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A Comparative Study of Student Achievement Between Four-Day School Week and Five-day School Week in Montana

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Abstract

The ability for school districts in Montana to move to a four-day school week (4dsw) schedule began following the 2005 legislative session when the annual attendance requirement was changed from 180 days to 1080 hours. While movement to the four-day week was slow at first, since that time, as of 2023, 141 school districts in Montana were utilizing the 4dsw schedule. This comprehensive study of student achievement in the 4dsw schedule as compared to the five-day school week (5dsw) schedule involved a census of all Montana student achievement data from 2008-2023. The results indicated that student achievement suffered in the 4dsw schedule.

Keywords: student achievement; four-day school week (4dsw)

1. Introduction

In 2005, the legislature in the state of Montana passed Senate Bill 170. This bill changed attendance requirements from the traditional 180 pupil instruction day school year, to instead requiring 1,080 minimum aggregate hours of pupil instruction per year (Montana Code Annotated, 20-1-301). This change allowed schools to explore alternative schedules, leading to ten Montana school districts transitioning to a four-day school week (4dsw) schedule by the conclusion of the 2006-2007 school year according to the Montana Office of Public Instruction (OPI). As of the 2022-2023 school year, a total of 152 Montana school districts, comprising 260 individual schools, have adopted a four-day school week schedule (OPI, 2024).

Every student deserves access to a high-quality education (U.S. Department of Education, 2021). Article X of the Montana Constitution states, “It is the goal of the people to establish a system of education which will develop the full educational potential of each person” (Montana Constitution). According to Sultana et al. (2009), quality in education is multidimensional and typically comprises student well-being, the quality of the curriculum, teacher quality, teaching methods, governance, and financing. Furthermore, according to Sack-Min (2018), successful schools design and carry out programs that provide students with a rich educational experience focused on the total child.

However, despite the growing number of schools seeking innovation through a 4dsw schedule, there remains a lack of analysis on multiple indicators of educational quality between school districts that have maintained a 5dsw schedule and those that have adopted the 4dsw schedule (Anderson & Walker, 2015; Heyward, 2018; Morton, 2021; Morton, et al., 2023; Thompson & Ward, 2022). According to an early study comparing academic achievement in Montana schools that had adopted a 4dsw schedule compared to achievement in schools that maintained the 5dsw schedule, there was a disparity in academic achievement (Tharp, 2014). Tharp (2014) found that in the first two years of implementation, student achievement scores in school districts utilizing the 4dsw schedule were better than the state average achievement scores. However, once the 4dsw schedule became part of the culture, the loss of the days of instruction appeared to negatively affect student performance (Tharp et al., 2016).

Consequently, some policymakers question whether the 4dsw schedule provides the same level of educational quality as a 5dsw schedule (Irving, 2023). As districts continue to implement the 4dsw schedule, policymakers need to understand the implications for educational quality between a 5dsw schedule and a 4dsw schedule (Hayward, 2018). Policy decisions regarding school scheduling need to be based on empirical evidence for each of the quality indicators of an effective education.

Research Question

Is there a difference in academic achievement by grade-level and sub-groups between schools operating on a four-day school week schedule and those operating on a five-day school week schedule?

Data Collected

Individual student achievement data from 2008 to 2023 for every student in every school district in the State of Montana was provided by OPI. These data were contained in three separate files: The first file ranging from 2008 to 2013, the second from 2016 to 2021, the final file ranging from 2022 to 2023. The first file included Montana Comprehensive Assessment (MontCas) scores for all students. The remaining files included Smarter Balance Assessment Consortium (SBAC) scores for all students in grades 3-8 and American College testing (ACT) scores for grade 11 students.

Limitations

- Two different assessments were utilized during the years analyzed in this research (MontCas & SBAC).
- Assessments were not taken by students during 2020 due to the COVID-19 pandemic.
- ACT scores were not collected as a state-wide assessment for high school prior to 2016.

Variables

The variables in this study were the school week schedule used in each school district (4dsw & 5dsw) and student achievement (MontCas, SBAC & ACT).

Data Analysis

Part 1 (MontCas and SBAC Assessments) – Data analysis began by creating a chart with every school district in the state and each year in the study. A block was then created for each grade level, starting with third grade. For each grade level and each school district and each year, the number for novice, nearing proficient, proficient, and advanced students were counted. The number of students for each grade level, for each school district, for each year was totaled. Each school district, for each year, was identified as being in a school district that utilized a 5dsw schedule or school districts that utilized a 4dsw schedule. Then, for each grade level the number of students in school districts that utilized the 4dsw schedule who were novice were totaled, the number nearing proficiency, the number proficient, and the number advanced were totaled. The same process was then followed for the school districts utilizing the 5dsw schedule. The total number of students who were proficient and advanced were then added together and the sum was divided by the total number of students in each category, yielding the percentage of students who were proficient or advanced in school districts utilizing the 4dsw schedule and students in school districts utilizing the 5dsw schedule in each grade level.

Part 2 (Cohorts Groups) – Data were organized by cohorts. A cohort is a group of school districts who began utilizing the 4dsw schedule in the same year. OPI provided a list of school districts who were utilizing the 4dsw schedule for each year. A chart was then developed to identify cohort groups of school districts to gauge their combined achievement over the period of time they were utilizing the 4dsw schedule. The percentage of students who were proficient or advanced was then calculated for each year and for each cohort.

Part 3 (ACT Data) – Assessment data at the High School level is limited to the ACT Assessment taken in the eleventh grade. For each high school, and each year, the average English, Math, Reading, Science, and Composite ACT score was calculated using a data extraction formula. The Composite ACT score is a unique score calculated by ACT and not a sum or average of the subject scores. The Composite score was calculated by ACT by adding up the English, Math, Reading, and Science scores and dividing them by 4. These average scores were compared for students in school districts utilizing the 4dsw schedule with the students in school districts utilizing the 5dsw. These data were validated by extracting individual Composite scores for each student in ten high schools. The mean was then calculated and compared with the mean in the formula driven approach.

It was determined for each school district and for each year how many years students experienced a 4dsw schedule. To explore the relationship between length of time in a 4dsw schedule and student achievement, a correlation was run between the number of years in a 4dsw schedule and student's ACT scores.

Results

Part 1 - For the years 2008-2023, students in school districts utilizing the 4dsw schedule demonstrated a lower percentage of proficiency in the state-wide assessments than school districts utilizing the 5dsw schedule. This analysis included the state-wide MontCas (2008-2013) and SBAC (2016-2023, excluding 2020) summative assessments in the areas of Reading and Math for grades 3-8. Additionally, ACT scores were examined for the years (2016-2023, excluding 2020) for grade 11. The analysis of student achievement by grade level demonstrated that students in school districts

utilizing the 4dsw schedule had a lower percentage of proficiency in grades 3-8.

Reading and Math Achievement – MontCas

Examining Reading and Math proficiency percentage data revealed that students in school districts utilizing the 5dsw schedule had a higher rate of proficiency in every grade in both the MontCas and SBAC assessments than students in school districts utilizing the 4dsw schedule.

Combined MontCas and SBAC Reading assessment scores for the years 2008 to 2023 showed that students in school districts utilizing the 5dsw schedule had a higher rate of proficiency, in every grade, than students in school districts utilizing the 4dsw schedule. By grade level, the disparity in the rate of proficiency ranged from 14.03% (801 students) to 15.85% (861 students). This proficiency disparity in each grade was evident in both the MontCas and SBAC assessments. (See Figure 1)

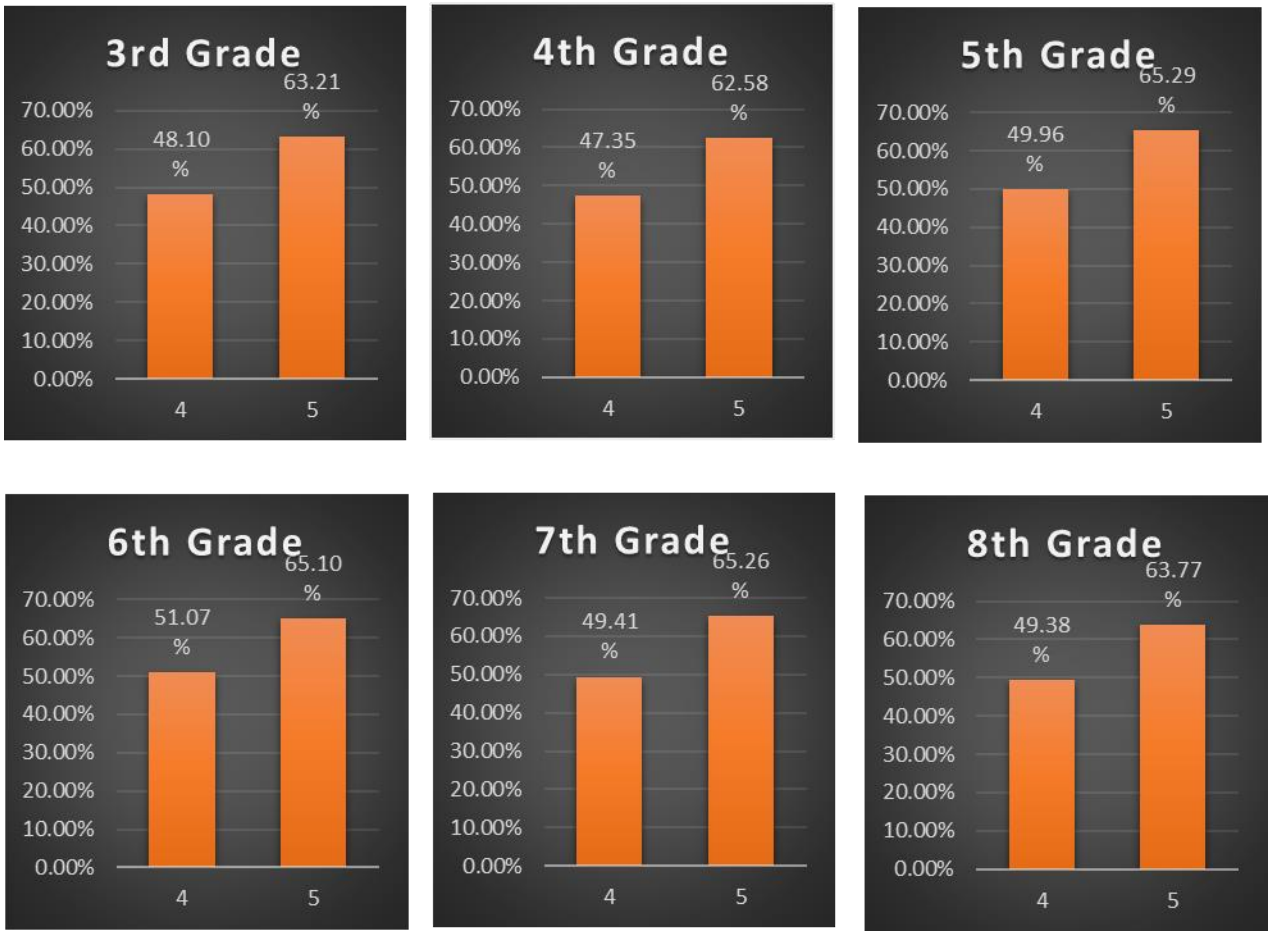


Figure 1. Combined MontCas and SBAC Achievement Data: Percentage Proficient and Advanced in Reading by Grade Level Comparing the School Districts Utilizing the 4dsw Schedule and School Districts Utilizing the 5dsw Schedule

