Grade 5 Standards of Learning – Performance Levels (ED Students)

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
Math 5												
Fail	71	31.4%	5	27.8%	9	36.0%	--	--	17	30.4%	107	32.0%
Proficient	127	56.2%	9	50.0%	15	60.0%	--	--	32	57.1%	186	55.7%
Advanced	28	12.4%	4	22.2%	1	4.0%	--	--	7	12.5%	41	12.3%
Reading 5												
Fail	91	40.3%	5	27.8%	12	48.0%	--	--	22	39.3%	134	40.1%
Proficient	125	55.3%	11	61.1%	13	52.0%	--	--	26	46.4%	180	53.9%
Advanced	10	4.4%	2	11.1%	0	0.0%	--	--	8	14.3%	20	6.0%

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
Science 5												
Fail	60	26.5%	3	18.8%	4	16.7%	--	--	9	20.9%	79	24.9%
Proficient	110	48.7%	7	43.8%	10	41.7%	--	--	23	53.5%	153	48.3%
Advanced	56	24.8%	6	37.5%	10	41.7%	--	--	11	25.6%	85	26.8%
Writing 5												
Fail	70	39.5%	2	12.5%	12	54.5%	--	--	18	43.9%	104	39.7%
Proficient	79	44.6%	9	56.3%	8	36.4%	--	--	20	48.8%	119	45.4%
Advanced	28	15.8%	5	31.3%	2	9.1%	--	--	3	7.3%	39	14.9%

Figure 2.48: Grade 6 Standards of Learning – Mean Scores (ED Students)

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
US History I	213	424.3	16	486.7	25	418.4	--	--	46	421.7	307	426.7
Math 6	199	429.8	12	453.3	24	425.3	--	--	46	411.3	287	427.4
Math 7	15	499.8	--	--	--	--	--	--	--	--	23	496.3
Reading 6	216	414.8	16	448.9	25	401	--	--	48	391.4	312	412.1

Figure 2.49: Grade 6 Standards of Learning – Performance Levels (ED Students)

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
US History I												
Fail	81	38.0%	2	12.5%	11	44.0%	--	--	20	43.5%	116	37.8%
Proficient	105	49.3%	7	43.8%	12	48.0%	--	--	18	39.1%	147	47.9%
Advanced	27	12.7%	7	43.8%	2	8.0%	--	--	8	17.4%	44	14.3%
Math 6												
Fail	50	25.1%	1	8.3%	3	12.5%	--	--	13	28.3%	69	24.0%
Proficient	136	68.3%	9	75.0%	21	87.5%	--	--	26	56.5%	196	68.3%
Advanced	13	6.5%	2	16.7%	0	0.0%	--	--	7	15.2%	22	7.7%
Math 7												
Fail	0	0	--	--	--	--	--	--	--	--	0	0
Proficient	9	60.0%	--	--	--	--	--	--	--	--	13	56.5%
Advanced	6	40.0%	--	--	--	--	--	--	--	--	10	43.5%
Reading 6												
Fail	84	38.9%	3	18.8%	12	48.0%	--	--	21	43.8%	123	39.4%
Proficient	117	54.2%	8	50.0%	13	52.0%	--	--	25	52.1%	167	53.5%
Advanced	15	6.9%	5	31.3%	0	0	--	--	2	4.2%	22	7.1%

Figure 2.50: Grade 7 Standards of Learning – Mean Scores (ED Students)

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Math 7	145	404.1	--	--	22	412.9	--	--	37	372.6	216	399.7
Math 8	48	457.5	--	--	--	--	--	--	11	443.1	67	455.6
Algebra I	14	473.6	--	--	--	--	--	--	--	--	21	474.1
Reading 7	207	418.5	16	455.6	24	407.6	--	--	50	416.5	304	419.5

Figure 2.51: Grade 7 Standards of Learning – Performance Levels (ED Students)

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
Math 7												
Fail	45	31.0%	4	57.1%	6	27.3%	--	--	19	51.4%	77	35.6%
Proficient	95	65.5%	3	42.9%	16	72.7%	--	--	15	40.5%	131	60.6%
Advanced	5	3.4%	0	0	0	0	--	--	3	8.1%	8	3.7%
Math 8												
Fail	1	2.1%	--	--	--	--	--	--	1	9.1%	2	3.0%
Proficient	41	85.4%	--	--	--	--	--	--	9	81.8%	56	83.6%
Advanced	6	12.5%	--	--	--	--	--	--	1	9.1%	9	13.4%
Algebra I												
Fail	0	0	--	--	--	--	--	--	--	--	0	0
Proficient	11	78.6%	--	--	--	--	--	--	--	--	17	81.0%
Advanced	3	21.4%	--	--	--	--	--	--	--	--	4	19.0%
Reading 7												
Fail	57	27.5%	2	12.5%	10	41.7%	--	--	11	22.0%	81	26.6%
Proficient	140	67.6%	11	68.8%	14	58.3%	--	--	32	64.0%	203	66.8%
Advanced	10	4.8%	3	18.8%	0	0	--	--	7	14.0%	20	6.6%

Figure 2.52: Grade 8 Standards of Learning – Mean Scores (ED Students)

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
World Geography	194	424.6	16	446	25	422.3	--	--	44	421.9	286	424.7
Math 8	40	387.1	--	--	--	--	--	--	16	412.4	70	398.8
Algebra I	140	425.1	--	--	16	421.4	--	--	26	430.9	195	425.7
Geometry	14	473.2	--	--	--	--	--	--	--	--	21	475.2
Reading 8	195	412.9	16	439.4	25	407.9	--	--	44	409	287	413.5
Science 8	195	419.4	16	449.3	25	425.6	--	--	44	423.2	287	422.1
Writing 8	186	423.1	16	462.6	23	411.5	--	--	42	424.7	274	425.1

Figure 2.53: Grade 8 Standards of Learning – Performance Levels (ED Students)

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
World Geography												
Fail	44	22.7%	1	6.3%	5	20.0%	--	--	10	22.7%	63	22.0%
Proficient	145	74.7%	15	93.8%	20	80.0%	--	--	34	77.3%	218	76.2%
Advanced	5	2.6%	0	0	0	0	--	--	0	0	5	1.7%
Math 8												
Fail	21	52.5%	--	--	--	--	--	--	4	25.0%	27	38.6%
Proficient	19	47.5%	--	--	--	--	--	--	12	75.0%	43	61.4%
Advanced	0	0	--	--	--	--	--	--	0	0	0	0
Algebra I												
Fail	29	20.7%	--	--	2	12.5%	--	--	3	11.5%	37	19.0%
Proficient	104	74.3%	--	--	14	87.5%	--	--	22	84.6%	150	76.9%
Advanced	7	5.0%	--	--	0	0	--	--	1	3.8%	8	4.1%
Geometry												
Fail	0	0	--	--	--	--	--	--	--	--	0	0
Proficient	10	71.4%	--	--	--	--	--	--	--	--	15	71.4%
Advanced	4	28.6%	--	--	--	--	--	--	--	--	6	28.6%
Reading 8												
Fail	70	35.9%	3	18.8%	9	36.0%	--	--	15	34.1%	100	34.8%
Proficient	114	58.5%	11	68.8%	16	64.0%	--	--	26	59.1%	171	59.6%
Advanced	11	5.6%	2	12.5%	0	0	--	--	3	6.8%	16	5.6%
Science 8												
Fail	54	27.7%	0	0	6	24.0%	--	--	13	29.5%	77	26.8%
Proficient	132	67.7%	15	93.8%	19	76.0%	--	--	30	68.2%	198	69.0%
Advanced	9	4.6%	1	6.3%	0	0	--	--	1	2.3%	12	4.2%
Writing 8												
Fail	66	35.5%	4	25.0%	11	47.8%	--	--	18	42.9%	102	37.2%
Proficient	97	52.2%	7	43.8%	11	47.8%	--	--	19	45.2%	135	49.3%
Advanced	23	12.4%	5	31.3%	1	4.3%	--	--	5	11.9%	37	13.5%

ADVANCED MATH CREDITS

Relative to the entire cohort, economically disadvantaged students who participated in APS Pre-K programs perform better against their peers in terms of the number of advanced math classes taken. While they still take fewer classes than students in privately provided and “Other” Pre-K programs in Grade 6, by Grades 7-8 the gap between APS Pre-K participants and these groups declines to the extent that participants overtake students in “Other” Pre-K programs in terms of the number of advanced math classes taken.

Figure 2.54: Advanced Math Course Enrollment (ED Students)

GROUP	GRADE 6		GRADE 7		GRADE 8	
	N	Pct	N	Pct	N	Pct
APS Pre-K	15	6.6%	63	28.6%	155	78.7%
Private Provider	4	23.5%	9	52.9%	13	81.3%
Head Start	1	3.7%	2	7.7%	16	64.0%
Other Pre-K	1	12.5%	2	25.0%	5	71.4%
No Pre-K	2	3.3%	13	21.0%	28	60.9%
Entire Cohort	23	6.8%	89	26.7%	217	74.6%

GRADE POINT AVERAGE

In terms of GPA, disadvantaged students who also participated in the APS Preschool programs outperform their peers without Pre-K experience and those in Head Start in Grades 6 and 7, however, by Grade 8 non-participants catch up with and pass them. Students in privately provided Pre-K programs routinely outperform APS Pre-K participants.

Figure 2.55: Mean GPA Values by Program Status and Grade (ED Students)

GROUP	GRADE 6		GRADE 7		GRADE 8	
	N	Mean	N	Mean	N	Mean
APS Pre-K	225	3.086	218	3.029	197	2.975
Private Provider	17	3.369	17	3.414	16	3.32
Head Start	27	2.997	26	2.886	25	2.804
Other Pre-K	8	3.137	8	2.99	7	2.934
No Pre-K	60	2.972	61	2.895	46	2.99
Entire Cohort	337	3.074	330	3.012	291	2.981

IAT REFERRALS

As we have limited the sample to include only economically disadvantaged students, the issue with the number of observations for the IAT referrals outcome was exacerbated. We have limited our discussion of differences between groups to cases where we have at least 10 observations for each group of students. In this case, we cannot draw any conclusions regarding how the groups compare to each other.