Combined MontCas and SBAC Math assessment scores for the years 2008 to 2023 showed that students in school districts utilizing the 5dsw schedule had a higher rate of proficiency, in every grade, than students in school districts utilizing the 4dsw schedule. By grade level, the disparity in the rate of proficiency ranged from 11.65% (648 students) to 16.21% (939 students). This proficiency disparity in each grade was evident in both the MontCas and SBAC assessments. (See Figure 2)

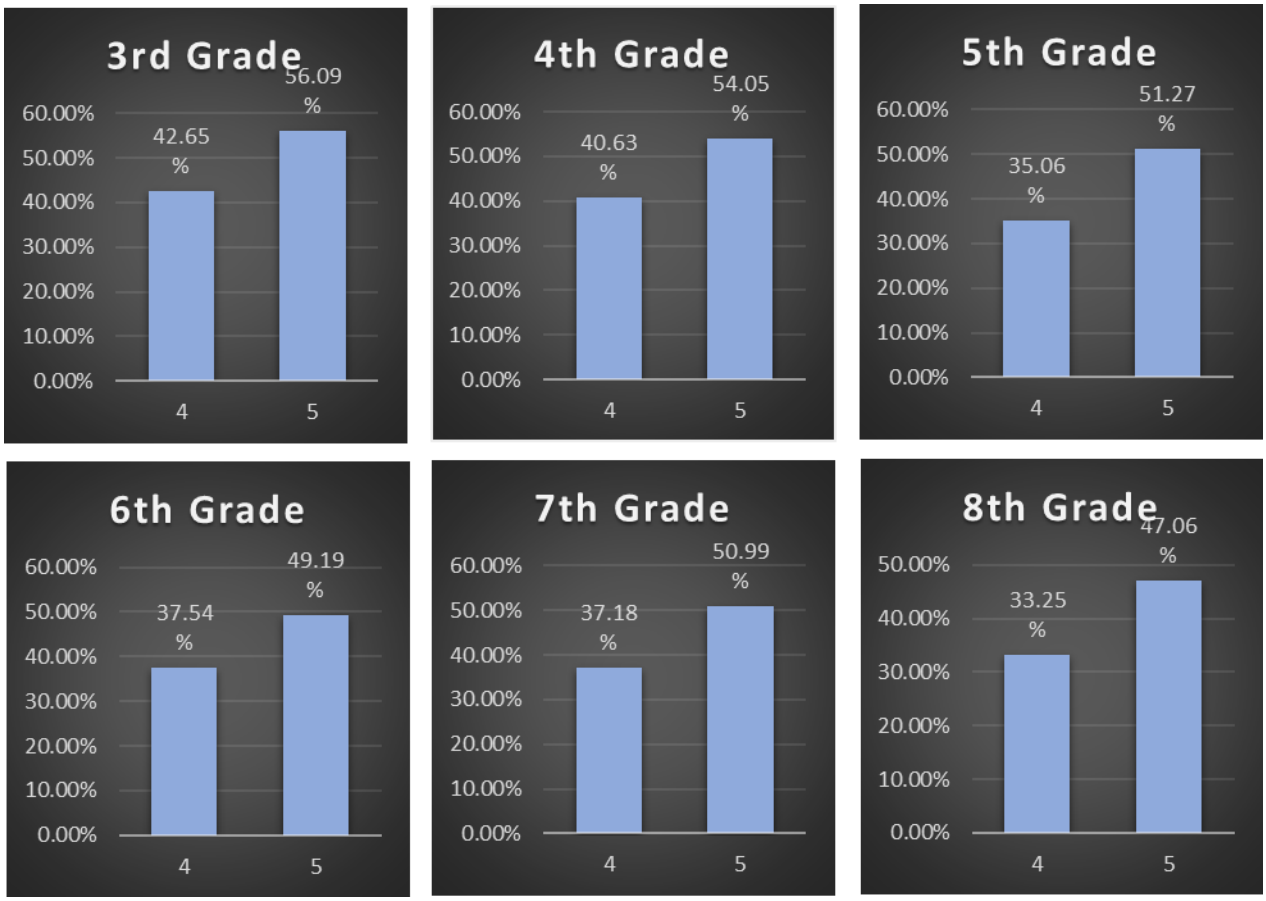


Figure 2. Combined MontCas and SBAC Achievement Data: Percentage Proficient and Advanced in Math by Grade Level Comparing School Districts Utilizing the 4dsw Schedule and School Districts Utilizing the 5dsw Schedule

Reading and Math by Year and Grade

For each year 2008 to 2023, students in school districts utilizing the 5dsw schedule had a higher rate of proficiency in Reading than students in school districts utilizing the 4dsw schedule (range of disparity: 1.21% - 8.86%) (See Appendix B). Further analyses by grade level showed that out of the 78 possible combinations of year and grade level there were five instances where students in districts utilizing the 4dsw schedule had a higher rate of Reading proficiency than those in districts utilizing the 5dsw schedule (range of disparity: 0.14% - 5.33%). In the 73 combinations in which districts utilizing the 5dsw schedule had a higher rate of Reading proficiency than those in districts utilizing the 4dsw schedule, the range of disparity was 0.12% - 12.36%. (See Figure 3)

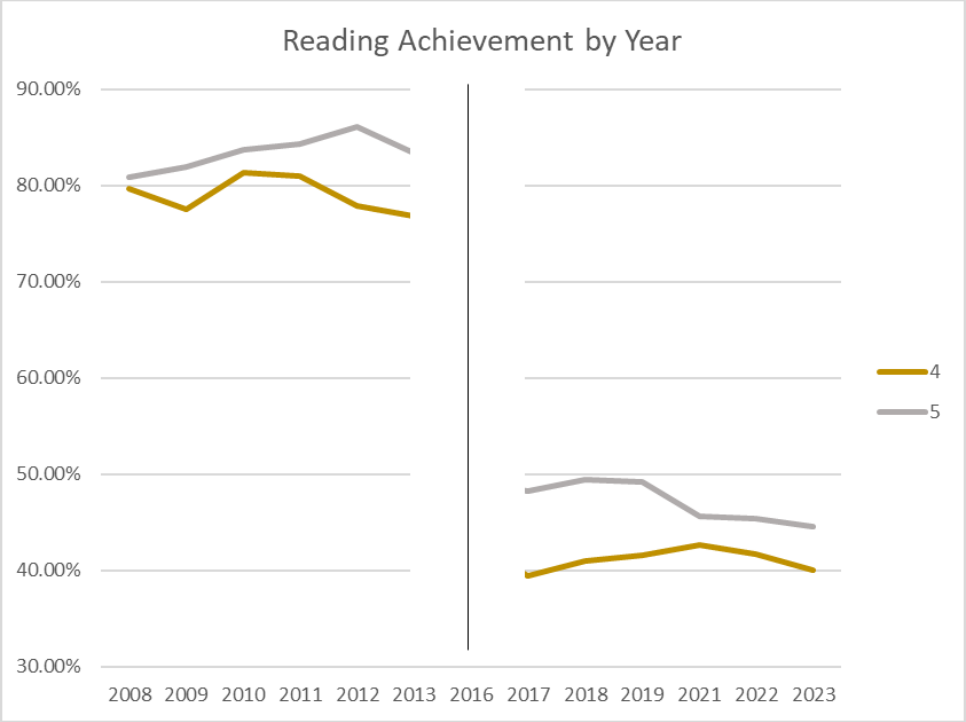


Figure 3. Reading Achievement by Year

Note. The gold line denotes the 4dsw and the grey line denotes the 5dsw. In the years 2014-2015, no data were collected because of the transition from the MontCas to the SBAC assessment. In 2020, student achievement was not assessed due to the COVID-19 pandemic.

Reading Achievement by Year and Grade (Figure 4)

Student Reading achievement in school districts utilizing the 4dsw schedule and school districts utilizing the 5dsw schedule was compared based on year and grade. Out of seventy-eight combinations of year and grade, the performance in the 4dsw exceeded that of the 5dsw in five instances. Figure 4 was developed to analyze these differences. The red highlighted cells indicate instances where the school districts utilizing the 4dsw schedule underperformed the school districts utilizing the 5dsw schedule in Reading.