Figure 2.56: IAT Referrals (ED Students)

GROUP	ACADEMIC IAT REFERRAL		BEHAVIOR IAT REFERRAL		BEHAVIOR AND ACADEMIC IAT REFERRAL		NEW IAT REFERRAL		REVISIT IAT REFERRAL		TOTAL IAT REFERRAL	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
Grade 4												
APS Pre-K	8	61.5%	1	7.7%	4	30.8%	11	84.6%	4	30.8%	13	100.0%
Private Provider	0	0.0%	0	0.0%	1	100.0%	1	100.0%	0	0.0%	1	100.0%
Head Start	3	100.0%	0	0.0%	2	66.7%	3	100.0%	2	66.7%	3	100.0%
Other Pre-K	1	100.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%	1	100.0%
No Pre-K	5	62.5%	0	0.0%	3	37.5%	8	100.0%	2	25.0%	8	100.0%
Entire Cohort	17	65.4%	1	3.8%	10	38.5%	23	88.5%	9	34.6%	26	100.0%
Grade 5												
APS Pre-K	4	50.0%	2	25.0%	2	25.0%	8	100.0%	2	25.0%	8	100.0%
Private Provider	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Head Start	2	100.0%	0	0.0%	0	0.0%	2	100.0%	0	0.0%	2	100.0%
Other Pre-K	1	100.0%	0	0.0%	0	0.0%	1	100.0%	0	0.0%	1	100.0%
No Pre-K	1	25.0%	1	25.0%	1	25.0%	3	75.0%	2	50.0%	4	100.0%
Entire Cohort	8	53.3%	3	20.0%	3	20.0%	14	93.3%	4	26.7%	15	100.0%
Grade 6												
APS Pre-K	5	45.5%	0	0.0%	3	27.3%	11	100.0%	1	9.1%	11	100.0%
Private Provider	1	50.0%	0	0.0%	1	50.0%	2	100.0%	0	0.0%	2	100.0%
Head Start	1	100.0%	0	0.0%	0	0.0%	1	100.0%	0	0.0%	1	100.0%
Other Pre-K	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
No Pre-K	2	100.0%	0	0.0%	0	0.0%	2	100.0%	2	100.0%	2	100.0%
Entire Cohort	9	56.3%	0	0.0%	4	25.0%	16	100.0%	3	18.8%	16	100.0%

ATTENDANCE

APS Pre-K participants have higher attendance rates than other groups in Grades 1, 3, and 6-8. Among the other four groups, no clear pattern emerges when it comes to attendance of one group relative to the rest in this subsample.

Figure 2.57: Attendance Across Grades and Program Status (ED Students)

GROUP	GRADE 1		GRADE 2		GRADE 3		GRADE 4		GRADE 5		GRADE 6		GRADE 7		GRADE 8	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
APS Pre-K	299	92.31	272	93.12	258	93.60	246	94.67	239	94.8	227	97.1	220	96.49	197	97.07
Private Provider	29	89.86	24	90.72	24	91.19	20	93.5	19	94.14	17	95.99	17	94.57	16	93.82
Head Start	36	90.93	35	93.54	32	93.31	30	94.84	27	95.33	27	97.07	26	96.14	25	96.02
Other Pre-K	14	90.46	9	95.20	8	94.61	9	97.10	10	96.16	8	98.49	8	97.75	7	94.55
No Pre-K	100	91.02	89	93.49	84	92.19	74	94.14	70	95.43	61	96.74	62	96.23	46	96.95
Entire Cohort	478	91.73	429	93.14	406	93.16	379	94.57	365	94.97	340	97.01	333	96.35	291	96.72

STUDENTS WITH LIMITED ENGLISH PROFICIENCY

In this subsection, Hanover Research only analyzes a subset of students who are designated as LEP, or Limited English Proficiency.

PHONOLOGICAL AWARENESS LITERACY SCREENING

Similar to economically disadvantaged students, when we limit the sample to only include LEP students we find that **APS preschool program participants perform better on the PALS assessment in terms of mean scores relative to all groups except for students in privately provided Pre-K programs in Kindergarten and Grade 1.** However, the gap between the two groups shrinks as the students progress through grades. For instance, participants are less likely to perform below benchmark by 28 percent relative to non-participants when they are in the fall semester of Kindergarten, but they are less likely to do so by only 6 percent when they are in the spring semester of Grade 1.

Figure 2.58: Kindergarten PALS Mean Scores and Below Benchmark Performance (LEP Students)

GROUP	FALL					SPRING				
	Average PALS Score			Percentage Performed below Benchmark		Average PALS Score			Percentage Performed below Benchmark	
	N	Mean	Standard Deviation	N	Pct	N	Mean	Standard Deviation	N	Pct
APS Pre-K	322	57.17	24.87	53	16.5%	324	90.23	14.49	45	13.9%
Private Provider	32	61.13	23.47	3	9.4%	38	91.89	10.79	5	13.2%
Head Start	33	42.48	25.85	12	36.4%	33	89.33	11.67	7	21.2%
Other Pre-K	25	52.04	23.73	6	24.0%	33	89.94	9.33	2	6.1%
No Pre-K	87	36.46	25.97	38	43.7%	100	82.09	19.29	33	33.0%
Entire Cohort	499	52.59	26.27	112	22.4%	528	88.73	15.19	92	17.4%

Figure 2.59: Grade 1 PALS Mean Scores and Below Benchmark Performance (LEP Students)

GROUP	FALL					SPRING				
	Average PALS Score			Percentage Performed below Benchmark		Average PALS Score			Percentage Performed below Benchmark	
	N	Mean	Standard Deviation	N	Pct	N	Mean	Standard Deviation	N	Pct
APS Pre-K	200	53.38	18.88	39	19.5%	255	44.5	15.94	66	25.9%
Private Provider	19	57.53	20.08	5	26.3%	21	49.33	14.36	3	14.3%
Head Start	23	52.43	16.87	6	26.1%	28	42.79	16.16	8	28.6%
Other Pre-K	11	47.45	18.29	3	27.3%	20	44.35	16.26	4	20.0%
No Pre-K	54	51.06	19.98	17	31.5%	68	40.65	16.94	22	32.4%
Entire Cohort	307	52.94	18.95	70	22.8%	392	43.96	16.11	103	26.3%

Figure 2.60: Grade 2 PALS Mean Scores and Below Benchmark Performance (LEP Students)

GROUP	FALL					SPRING				
	Average PALS Score			Percentage Performed below Benchmark		Average PALS Score			Percentage Performed below Benchmark	
	N	Mean	Standard Deviation	N	Pct	N	Mean	Standard Deviation	N	Pct
APS Pre-K	55	28.44	13.89	40	72.7%	215	64.86	14.34	36	16.7%
Private Provider	4	31	15.75	2	50.0%	14	68.71	12.34	2	14.3%
Head Start	10	38.1	16.83	3	30.0%	28	65.14	15.14	5	17.9%
Other Pre-K	3	31.67	8.5	1	33.3%	11	64.45	8.88	1	9.1%
No Pre-K	18	29.17	15.11	9	50.0%	59	63.83	16.5	9	15.3%
Entire Cohort	90	29.88	14.44	55	61.1%	327	64.85	14.55	53	16.2%

DEGREES OF READING POWER

LEP students who participated in any of the APS preschool programs consistently outperform their peers in Head Start, but do worse than students in other groups. The difference in mean DRP scores are more pronounced for this sample compared to what we saw with the economically disadvantaged sample.

Figure 2.61: Degrees of Reading Power – Mean Scores and Remediation (LEP Students)

GROUP	GRADE 2					GRADE 4				
	Average DRP Score			Percentage Identified for Remediation		Average DRP Score			Percentage Identified for Remediation	
	N	Mean	Standard Deviation	N	Pct	N	Mean	Standard Deviation	N	Pct
APS Pre-K	188	26.89	8.56	31	16.5%	212	31.06	9.42	92	43.4%
Private Provider	18	31.61	8.73	2	11.1%	18	37.44	11.21	5	27.8%
Head Start	24	21.71	9.22	9	37.5%	22	29.09	8.12	12	54.5%
Other Pre-K	11	29.55	11.36	2	18.2%	12	33.42	11.6	4	33.3%
No Pre-K	48	25.44	8.76	6	12.5%	54	31.52	10.3	27	50.0%
Entire Cohort	289	26.62	8.95	50	17.3%	318	31.45	9.76	140	44.0%

STANDARDS OF LEARNING

Relative to the economically disadvantaged subgroup, LEP subgroup participant students perform similarly on SOL assessments. In this case we are also able to draw comparisons to students in “Other” Pre-K programs, and find that those students do better on SOL assessments than participants in APS Pre-K programs.

Figure 2.62: Grade 3 Standards of Learning – Mean Scores (LEP Students)

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
History 3	200	448.5	21	496.7	21	424.9	10	479.1	54	439.3	306	449.6
Math 3	236	502.6	22	515.5	26	489.6	12	506.7	61	497.1	357	501.6
Reading 3	236	418.1	22	475.3	26	414.2	12	445.8	61	417.8	357	422.2
Science 3	173	463.1	21	489.9	19	452.4	10	495.9	44	457.7	267	464.8

Figure 2.63: Grade 3 Standards of Learning – Performance Levels (LEP Students)

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
History 3												
Fail	50	25.0%	2	9.5%	10	47.6%	1	10.0%	14	25.9%	77	25.2%
Proficient	106	53.0%	9	42.9%	8	38.1%	5	50.0%	30	55.6%	158	51.6%
Advanced	44	22.0%	10	47.6%	3	14.3%	4	40.0%	10	18.5%	71	23.2%
Math 3												
Fail	24	10.2%	1	4.5%	2	7.7%	1	8.3%	6	9.8%	34	9.5%
Proficient	78	33.1%	5	22.7%	11	42.3%	4	33.3%	21	34.4%	119	33.3%
Advanced	134	56.8%	16	72.7%	13	50.0%	7	58.3%	34	55.7%	204	57.1%
Reading 3												
Fail	57	24.2%	3	13.6%	12	46.2%	2	16.7%	14	23.0%	88	24.6%
Proficient	113	47.9%	9	40.9%	8	30.8%	4	33.3%	29	47.5%	163	45.7%
Advanced	66	28.0%	10	45.5%	6	23.1%	6	50.0%	18	29.5%	106	29.7%
Science 3												
Fail	23	13.3%	3	14.3%	5	26.3%	0	0	9	20.5%	40	15.0%
Proficient	96	55.5%	8	38.1%	9	47.4%	3	30.0%	24	54.5%	140	52.4%
Advanced	54	31.2%	10	47.6%	5	26.3%	7	70.0%	11	25.0%	87	32.6%

Figure 2.64: Grade 4 Standards of Learning – Mean Scores (LEP Students)

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
US/VA Studies 4	183	475.9	18	533.7	19	459.2	11	485.9	45	488.6	276	481
Math 4	221	421.6	19	468.3	24	420.3	12	420.8	60	416.4	336	423.2
Reading 4	220	449.2	19	503.2	24	433.2	12	466.8	58	449.6	333	451.8
Science 5	10	443.4	--	--	--	--	--	--	--	--	15	456.5