		3rd Grade					4th Grade					5th Grade	
2008	4	78.46%	-4.36%		2008	4	78.18%	0.56%		2008	4	77.61%	-2.74%
2008	5	82.82%			2008	5	77.63%			2008	5	80.35%	
2009	4	79.76%	-3.65%		2009	4	70.53%	-9.74%		2009	4	82.05%	-0.81%
2009	5	83.41%			2009	5	80.27%			2009	5	82.86%	
2010	4	83.87%	0.14%		2010	4	76.19%	-5.90%		2010	4	84.43%	-0.89%
2010	5	83.73%			2010	5	82.09%			2010	5	85.32%	
2011	4	81.48%	-2.71%		2011	4	82.82%	1.08%		2011	4	85.09%	-0.88%
2011	5	84.19%			2011	5	81.75%			2011	5	85.98%	
2012	4	78.60%	-4.55%		2012	4	72.49%	-11.57%		2012	4	79.64%	-7.22%
2012	5	83.14%			2012	5	84.06%			2012	5	86.86%	
2013	4	75.25%	-8.87%		2013	4	78.81%	-2.78%		2013	4	77.91%	-6.63%
2013	5	84.12%			2013	5	81.58%			2013	5	84.54%	
2016	4	38.86%	-8.55%		2016	4	39.04%	-9.22%		2016	4	46.04%	-1.98%
2016	5	47.41%			2016	5	48.26%			2016	5	48.02%	
2017	4	40.61%	-5.30%		2017	4	37.59%	-8.46%		2017	4	37.84%	-12.36%
2017	5	45.90%			2017	5	46.04%			2017	5	50.21%	
2018	4	41.48%	-6.43%		2018	4	37.00%	-11.16%		2018	4	42.33%	-9.97%
2018	5	47.90%			2018	5	48.16%			2018	5	52.31%	
2019	4	41.77%	-5.57%		2019	4	40.97%	-5.38%		2019	4	42.99%	-9.81%
2019	5	47.34%			2019	5	46.36%			2019	5	52.80%	
2021	4	39.32%	-3.77%		2021	4	41.73%	-3.74%		2021	4	41.36%	-5.25%
2021	5	43.09%			2021	5	45.47%			2021	5	46.61%	
2022	4	39.24%	-4.32%		2022	4	38.11%	-7.49%		2022	4	42.77%	-4.02%
2022	5	43.56%			2022	5	45.60%			2022	5	46.79%	
2023	4	38.80%	-3.99%		2023	4	40.29%	-5.68%		2023	4	39.36%	-5.43%
2023	5	42.79%			2023	5	45.97%			2023	5	44.79%	
		6th Grade					7th Grade					8th Grade	
2008	4	81.54%	-0.99%		2008	4	87.04%	5.33%		2008	4	76.62%	-3.43%
2008	5	82.53%			2008	5	81.71%			2008	5	80.06%	
2009	4	73.81%	-9.65%		2009	4	84.62%	2.64%		2009	4	75.95%	-3.84%
2009	5	83.46%			2009	5	81.97%			2009	5	79.79%	
2010	4	83.10%	-2.08%		2010	4	79.02%	-3.78%		2010	4	80.65%	-2.42%
2010	5	85.18%			2010	5	82.80%			2010	5	83.06%	
2011	4	84.38%	-1.87%		2011	4	72.61%	-11.91%		2011	4	79.31%	-3.67%
2011	5	86.25%			2011	5	84.52%			2011	5	82.99%	
2012	4	80.41%	-7.57%		2012	4	80.88%	-7.44%		2012	4	74.90%	-11.14%
2012	5	87.98%			2012	5	88.32%			2012	5	86.04%	
2013	4	79.59%	-5.33%		2013	4	73.78%	-8.66%		2013	4	75.37%	-7.09%
2013	5	84.91%			2013	5	82.44%			2013	5	82.45%	
2016	4	46.07%	-4.82%		2016	4	41.94%	-9.61%		2016	4	46.67%	-3.34%
2016	5	50.89%			2016	5	51.55%			2016	5	50.00%	
2017	4	43.80%	-3.83%		2017	4	40.54%	-11.87%		2017	4	36.19%	-11.27%
2017	5	47.64%			2017	5	52.41%			2017	5	47.47%	
2018	4	40.38%	-9.67%		2018	4	43.32%	-7.11%		2018	4	41.68%	-6.34%
2018	5	50.05%			2018	5	50.43%			2018	5	48.02%	
2019	4	45.57%	-4.64%		2019	4	40.31%	-10.99%		2019	4	37.34%	-9.46%
2019	5	50.20%			2019	5	51.30%			2019	5	46.81%	
2021	4	44.98%	-0.12%		2021	4	44.07%	-2.16%		2021	4	43.86%	-3.39%
2021	5	45.10%			2021	5	46.23%			2021	5	47.25%	
2022	4	42.84%	-2.16%		2022	4	44.99%	-1.84%		2022	4	42.05%	-2.69%
2022	5	44.99%			2022	5	46.83%			2022	5	44.74%	
2023	4	41.26%	-3.33%		2023	4	36.78%	-7.43%		2023	4	43.02%	-1.68%
2023	5	44.60%			2023	5	44.21%			2023	5	44.70%	

Figure 4. Reading Achievement by Year and Grade

Note. The red highlighted cells indicate instances where school districts utilizing the 4dsw schedule underperformed the school districts utilizing the 5dsw schedule in Reading.

For each year 2008 to 2023, students in school districts utilizing the 5dsw schedule had a higher rate of proficiency in Math than students in school districts utilizing the 4dsw schedule (range of disparity: 2.04% - 14.03%). Further analyses by grade level showed that out of the 78 possible combinations of year and grade level, there were nine instances where students in districts utilizing the 4dsw schedule had a higher rate of Math proficiency than those in districts utilizing the 5dsw schedule (range of disparity: 0.08% - 5.13%). In the 69 combinations in which districts utilizing the 5dsw schedule had a higher rate of Reading proficiency than those in districts utilizing the 4dsw schedule, the range of

disparity was 1.67% - 21.62%. (See Figure 5)

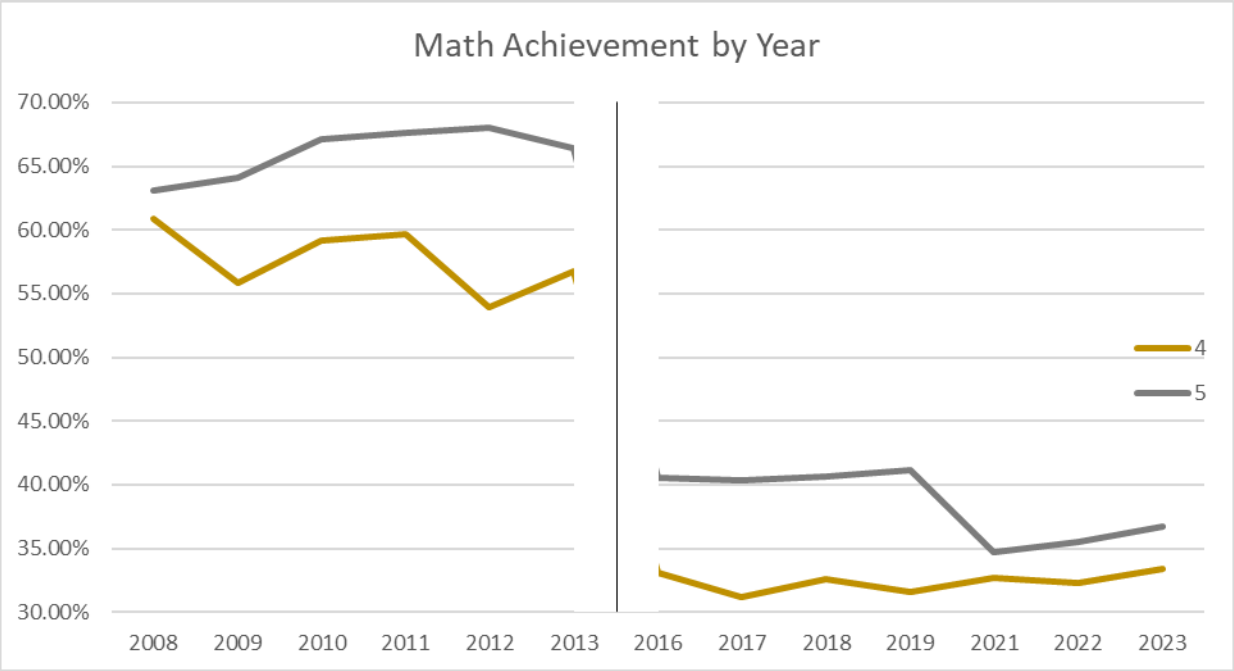


Figure 5. Math Achievement by Year in the School Districts Utilizing the 4dsw Schedule and School Districts Utilizing the 5dsw Schedule

Note. The gold line denotes school districts utilizing the 4dsw schedule and the grey line denotes school districts utilizing the 5dsw schedule. In the years 2014-2015, no data were collected because of the transition from the MontCas to the SBAC assessment. In 2020, student achievement was not assessed due to the COVID-19 pandemic.

Math Achievement by Year and Grade (See Figure 6)

Student Math achievement in the school districts utilizing the 4dsw schedule and the school districts utilizing the 5dsw schedule was compared based on student grade level and school year. Out of 78 combinations of grade and year, the performance in the school districts utilizing the 4dsw schedule exceeded that of school districts utilizing the 5dsw schedule in nine instances. Figure 6 was developed to analyze these differences. The red highlighted cells indicate instances where school districts utilizing the 4dsw schedule underperformed school districts utilizing the 5dsw schedule in Math.

		3rd Grade					4th Grade					5th Grade	
2008	4	49.23%	-12.86%		2008	4	69.09%	3.77%		2008	4	58.21%	-7.95%
2008	5	62.09%			2008	5	65.32%			2008	5	66.16%	
2009	4	45.24%	-20.82%		2009	4	56.84%	-8.95%		2009	4	48.72%	-17.09%
2009	5	66.06%			2009	5	65.79%			2009	5	65.80%	
2010	4	52.26%	-15.53%		2010	4	62.59%	-5.16%		2010	4	61.08%	-8.11%
2010	5	67.79%			2010	5	67.75%			2010	5	69.19%	
2011	4	61.11%	-7.69%		2011	4	61.35%	-7.48%		2011	4	62.73%	-7.96%
2011	5	68.80%			2011	5	68.83%			2011	5	70.69%	
2012	4	57.89%	-12.89%		2012	4	54.69%	-13.04%		2012	4	61.79%	-9.96%
2012	5	70.79%			2012	5	67.73%			2012	5	71.75%	
2013	4	55.05%	-13.66%		2013	4	60.91%	-5.59%		2013	4	59.04%	-10.27%
2013	5	68.71%			2013	5	66.49%			2013	5	69.31%	
2016	4	38.92%	-10.12%		2016	4	31.43%	-12.09%		2016	4	30.25%	-5.76%
2016	5	49.03%			2016	5	43.51%			2016	5	36.01%	
2017	4	38.75%	-7.85%		2017	4	33.04%	-10.68%		2017	4	23.68%	-15.56%
2017	5	46.61%			2017	5	43.73%			2017	5	39.24%	
2018	4	38.90%	-8.99%		2018	4	33.71%	-9.91%		2018	4	29.14%	-10.05%
2018	5	47.89%			2018	5	43.62%			2018	5	39.20%	
2019	4	36.90%	-10.91%		2019	4	35.15%	-9.48%		2019	4	28.75%	-10.96%
2019	5	47.80%			2019	5	44.64%			2019	5	39.72%	
2021	4	38.85%	-4.26%		2021	4	36.34%	-2.66%		2021	4	27.89%	-3.42%
2021	5	43.11%			2021	5	39.00%			2021	5	31.30%	
2022	4	38.48%	-5.69%		2022	4	35.79%	-5.44%		2022	4	30.50%	-2.52%
2022	5	44.17%			2022	5	41.23%			2022	5	33.02%	
2023	4	41.94%	-2.71%		2023	4	39.64%	-4.66%		2023	4	27.36%	-5.99%
2023	5	44.64%			2023	5	44.30%			2023	5	33.36%	
		6th Grade					7th Grade					8th Grade	
2008	4	63.08%	1.24%		2008	4	70.37%	5.13%		2008	4	58.44%	0.45%
2008	5	61.84%			2008	5	65.24%			2008	5	57.99%	
2009	4	52.38%	-10.95%		2009	4	69.23%	4.54%		2009	4	63.29%	4.26%
2009	5	63.34%			2009	5	64.69%			2009	5	59.03%	
2010	4	61.27%	-5.94%		2010	4	63.64%	-2.35%		2010	4	54.84%	-10.26%
2010	5	67.21%			2010	5	65.99%			2010	5	65.10%	
2011	4	58.13%	-7.05%		2011	4	57.32%	-10.70%		2011	4	57.24%	-6.89%
2011	5	65.18%			2011	5	68.02%			2011	5	64.14%	
2012	4	60.14%	-7.61%		2012	4	44.51%	-21.62%		2012	4	45.25%	-18.61%
2012	5	67.75%			2012	5	66.14%			2012	5	63.86%	
2013	4	54.82%	-8.79%		2013	4	60.56%	-7.95%		2013	4	50.11%	-11.77%
2013	5	63.61%			2013	5	68.50%			2013	5	61.88%	
2016	4	34.83%	-3.81%		2016	4	34.75%	-5.15%		2016	4	27.80%	-7.38%
2016	5	38.64%			2016	5	39.90%			2016	5	35.18%	
2017	4	33.82%	-3.25%		2017	4	32.30%	-7.15%		2017	4	25.26%	-10.00%
2017	5	37.07%			2017	5	39.45%			2017	5	35.26%	
2018	4	28.65%	-9.83%		2018	4	34.49%	-3.24%		2018	4	30.77%	-5.49%
2018	5	38.48%			2018	5	37.73%			2018	5	36.26%	
2019	4	32.52%	-5.52%		2019	4	29.01%	-11.80%		2019	4	26.62%	-8.91%
2019	5	38.04%			2019	5	40.82%			2019	5	35.54%	
2021	4	33.77%	3.50%		2021	4	30.17%	-3.64%		2021	4	27.59%	-3.09%
2021	5	30.27%			2021	5	33.81%			2021	5	30.68%	
2022	4	27.30%	-4.61%		2022	4	34.44%	0.08%		2022	4	26.69%	-3.02%
2022	5	31.90%			2022	5	34.35%			2022	5	29.71%	
2023	4	34.19%	1.17%		2023	4	26.75%	-7.49%		2023	4	29.65%	-1.67%
2023	5	33.03%			2023	5	34.24%			2023	5	31.32%	