Figure 2.65: Grade 4 Standards of Learning – Performance Levels (LEP Students)

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
US/VA Studies 4												
Fail	28	15.3%	0	0	4	21.1%	2	18.2%	2	4.4%	36	13.0%
Proficient	85	46.4%	5	27.8%	8	42.1%	3	27.3%	24	53.3%	125	45.3%
Advanced	70	38.3%	13	72.2%	7	36.8%	6	54.5%	19	42.2%	115	41.7%
Math 4												
Fail	75	33.9%	3	15.8%	10	41.7%	5	41.7%	18	30.0%	111	33.0%
Proficient	124	56.1%	10	52.6%	13	54.2%	6	50.0%	31	51.7%	184	54.8%
Advanced	22	10.0%	6	31.6%	1	4.2%	1	8.3%	11	18.3%	41	12.2%
Reading 4												
Fail	43	19.5%	1	5.3%	7	29.2%	3	25.0%	10	17.2%	64	19.2%
Proficient	117	53.2%	8	42.1%	13	54.2%	6	50.0%	36	62.1%	180	54.1%
Advanced	60	27.3%	10	52.6%	4	16.7%	3	25.0%	12	20.7%	89	26.7%
Science 5												
Fail	3	30.0%	--	--	--	--	--	--	--	--	3	20.0%
Proficient	5	50.0%	--	--	--	--	--	--	--	--	8	53.3%
Advanced	2	20.0%	--	--	--	--	--	--	--	--	4	26.7%

Figure 2.66: Grade 5 Standards of Learning – Mean Scores (LEP Students)

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Math 5	219	437.8	19	473.9	21	433.8	13	459.8	56	435.8	328	440.1
Reading 5	219	408.1	19	456.1	21	403	13	421.3	56	412	328	411.7
Science 5	219	433.1	15	466.1	20	479.1	10	446.5	44	460.7	308	442
Writing 5	169	432	17	494.9	18	409.4	10	436.2	39	429.1	253	434.4

Figure 2.67: Grade 5 Standards of Learning – Performance Levels (LEP Students)

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
Math 5												
Fail	58	26.5%	2	10.5%	6	28.6%	5	38.5%	14	25.0%	85	25.9%
Proficient	128	58.4%	12	63.2%	14	66.7%	3	23.1%	32	57.1%	189	57.6%
Advanced	33	15.1%	5	26.3%	1	4.8%	5	38.5%	10	17.9%	54	16.5%
Reading 5												
Fail	81	37.0%	5	26.3%	10	47.6%	6	46.2%	21	37.5%	123	37.5%
Proficient	126	57.5%	9	47.4%	11	52.4%	5	38.5%	26	46.4%	177	54.0%
Advanced	12	5.5%	5	26.3%	0	0	2	15.4%	9	16.1%	28	8.5%
Science 5												
Fail	61	27.9%	2	13.3%	4	20.0%	4	40.0%	7	15.9%	78	25.3%
Proficient	102	46.6%	7	46.7%	7	35.0%	3	30.0%	22	50.0%	141	45.8%
Advanced	56	25.6%	6	40.0%	9	45.0%	3	30.0%	15	34.1%	89	28.9%
Writing 5												
Fail	59	34.9%	0	0	9	50.0%	3	30.0%	15	38.5%	86	34.0%
Proficient	81	47.9%	9	52.9%	7	38.9%	5	50.0%	18	46.2%	120	47.4%
Advanced	29	17.2%	8	47.1%	2	11.1%	2	20.0%	6	15.4%	47	18.6%

Figure 2.68: Grade 6 Standards of Learning – Mean Scores (LEP Students)

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
US History I	204	431.2	19	473.2	21	418.3	12	481.5	48	431.4	304	434.9
Math 6	188	435.1	13	443.5	20	431.8	11	441.9	45	414.9	277	432.3
Math 7	17	498.8	--	--	--	--	--	--	--	--	30	503
Reading 6	207	417.6	19	443.2	21	395.9	12	428.8	50	396.6	309	414.8

Figure 2.69: Grade 6 Standards of Learning – Performance Levels (LEP Students)

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
US History I												
Fail	67	32.8%	3	15.8%	9	42.9%	2	16.7%	18	37.5%	99	32.6%
Proficient	107	52.5%	10	52.6%	10	47.6%	5	41.7%	20	41.7%	152	50.0%
Advanced	30	14.7%	6	31.6%	2	9.5%	5	41.7%	10	20.8%	53	17.4%
Math 6												
Fail	40	21.3%	3	23.1%	2	10.0%	3	27.3%	9	20.0%	57	20.6%
Proficient	134	71.3%	9	69.2%	18	90.0%	7	63.6%	31	68.9%	199	71.8%
Advanced	14	7.4%	1	7.7%	0	0	1	9.1%	5	11.1%	21	7.6%

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
Math 7												
Fail	0	0	--	--	--	--	--	--	--	--	0	0
Proficient	11	64.7%	--	--	--	--	--	--	--	--	16	53.3%
Advanced	6	35.3%	--	--	--	--	--	--	--	--	14	46.7%
Reading 6												
Fail	73	35.3%	6	31.6%	10	47.6%	4	33.3%	21	42.0%	114	36.9%
Proficient	121	58.5%	9	47.4%	11	52.4%	7	58.3%	25	50.0%	173	56.0%
Advanced	13	6.3%	4	21.1%	0	0	1	8.3%	4	8.0%	22	7.1%