Figure 6. Math Achievement by Year and Grade

Note. The red highlighted cells indicate instances where school districts utilizing the 4dsw schedule underperformed school districts utilizing the 5dsw schedule in Math.

Students Receiving Special Education Services

Data were organized to represent student achievement scores for students receiving Special Education services attending school districts utilizing the 5dsw schedule and students attending school districts utilizing the 4dsw schedule. Because of the large discrepancy in student numbers between students attending school districts utilizing the 5dsw and 4dsw schedules, caution must be used in interpreting these findings.

The data for students receiving Special Education services were analyzed by subject areas (Reading and Math) by MontCas, SBAC, and combined MontCas and SBAC achievement. For Reading, students in school districts utilizing the 5dsw schedule showed higher percentages of proficiency than students attending school districts utilizing the 4dsw schedule in five out of six grades as per MontCas scores, six out of six grades per SBAC scores, and six out of six grades per combined MontCas and SBAC scores. Examining student achievement in Math, students in school districts utilizing the 5dsw schedule showed higher percentages of proficiency than students attending school districts utilizing the 4dsw schedule in five out of six grades as per MontCas and SBAC scores, and six out of six grades per combined MontCas and SBAC Math scores.

Reading and Math Cohorts

Part 2 - Data were organized by cohorts. A cohort is a group of school districts who transitioned to utilizing the 4dsw schedule in the same year. There were 14 individual cohorts beginning 2008 and ending in 2022. In the years 2014-2015, no data were collected because of the transition from the MontCas to the SBAC assessment. In 2020, student achievement was not assessed due to the COVID-19 pandemic. There were no school districts starting the 4dsw schedule in 2014. In the 2018 school year, there was only one school district with too few students to report due to FERPA requirements. In the 2009 cohort, one of the school districts returned to the 5dsw schedule in 2017. The remaining school districts in this cohort did not have an adequate number of students to report in the years following 2017, due to FERPA requirements.

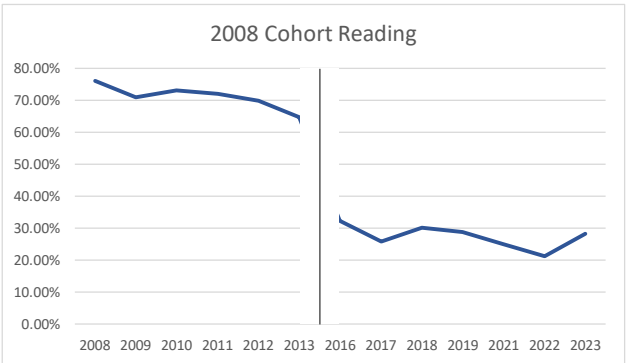
Five cohorts (cohort start years 2008, 2010, 2011, & 2012), comprised of 34 school districts which utilized the MontCas assessment, experienced a decrease in student Reading achievement. Only the 2009 cohort, comprised of six districts, demonstrated a Reading achievement gain. Nine cohorts (cohort start years 2010, 2012, 2013, 2015, 2016, 2019, 2020, 2021, & 2022), comprised of 93 school districts which utilized the SBAC assessment, experienced a decrease in student Reading achievement. Only the 2011 and 2017 cohorts, comprised of eight school districts, demonstrated Reading achievement gains. (See Figure 7)

Four cohorts (cohort start years 2008, 2011, 2012, & 2013), comprised of 47 school districts which utilized the MontCas assessment, experienced a decrease in student Math achievement. Only 2 cohorts (2009 & 2010), comprised of 19 districts, demonstrated a Math achievement gain. Eight cohorts (cohort start years 2008, 2010, 2015, 2016, 2017, 2019, 2020, & 2021), comprised of 69 school districts which utilized the SBAC assessment, experienced a decrease in student Math achievement. The 2011, 2012, 2013, & 2022 cohorts, comprised of 58 school districts, demonstrated Math achievement gains.

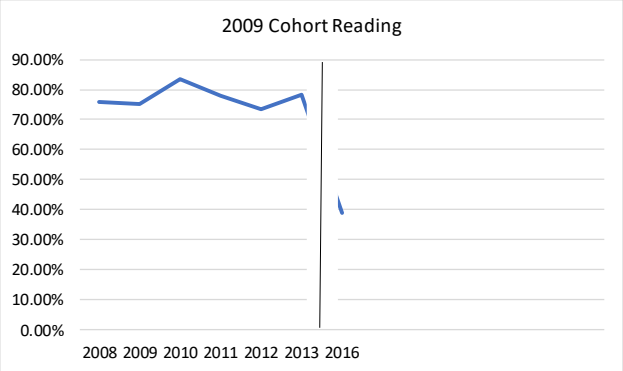
4dsw Cohort School District Reading Achievement

School districts were identified in cohorts based on the year they started utilizing the 4dsw schedule. Their achievement was tracked as a group from the year they entered the 4dsw schedule until 2023. School districts who did not continuously utilize the 4dsw schedule for the duration of the cohort were removed from the 4dsw data during the years they were utilizing the 5dsw schedule. Figure 7 represents fourteen cohorts from the years 2008 to 2022. The first cohort began in 2008.

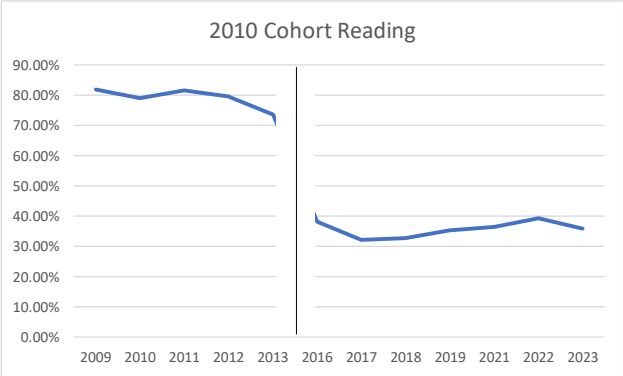
2008 Cohort	2008	2009	2010	2011	2012	2013	2016	2017	2018	2019	2021	2022	2023
7 Districts	76.10%	70.95%	73.08%	72.00%	69.79%	64.85%	32.37%	25.97%	30.12%	28.73%	25.00%	21.35%	28.26%



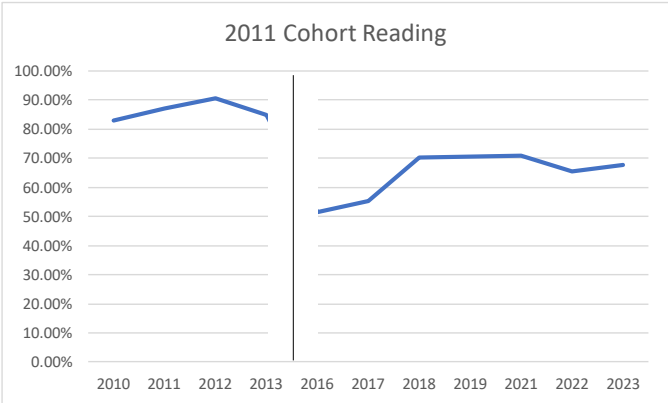
2009 Cohort	2008	2009	2010	2011	2012	2013	2016
6 Districts	75.81%	75.00%	83.33%	77.86%	73.58%	78.29%	38.84%



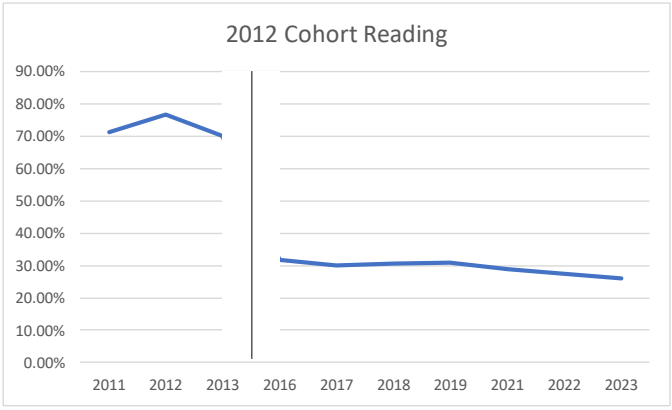
2010 Cohort	2009	2010	2011	2012	2013	2016	2017	2018	2019	2021	2022	2023
9 Districts	81.99%	78.97%	81.76%	79.57%	73.77%	38.24%	32.14%	32.70%	35.42%	36.48%	39.21%	35.84%



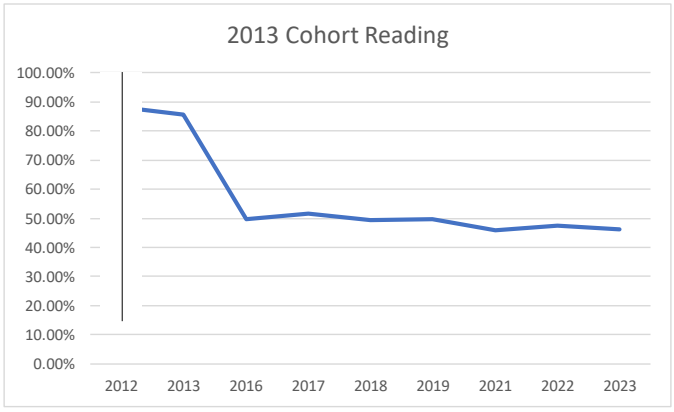
2011 Cohort	2010	2011	2012	2013	2016	2017	2018	2019	2021	2022	2023
5 Districts	82.98%	87.23%	90.70%	85.00%	51.35%	55.26%	70.27%	70.73%	70.97%	65.52%	67.86%



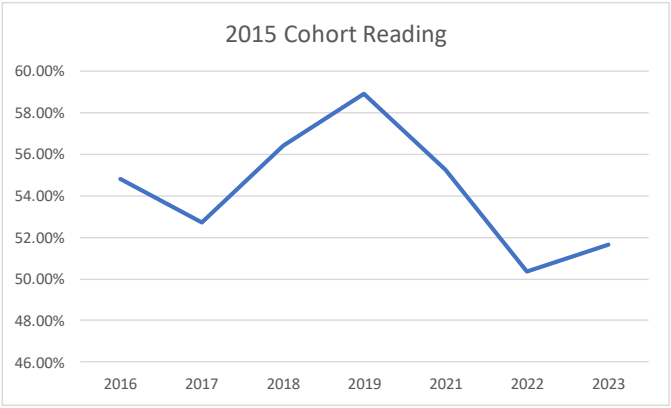
2012 Cohort	2011	2012	2013	2016	2017	2018	2019	2021	2022	2023
13 Districts	71.28%	76.76%	70.06%	31.74%	30.14%	30.53%	30.97%	28.96%	27.56%	26.14%



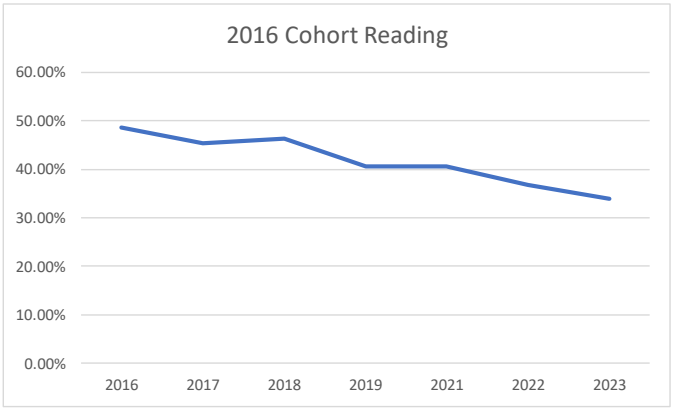
2013 Cohort	2012	2013	2016	2017	2018	2019	2021	2022	2023
22 Districts	88.07%	85.55%	49.78%	51.52%	49.44%	49.78%	46.02%	47.50%	46.06%



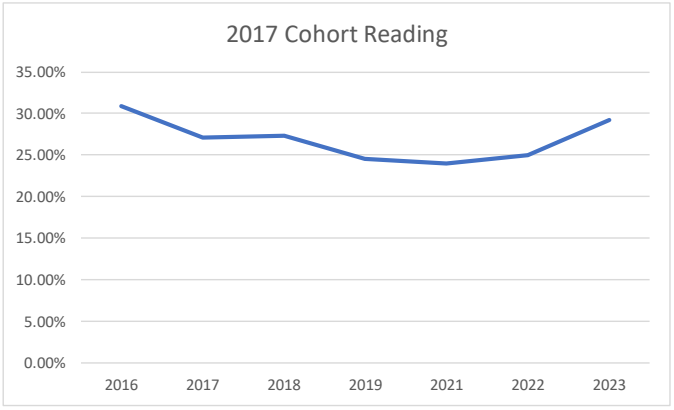
2015 Cohort	2016	2017	2018	2019	2021	2022	2023
16 Districts	54.80%	52.72%	56.42%	58.91%	55.26%	50.35%	51.64%



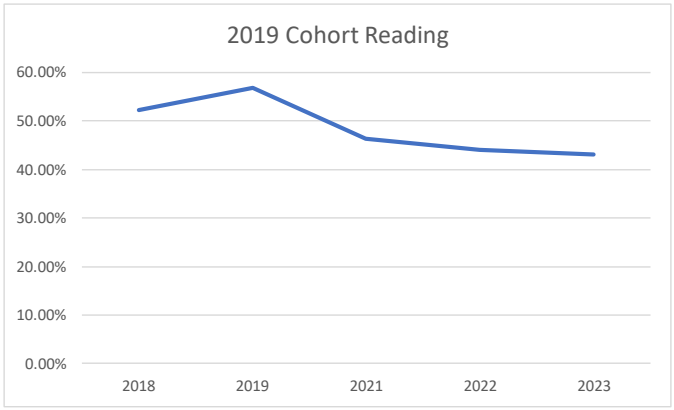
2016 Cohort	2016	2017	2018	2019	2021	2022	2023
6 Districts	48.55%	45.45%	46.24%	40.51%	40.66%	36.74%	33.98%



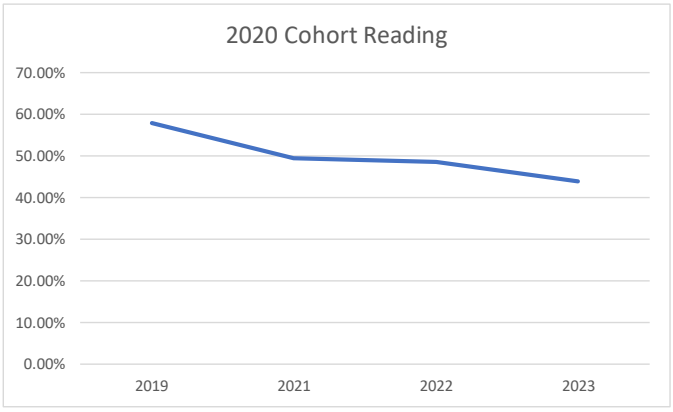
2017 Cohort	2016	2017	2018	2019	2021	2022	2023
3 Districts	30.91%	27.12%	27.27%	24.53%	24.00%	25.00%	29.17%



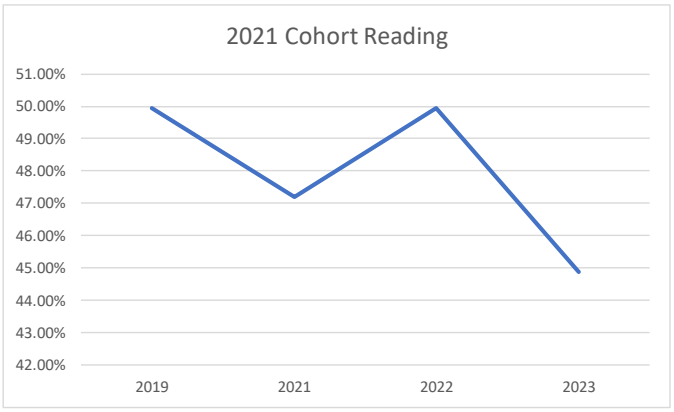
2019 Cohort	2018	2019	2021	2022	2023
6 Districts	52.17%	56.80%	46.41%	44.12%	43.16%



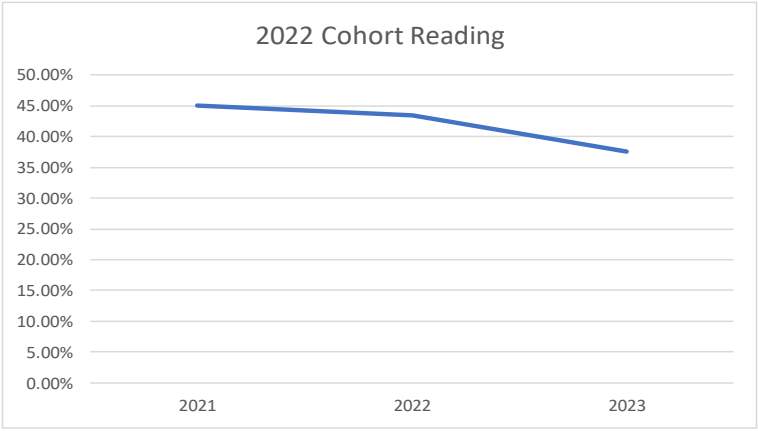
2020 Cohort	2019	2021	2022	2023
8 Districts	57.98%	49.38%	48.64%	43.85%



2021 Cohort	2019	2021	2022	2023
14 Districts	49.95%	47.20%	49.95%	44.89%



2022 Cohort	2021	2022	2023
5 Districts	45.10%	43.51%	37.50%



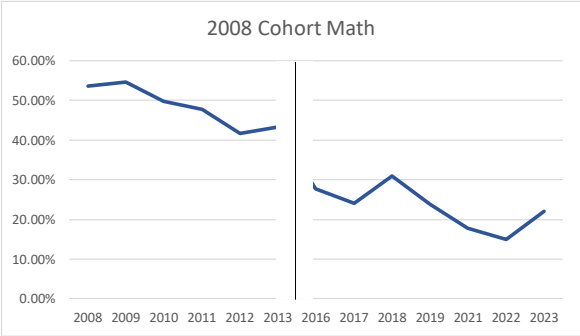
2023 Cohort	2022	2023
20 Districts	39.90%	42.61%

Figure 7. MontCas and SBAC Reading Achievement by Cohort Start Year

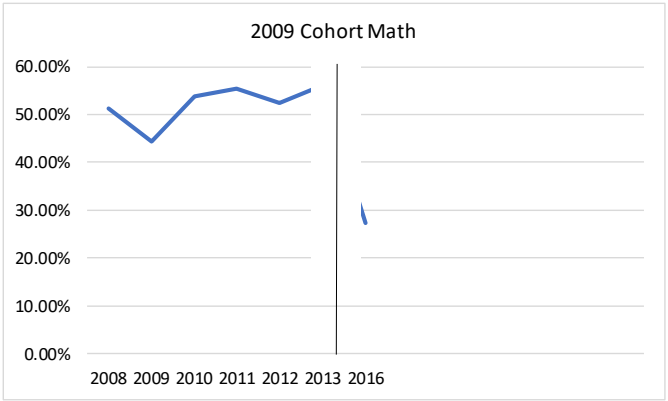
Note. In the years 2014-2015, no data were collected because of the transition from the MontCas to the SBAC assessment. In 2020, student achievement was not assessed due to the COVID-19 pandemic, therefore, there will be no data for that year. There were no school districts starting the 4dsw schedule in 2014. In the 2018 school year, there was only one school district with too few students to report due to FERPA requirements. In the 2009 cohort, one of the school districts returned to the 5dsw schedule in 2017. The remaining school districts in this cohort did not have an adequate number of students to report in the years following 2017, due to FERPA requirements. Data highlighted in green represent the baseline year data (5dsw schedule) prior to transitioning to the 4dsw schedule for each cohort.