Figure 2.70: Grade 7 Standards of Learning – Mean Scores (LEP Students)

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Math 7	132	409.1	--	--	18	421.4	--	--	35	376.7	200	403.3
Math 8	51	461.8	--	--	--	--	--	--	12	436.7	74	459.4
Algebra I	15	477.9	--	--	--	--	--	--	--	--	26	484.1
Reading 7	198	421.8	19	447.3	20	409.9	11	432.2	52	420.5	300	422.8

Figure 2.71: Grade 7 Standards of Learning – Performance Levels (LEP Students)

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
Math 7												
Fail	36	27.3%	--	--	4	22.2%	--	--	16	45.7%	65	32.5%
Proficient	90	68.2%	--	--	14	77.8%	--	--	16	45.7%	126	63.0%
Advanced	6	4.5%	--	--	0	0	--	--	3	8.6%	9	4.5%
Math 8												
Fail	1	2.0%	--	--	--	--	--	--	--	--	2	2.7%
Proficient	41	80.4%	--	--	--	--	--	--	--	--	58	78.4%
Advanced	9	17.6%	--	--	--	--	--	--	--	--	14	18.9%
Algebra I												
Fail	0	0	--	--	--	--	--	--	--	--	0	0
Proficient	11	73.3%	--	--	--	--	--	--	--	--	19	73.1%
Advanced	4	26.7%	--	--	--	--	--	--	--	--	7	26.9%
Reading 7												
Fail	47	23.7%	4	21.1%	8	40.0%	2	18.2%	11	21.2%	72	24.0%
Proficient	142	71.7%	11	57.9%	12	60.0%	8	72.7%	31	59.6%	204	68.0%
Advanced	9	4.5%	4	21.1%	0	0	1	9.1%	10	19.2%	24	8.0%

Figure 2.72: Grade 8 Standards of Learning – Mean Scores (LEP Students)

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
World Geography	187	429.3	17	458.1	21	421.5	11	427.9	46	428	282	430.1
Math 8	32	393	--	--	--	--	--	--	14	410.9	57	400.5
Algebra I	138	430.8	10	442.2	15	418.9	--	--	28	430.6	198	430.2
Geometry	16	475.3	--	--	--	--	--	--	--	--	26	484.8
Reading 8	187	418	17	444.8	21	403.9	11	423.1	46	415.1	282	418.3
Science 8	187	424.7	17	455.9	21	425.9	11	435.6	46	431.2	282	428.1
Writing 8	178	430	17	474.2	19	411.3	11	422.4	44	429.7	269	431.1

Figure 2.73: Grade 8 Standards of Learning – Performance Levels (LEP Students)

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
World Geography												
Fail	36	19.3%	1	5.9%	4	19.0%	3	27.3%	10	21.7%	54	19.1%
Proficient	144	77.0%	13	76.5%	17	81.0%	8	72.7%	34	73.9%	216	76.6%
Advanced	7	3.7%	3	17.6%	0	0	0	0	2	4.3%	12	4.3%
Math 8												
Fail	14	43.8%	--	--	--	--	--	--	4	28.6%	21	36.8%
Proficient	18	56.3%	--	--	--	--	--	--	10	71.4%	36	63.2%
Advanced	0	0	--	--	--	--	--	--	0	0	0	0
Algebra I												
Fail	24	17.4%	2	20.0%	2	13.3%	--	--	4	14.3%	33	16.7%
Proficient	105	76.1%	8	80.0%	13	86.7%	--	--	23	82.1%	155	78.3%
Advanced	9	6.5%	0	0	0	0	--	--	1	3.6%	10	5.1%
Geometry												
Fail	0	0	--	--	--	--	--	--	--	--	0	0
Proficient	11	68.8%	--	--	--	--	--	--	--	--	15	57.7%
Advanced	5	31.3%	--	--	--	--	--	--	--	--	11	42.3%
Reading 8												
Fail	58	31.0%	3	17.6%	8	38.1%	4	36.4%	14	30.4%	87	30.9%
Proficient	115	61.5%	13	76.5%	13	61.9%	7	63.6%	28	60.9%	176	62.4%
Advanced	14	7.5%	1	5.9%	0	0	0	0	4	8.7%	19	6.7%
Science 8												
Fail	45	24.1%	0	0	5	23.8%	5	45.5%	12	26.1%	67	23.8%
Proficient	131	70.1%	16	94.1%	16	76.2%	4	36.4%	31	67.4%	198	70.2%
Advanced	11	5.9%	1	5.9%	0	0	2	18.2%	3	6.5%	17	6.0%

COURSE	APS PRE-K		PRIVATE PROVIDER		HEAD START		OTHER PRE-K		NO PRE-K		ENTIRE COHORT	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
Writing 8												
Fail	58	32.6%	3	17.6%	9	47.4%	4	36.4%	18	40.9%	92	34.2%
Proficient	94	52.8%	6	35.3%	9	47.4%	6	54.5%	20	45.5%	135	50.2%
Advanced	26	14.6%	8	47.1%	1	5.3%	1	9.1%	6	13.6%	42	15.6%

ADVANCED MATH CREDITS

Similar to the economically disadvantaged subgroup, LEP participants take more advanced math classes than their peers by Grade 8. In Grade 8, roughly 82 percent of APS preschool program participants take at least one advanced math class, while only 72 percent of Head Start and 67 percent of No Pre-K students do. Students in private Pre-K programs are still more likely to take advanced math courses, though the gap narrows by Grade 8.