School districts were identified in cohorts based on the year they started utilizing the 4dsw schedule. Their achievement was tracked as a group from the year they entered the 4dsw schedule until 2023. School districts who were not continuously utilizing the 4dsw schedule for the duration of the cohort were removed from the 4dsw data during the years they utilized the 5dsw schedule. Figure 8 represents fourteen cohorts from the years 2008 to 2022. The first cohort began in 2008.

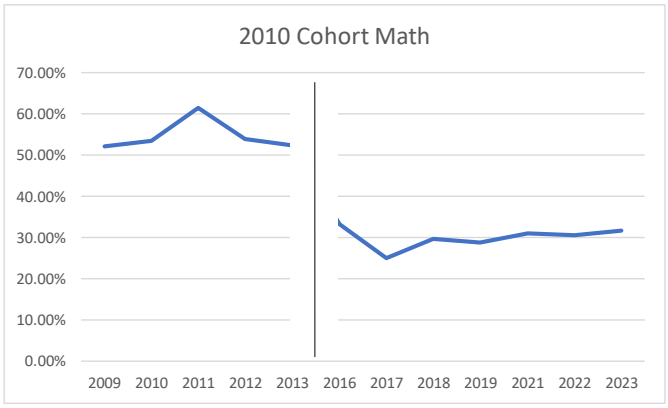
2008 Cohort	2008	2009	2010	2011	2012	2013	2016	2017	2018	2019	2021	2022	2023
7 Districts	53.57%	54.66%	49.69%	47.68%	41.72%	43.29%	27.75%	24.04%	30.91%	23.86%	17.80%	15.00%	21.98%



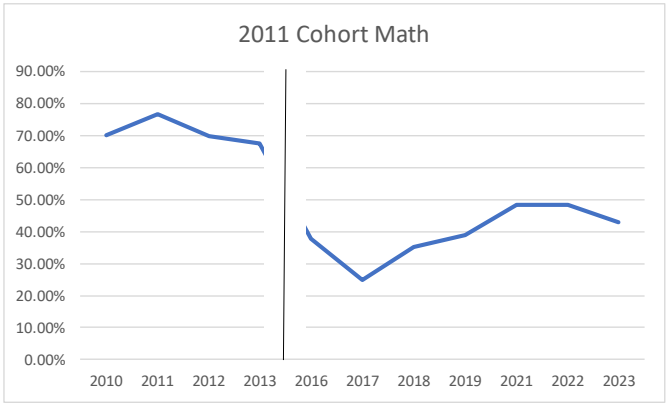
2009 Cohort	2008	2009	2010	2011	2012	2013	2016
6 Districts	51.26%	44.44%	53.85%	55.38%	52.38%	56.10%	27.27%



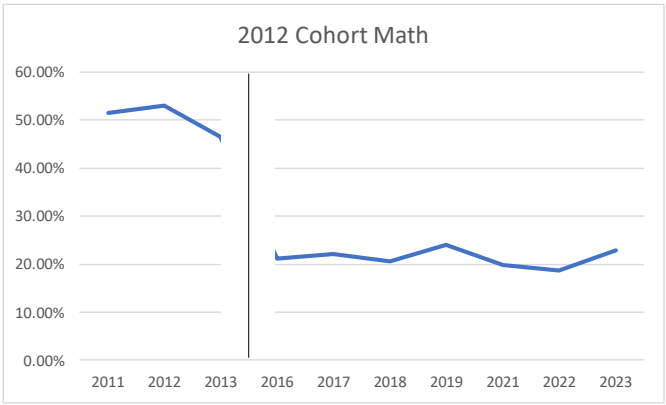
2010 Cohort	2009	2010	2011	2012	2013	2016	2017	2018	2019	2021	2022	2023
9 Districts	52.15%	53.58%	61.57%	54.01%	52.48%	33.25%	25.00%	29.70%	28.81%	31.03%	30.52%	31.70%



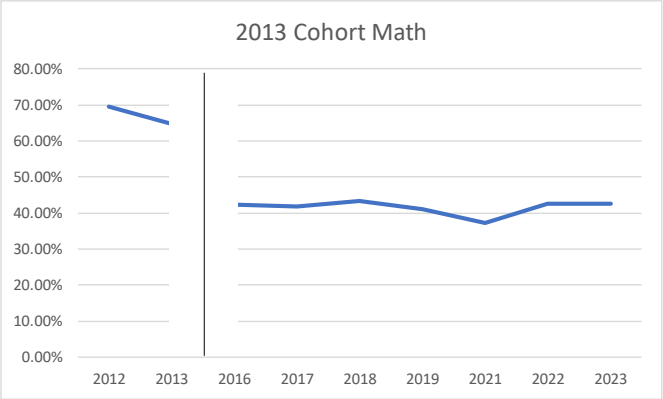
2011 Cohort	2010	2011	2012	2013	2016	2017	2018	2019	2021	2022	2023
5 Districts	70.21%	76.60%	69.77%	67.50%	37.84%	25.00%	35.14%	39.02%	48.39%	48.28%	42.86%



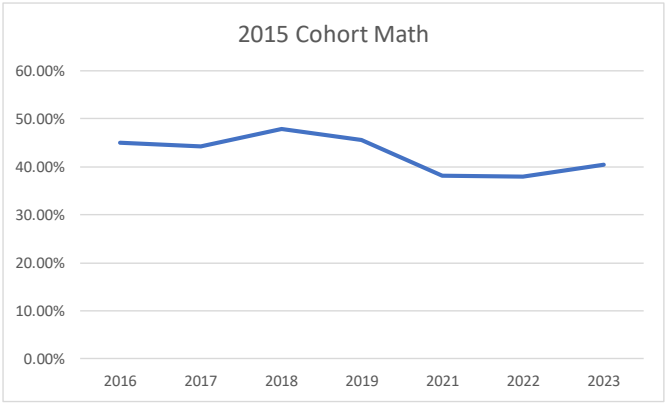
2012 Cohort	2011	2012	2013	2016	2017	2018	2019	2021	2022	2023
13 Districts	51.59%	53.01%	46.51%	21.11%	22.08%	20.63%	24.06%	19.83%	18.64%	22.79%



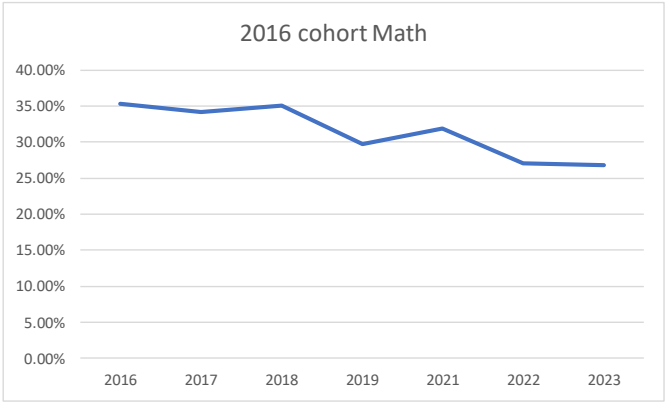
2013 Cohort	2012	2013	2016	2017	2018	2019	2021	2022	2023
22 Districts	69.42%	64.61%	42.37%	41.92%	43.37%	40.97%	37.15%	42.49%	42.47%



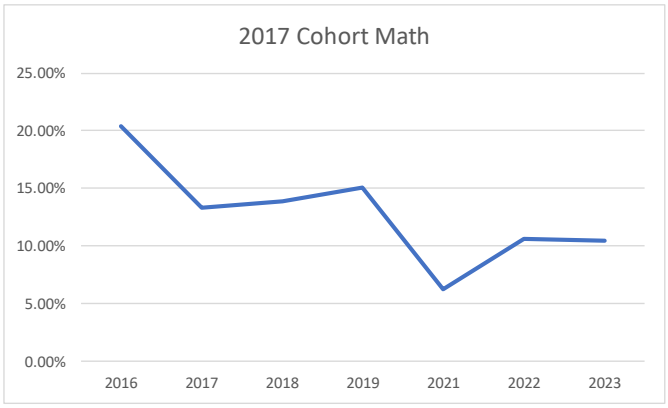
2015 Cohort	2016	2017	2018	2019	2021	2022	2023
16 Districts	44.96%	44.18%	47.84%	45.68%	38.22%	37.88%	40.52%



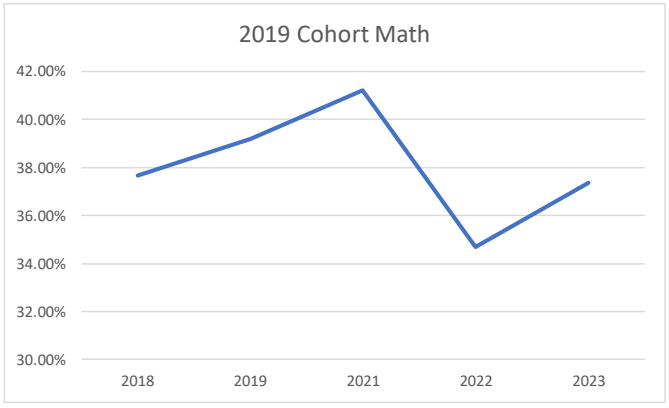
2016 Cohort	2016	2017	2018	2019	2021	2022	2023
6 Districts	35.29%	34.19%	35.08%	29.70%	31.87%	27.07%	26.82%



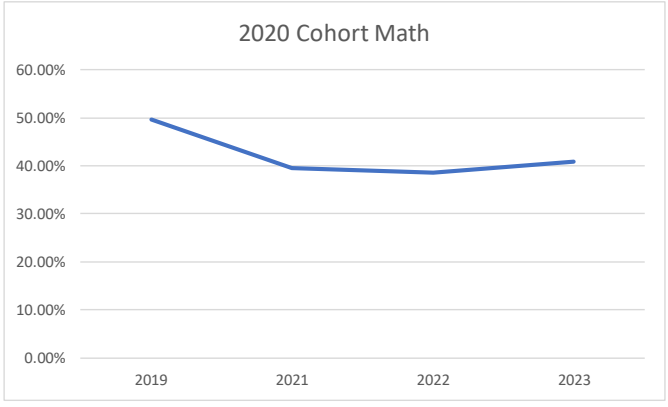
2017 Cohort	2016	2017	2018	2019	2021	2022	2023
3 Districts	20.37%	13.33%	13.85%	15.09%	6.25%	10.64%	10.42%



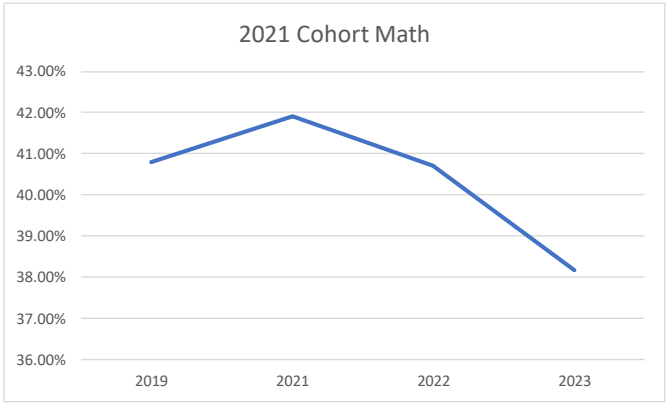
2019 Cohort	2018	2019	2021	2022	2023
6 Districts	37.68%	39.20%	41.22%	34.71%	37.37%



2020 Cohort	2019	2021	2022	2023
8 Districts	49.61%	39.48%	38.52%	40.93%



2021 Cohort	2019	2021	2022	2023
14 Districts	40.79%	41.91%	40.70%	38.17%



2022 Cohort	2022	2023
5 Districts	36.53%	37.52%

2023 Cohort	2023
20 Districts	33.28%

Figure 8. MontCas and SBAC Math Achievement by Cohort Start Year

Note. In the years 2014-2015, no data were collected because of the transition from the MontCas to the SBAC assessment. In 2020, student achievement was not assessed due to the COVID-19 pandemic. There were no school districts starting the 4dsw schedule in the 2014 school year. In the 2018 school year, there was only one school district with too few students to report due to FERPA requirements. In the 2009 cohort, one of the school districts returned to the 5dsw in 2017. The remaining school districts in this cohort did not have an adequate number of students to report in the years following 2017, due to FERPA requirements. Data highlighted in green represent the baseline year data prior to transitioning to the 4dsw schedule for each cohort.

Basic/Novice Proficiencies Compared to Advanced in Cohort School Districts Utilizing the 4dsw Schedule

The percentage of students achieving at the Basic/Novice Level was compared to Advanced Level in school districts utilizing the 4dsw schedule by cohort. School districts were identified in cohorts based on the year they started utilizing the 4dsw schedule. Their achievement was tracked as a group from the year they entered the 4dsw schedule until 2023. School districts who were not continuously utilizing the 4dsw schedule for the duration of the cohort were removed from the 4dsw data during the years they utilized the 5dsw schedule. The general trend, as the cohort progressed, was for the percentage of students scoring basic/novice to increase and the percentage of students scoring advanced to decrease in school districts utilizing the 4dsw schedule. (See Figures 9 & 10)

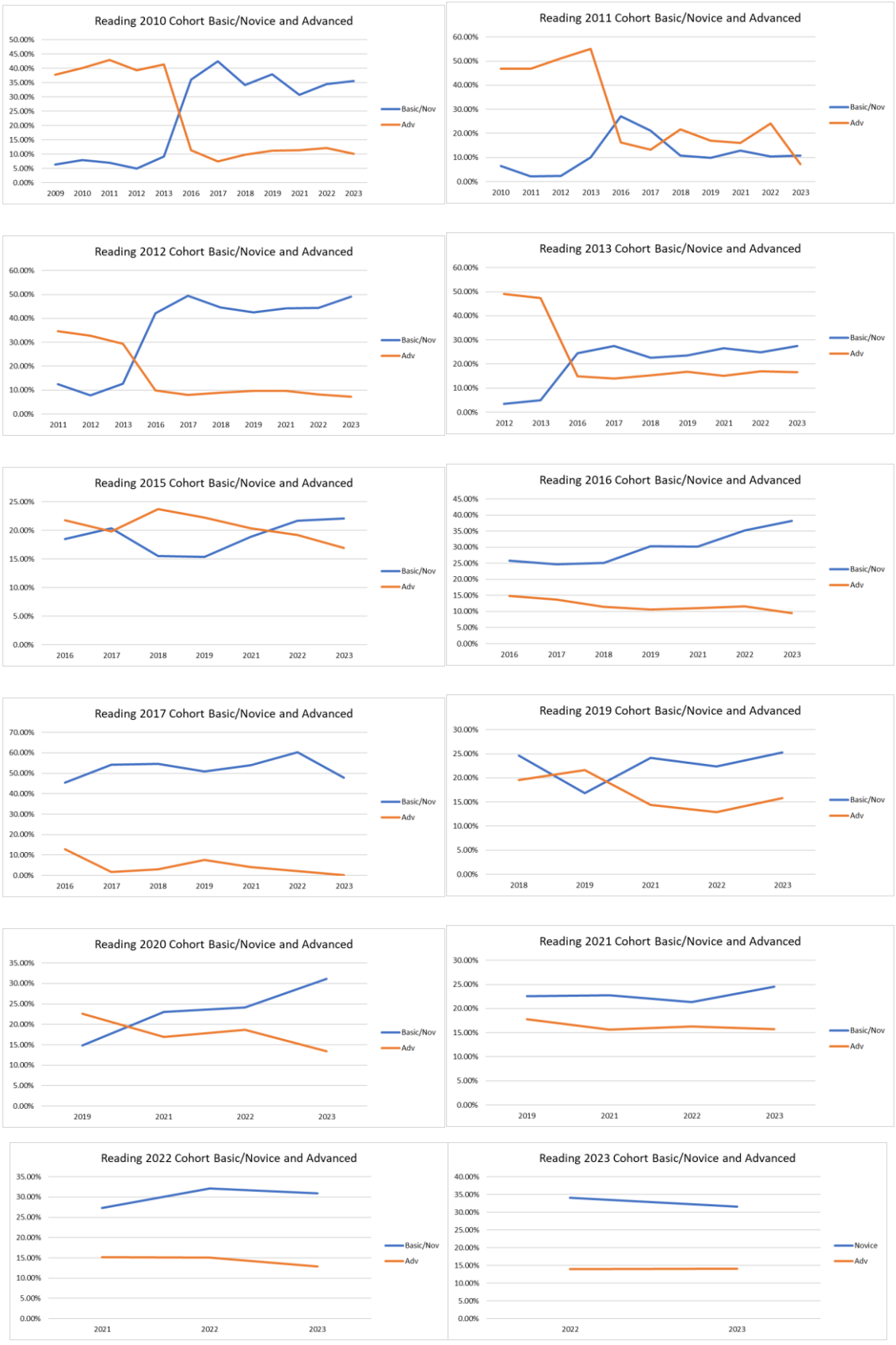
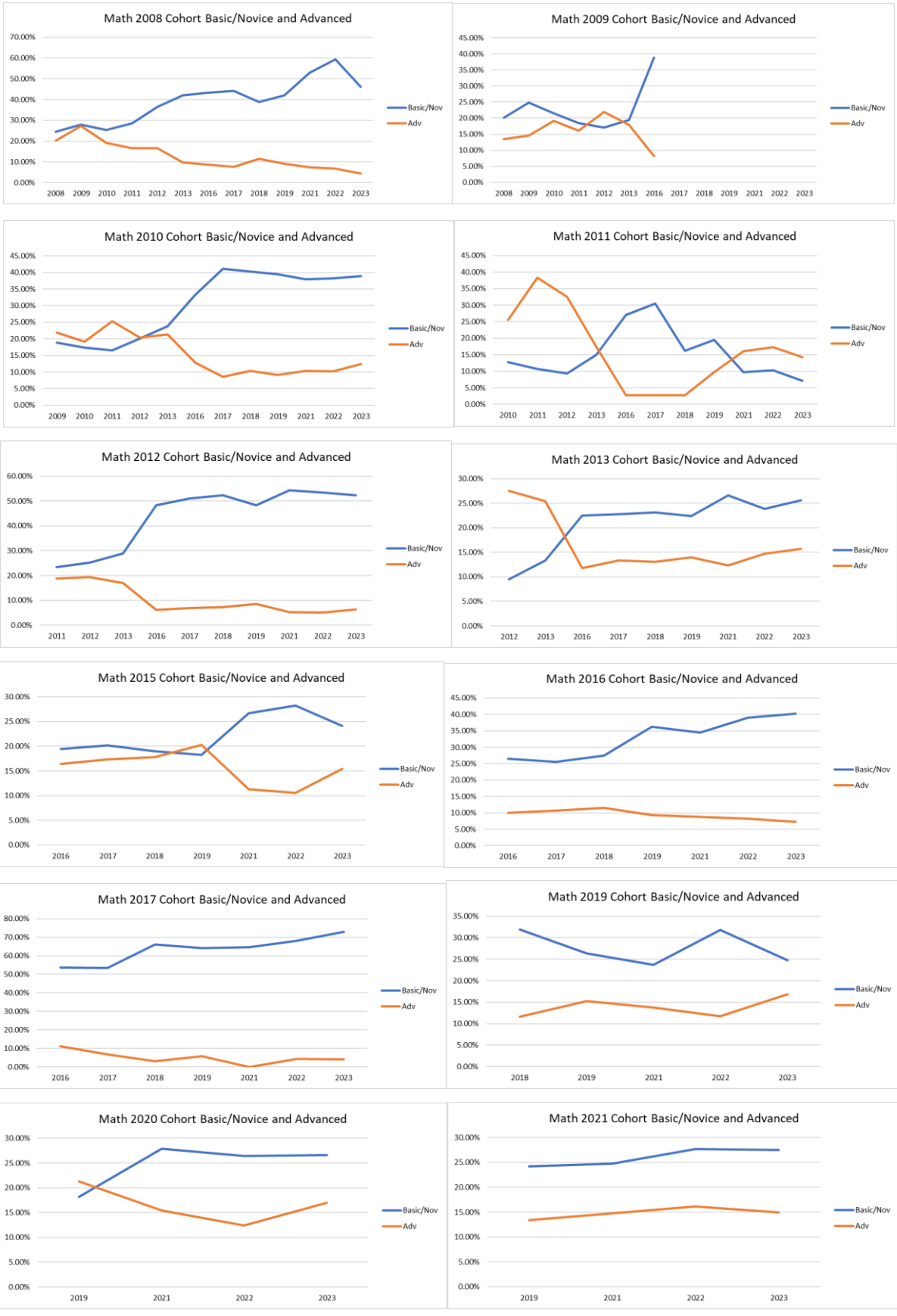