Figure 2.74: Advanced Math Course Enrollment (LEP Students)

GROUP	GRADE 6		GRADE 7		GRADE 8	
	N	Pct	N	Pct	N	Pct
APS Pre-K	17	7.9%	66	31.6%	154	81.9%
Private Provider	6	31.6%	11	57.9%	15	88.2%
Head Start	1	4.5%	2	9.5%	15	71.4%
Other Pre-K	1	6.7%	5	35.7%	8	72.7%
No Pre-K	5	8.8%	17	28.8%	32	66.7%
Entire Cohort	30	9.1%	101	31.4%	224	78.6%

GRADE POINT AVERAGE

APS Pre-K participants consistently earn higher GPA than students in Head Start and students without Pre-K experience, but they are outperformed by their peers in privately provided and “Other” Pre-K programs.

Figure 2.75: Mean GPA Values by Program Status and Grade (LEP Students)

GROUP	GRADE 6		GRADE 7		GRADE 8	
	N	Mean	N	Mean	N	Mean
APS Pre-K	216	3.142	208	3.081	188	3.048
Private Provider	19	3.216	19	3.18	17	3.352
Head Start	22	3.116	21	3.02	21	2.962
Other Pre-K	15	3.297	14	3.24	11	3.068
No Pre-K	57	3.104	59	3.006	48	3.066
Entire Cohort	329	3.145	321	3.076	285	3.064

IAT REFERRALS

Among LEP students, the number of observations is too low to be able to compare the two groups in terms of IAT referrals.

Figure 2.76: IAT Referrals (LEP Students)

GROUP	ACADEMIC IAT REFERRAL		BEHAVIOR IAT REFERRAL		BEHAVIOR AND ACADEMIC IAT REFERRAL		NEW IAT REFERRAL		REVISIT IAT REFERRAL		TOTAL IAT REFERRAL	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
Grade 4												
APS Pre-K	6	60.0%	1	10.0%	3	30.0%	9	90.0%	2	20.0%	10	100.0%
Private Provider	0	0.0%	0	0.0%	1	100.0%	1	100.0%	0	0.0%	1	100.0%
Head Start	2	100.0%	0	0.0%	1	50.0%	2	100.0%	1	50.0%	2	100.0%
Other Pre-K	1	100.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%	1	100.0%
No Pre-K	3	50.0%	0	0.0%	2	33.3%	6	100.0%	1	16.7%	6	100.0%
Entire Cohort	12	60.0%	1	5.0%	7	35.0%	18	90.0%	5	25.0%	20	100.0%
Grade 5												
APS Pre-K	4	66.7%	1	16.7%	1	16.7%	6	100.0%	1	16.7%	6	100.0%
Private Provider	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Head Start	2	100.0%	0	0.0%	0	0.0%	2	100.0%	0	0.0%	2	100.0%
Other Pre-K	1	100.0%	0	0.0%	0	0.0%	1	100.0%	0	0.0%	1	100.0%
No Pre-K	1	50.0%	1	50.0%	0	0.0%	2	100.0%	1	50.0%	2	100.0%
Entire Cohort	8	72.7%	2	18.2%	1	9.1%	11	100.0%	2	18.2%	11	100.0%
Grade 6												
APS Pre-K	4	50.0%	0	0.0%	2	25.0%	8	100.0%	1	12.5%	8	100.0%
Private Provider	0	0.0%	0	0.0%	1	100.0%	1	100.0%	0	0.0%	1	100.0%
Head Start	1	100.0%	0	0.0%	0	0.0%	1	100.0%	0	0.0%	1	100.0%
Other Pre-K	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
No Pre-K	1	100.0%	0	0.0%	0	0.0%	1	100.0%	1	100.0%	1	100.0%
Entire Cohort	6	54.5%	0	0.0%	3	27.3%	11	100.0%	2	18.2%	11	100.0%

ATTENDANCE

Trends in attendance rates by Pre-K program type are not particularly consistent, with no group displaying a consistent advantage in attendance over the full range of grade levels. APS Pre-K participants do not have either the highest or the lowest attendance rate in any grade level among LEP students.

Figure 2.77: Attendance Across Grades and Program Status (LEP Students)

GROUP	GRADE 1		GRADE 2		GRADE 3		GRADE 4		GRADE 5		GRADE 6		GRADE 7		GRADE 8	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
APS Pre-K	287	92.96	261	93.87	248	94.41	232	95.09	230	94.9	216	97.48	209	96.84	188	97.36
Private Provider	28	91.88	22	91.31	23	92.59	19	95.07	19	93.73	19	97.79	19	97.75	17	97.52
Head Start	33	92.24	30	94.34	27	94.58	25	95.74	22	95.42	22	97.05	21	96.27	21	95.79
Other Pre-K	22	93.04	16	95.38	14	94.09	13	95	14	95.74	15	97.97	14	98.11	11	95.53
No Pre-K	89	92.12	77	94.24	72	94.44	69	94.1	64	95.9	57	97.02	59	96.62	48	97.17
Entire Cohort	459	92.68	406	93.9	384	94.3	358	94.94	349	95.09	329	97.41	322	96.87	285	97.15

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Pre-K Social-Emotional Outcomes

In a typical school year, VPI and special education Pre-K teachers record social-emotional indicators for each student twice annually on the Pre-K progress report to share with parents at the spring and end-of-year conferences. The progress report includes other academic indicators as well. For purposes of this evaluation, the Office of Planning and Evaluation collected this data centrally from all teachers, including Montessori, and added an additional data collection period in the fall so that baseline data would be available for all students.

The five social-emotional areas are:

- **Self-Concept:** The child will demonstrate self-confidence and self-reflection.
- **Self-Control:** The child will show self-direction and responsibility.
- **Approach to Learning:** The child will show eagerness and persistence as a learner.
- **Interactions with Others:** The child will interact easily with other children and with familiar adults.
- **Social Problem Solving:** The child will use non-physical ways to resolve conflict.

Teachers assessed their students on each area using the following rubric:

- **Meeting:** Child consistently meets behavior or skill. Student independently demonstrates an understanding of the key concepts and skills.
- **Progressing:** Child is in the process of developing a behavior or skill. Student demonstrates or applies key skills, strategies, or concepts inconsistently. Student partially meets the standard.
- **Not Yet:** Child is not yet demonstrating behavior or skill.

Table 1: 2015-16 VPI Social-Emotional Indicators

Area	Fall			Winter			Spring		
	n		%	n		%	n		%
Self-Concept	505	Meeting	17.8%	498	Meeting	35.9%	481	Meeting	72.1%
		Progressing	69.9%		Progressing	60.2%		Progressing	0.0%
		Not Yet	12.3%		Not Yet	3.8%		Not Yet	27.8%
Self-Control	505	Meeting	16.8%	498	Meeting	34.3%	496	Meeting	66.3%
		Progressing	63.2%		Progressing	60.4%		Progressing	31.3%
		Not Yet	20.0%		Not Yet	5.2%		Not Yet	2.4%
Approach to Learning	506	Meeting	20.8%	498	Meeting	43.2%	496	Meeting	75.6%
		Progressing	71.3%		Progressing	54.4%		Progressing	23.4%
		Not yet	7.9%		Not yet	2.4%		Not yet	1.0%
Interactions with others	505	Meeting	18.4%	498	Meeting	38.4%	497	Meeting	73.0%
		Progressing	70.5%		Progressing	59.2%		Progressing	25.6%
		Not Yet	11.1%		Not Yet	2.4%		Not Yet	1.4%
Social Problem Solving	506	Meeting	15.0%	498	Meeting	29.7%	497	Meeting	67.8%
		Progressing	64.8%		Progressing	65.3%		Progressing	30.2%
		Not Yet	20.2%		Not Yet	5.0%		Not Yet	2.0%

Table 2: 2015-16 Montessori Social-Emotional Indicators

Area	Fall			Winter			Spring		
	n		%	n		%	n		%
Self-Concept	144	Meeting	19.4%	132	Meeting	40.2%	129	Meeting	61.2%
		Progressing	71.5%		Progressing	58.3%		Progressing	38.8%
		Not Yet	9.0%		Not Yet	1.5%		Not Yet	0.0%
Self-Control	144	Meeting	22.2%	131	Meeting	38.9%	136	Meeting	52.9%
		Progressing	68.8%		Progressing	58.8%		Progressing	46.3%
		Not Yet	9.0%		Not Yet	2.3%		Not Yet	0.7%
Approach to Learning	144	Meeting	20.1%	131	Meeting	40.5%	135	Meeting	59.3%
		Progressing	72.9%		Progressing	57.3%		Progressing	40.0%
		Not yet	6.9%		Not yet	2.3%		Not yet	0.7%
Interactions with others	134	Meeting	23.1%	131	Meeting	53.4%	135	Meeting	57.8%
		Progressing	70.9%		Progressing	45.8%		Progressing	42.2%
		Not Yet	6.0%		Not Yet	0.8%		Not Yet	0.0%
Social Problem Solving	134	Meeting	29.9%	131	Meeting	42.7%	135	Meeting	51.1%
		Progressing	59.7%		Progressing	54.2%		Progressing	47.4%
		Not Yet	10.4%		Not Yet	3.1%		Not Yet	1.5%

Table 3: 2015-16 Special Education Social- Emotional Indicators

Area	Fall			Winter			Spring		
	n		%	n		%	n		%
Self-Concept	77	Meeting	27.3%	84	Meeting	36.9%	85	Meeting	47.1%
		Progressing	61.0%		Progressing	57.1%		Progressing	49.4%
		Not Yet	11.7%		Not Yet	6.0%		Not Yet	3.5%
Self-Control	77	Meeting	19.5%	84	Meeting	35.7%	85	Meeting	47.1%
		Progressing	67.5%		Progressing	52.4%		Progressing	45.9%
		Not Yet	13.0%		Not Yet	11.9%		Not Yet	7.1%
Approach to Learning	77	Meeting	26.0%	84	Meeting	46.4%	85	Meeting	56.5%
		Progressing	67.5%		Progressing	50.0%		Progressing	40.0%
		Not yet	6.5%		Not yet	3.6%		Not yet	3.5%
Interactions with others	77	Meeting	20.8%	84	Meeting	38.1%	85	Meeting	50.6%
		Progressing	68.8%		Progressing	54.8%		Progressing	45.9%
		Not Yet	10.4%		Not Yet	7.1%		Not Yet	3.5%
Social Problem Solving	77	Meeting	16.9%	84	Meeting	34.5%	85	Meeting	44.7%
		Progressing	62.3%		Progressing	50.0%		Progressing	47.1%
		Not Yet	20.8%		Not Yet	15.5%		Not Yet	8.2%