Figure 9. Comparison of the Percentage of Students Achieving at the Basic/Novice Level in Reading Compared to Advanced Level in School Districts Utilizing the 4dsw Schedule by Cohort


Math 2008 Cohort Basic/Novice and Advanced
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
2008 2009 2010 2011 2012 2013 2016 2017 2018 2019 2021 2022 2023
Basic/Nov
Adv
Math 2009 Cohort Basic/Novice and Advanced
45.00%
40.00%
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
2008 2009 2010 2011 2012 2013 2016 2017 2018 2019 2021 2022 2023
Basic/Nov
Adv
Math 2010 Cohort Basic/Novice and Advanced
45.00%
40.00%
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
2009 2010 2011 2012 2013 2016 2017 2018 2019 2021 2022 2023
Basic/Nov
Adv
Math 2011 Cohort Basic/Novice and Advanced
45.00%
40.00%
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
2010 2011 2012 2013 2016 2017 2018 2019 2021 2022 2023
Basic/Nov
Adv
Math 2012 Cohort Basic/Novice and Advanced
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
2011 2012 2013 2016 2017 2018 2019 2021 2022 2023
Basic/Nov
Adv
Math 2013 Cohort Basic/Novice and Advanced
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
2012 2013 2016 2017 2018 2019 2021 2022 2023
Basic/Nov
Adv
Math 2015 Cohort Basic/Novice and Advanced
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
2016 2017 2018 2019 2021 2022 2023
Basic/Nov
Adv
Math 2016 Cohort Basic/Novice and Advanced
45.00%
40.00%
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
2016 2017 2018 2019 2021 2022 2023
Basic/Nov
Adv
Math 2017 Cohort Basic/Novice and Advanced
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
2016 2017 2018 2019 2021 2022 2023
Basic/Nov
Adv
Math 2019 Cohort Basic/Novice and Advanced
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
2018 2019 2021 2022 2023
Basic/Nov
Adv
Math 2020 Cohort Basic/Novice and Advanced
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
2019 2021 2022 2023
Basic/Nov
Adv
Math 2021 Cohort Basic/Novice and Advanced
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
2019 2021 2022 2023
Basic/Nov
Adv

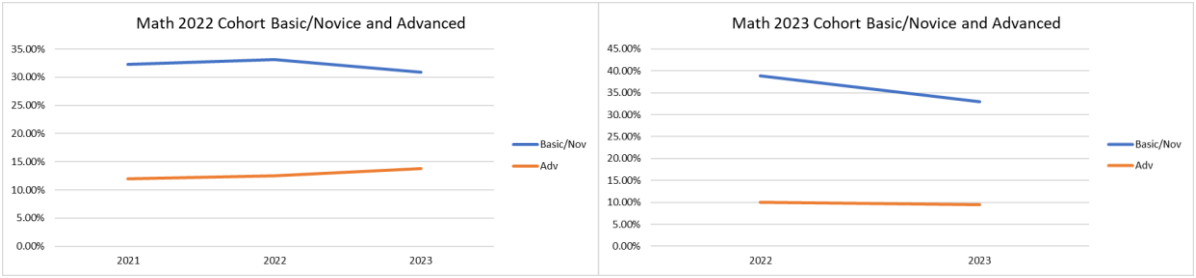


Figure 10. Comparison of the Percentage of Students Achieving at the Basic/Novice Level in Math Compared to Advanced Level in School Districts Utilizing the 4dsw Schedule by Cohort

Note. In the years 2014-2015, no data were collected because of the transition from the MontCas to the SBAC assessment. In 2020, student achievement was not assessed due to the COVID-19 pandemic. There were no school districts starting the 4dsw schedule in the 2014. In the 2018 school year, there was only one school district with too few students to report due to FERPA requirements. In the 2009 cohort, one of the school districts returned to the 5dsw in 2017. The remaining school districts in this cohort did not have an adequate number of students to report in the years following 2017, due to FERPA requirements.

ACT

The ACT assessment was administered to all eleventh-grade students, beginning in 2013. The ACT score consists of five areas: (a) English, (b) Math, (c) Reading, (d) Science, and (e) Composite. The Composite score is the rounded average of English, Math, Reading, and Science. This calculation is performed by the ACT testing service.

The ACT data differ from the MontCas and SBAC data in that it is reported as mean scores rather than the percentage of proficient and advanced achievement as used in MontCas and SBAC. These mean scores were verified for accuracy as part of the analyses by manually filtering scores for ten high schools with varying enrollments and then comparing these analyses with the formula generated means.

ACT scores for all students for the years 2013-2023 were analyzed by calculating the (a) overall average ACT scores for all students in school districts utilizing the 5dsw schedule and school districts utilizing the 4dsw schedule in the areas of English, Math, Reading, Science, and Composite scores, (b) differences in the average ACT scores by year between school districts utilizing the 4dsw schedule and school districts utilizing the 5dsw schedule, and (c) the relationship between the length of time in school districts utilizing the 4dsw schedule and the ACT scores.

A comparison of the English, Math, Reading, Science, and Composite scores for Montana students from 2013-2023 indicated that students in school districts using the 5dsw schedule outperformed students in school districts using the 4dsw schedule in each category (See figures 11and 12).

Calendar	English	Math	Reading	Science	Composite
5	17.52	18.99	19.51	19.20	18.93
4	17.31	18.93	19.39	19.08	18.81
Mean Difference	-0.21	-0.05	-0.12	-0.12	-0.12

Figure 11. Average ACT Scores for All Students in School Districts Utilizing the 5dsw Schedule and School Districts Utilizing the 4dsw Schedule for the Years 2013-2023

Note. The ACT Assessment was not administered in the year 2020 due to the COVID-19 Pandemic. The red highlighted cells indicate instances where the 4dsw underperformed the 5dsw in ACT assessment.

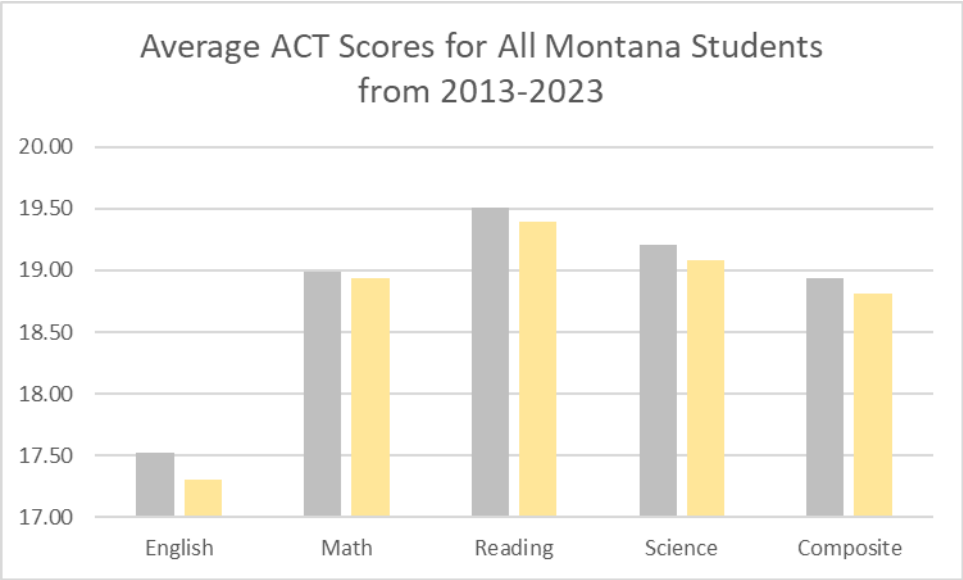


Figure 12. Comparison of Average ACT Scores for All Montana Students by School Districts Using the 4dsw Schedule and School Districts Utilizing the 5dsw Schedule

Note. The 5dsw is represented by the gray bar and the 4dsw is represented by the yellow bar.

ACT Assessment by Year

ACT assessment data were averaged in each category by year. The scores were divided into school districts utilizing the 5dsw and 4dsw schedule. The comparison was then made noting the difference between students in school districts utilizing the 5dsw and 4dsw schedule (See figure 13).

		Average ACT Scores					Difference Between the 5dsw and 4dsw Schedule				
		English	Math	Reading	Science	Composite	English	Math	Reading	Science	Composite
2013	5	18.44	19.99	20.11	19.61	19.66	0.16	0.21	0.30	0.34	0.25
	4	18.60	20.20	20.41	19.95	19.91					
2014	5	17.63	19.62	19.76	19.48	19.26	-0.63	-0.79	-0.67	-0.31	-0.60
	4	17.00	18.83	19.10	19.18	18.66					
2015	5	17.68	19.52	19.58	19.55	19.20	-0.33	-0.37	-0.44	-0.48	-0.40
	4	17.36	19.15	19.13	19.07	18.80					
2016	5	17.76	19.31	20.06	19.59	19.30	-0.12	0.15	0.28	0.14	0.09
	4	17.64	19.46	20.34	19.72	19.39					
2017	5	17.53	19.04	19.62	19.03	18.93	-0.36	-0.07	-0.19	-0.11	-0.13
	4	17.17	18.97	19.43	18.92	18.80					
2018	5	17.50	18.91	19.48	19.05	18.88	-0.37	-0.10	-0.18	-0.45	-0.27
	4	17.13	18.81	19.31	18.60	18.61					
2019	5	17.76	18.96	19.70	19.32	19.07	-0.42	0.25	-0.25	-0.32	-0.18
	4	17.34	19.21	19.45	19.00	18.89					
2020	5										
	4										
2021	5	16.75	18.19	18.88	18.72	18.25	-0.01	0.29	-0.04	0.02	0.07
	4	16.74	18.48	18.83	18.74	18.33					
2022	5	16.43	17.96	18.61	18.65	18.03	-0.04	-0.03	0.01	0.00	0.00
	4	16.40	17.93	18.63	18.65	18.03					
2023	5	17.74	18.38	19.29	19.04	18.74	-0.02	-0.08	0.01	-0.06	-0.03
	4	17.72	18.30	19.29	18.98	18.71					

Figure 13. Average ACT Scores by Year in School Districts Utilizing the 4dsw Schedule and School Districts Utilizing the 5dsw Schedule

Note. The ACT assessment was not administered in the year 2020 due to the COVID-19 pandemic. The red highlighted cells indicate instances where the 4dsw underperformed the 5dsw on the ACT assessment.

Comparing ACT data for 11th grade students, these students exhibited lower ACT scores the longer they had been in school districts that utilized the 4dsw schedule. This disparity between students who were in the first year of the 4dsw and students who were in the twelfth year of the 4dsw was 2.3 points on the Composite ACT score, with the largest disparity found in Reading, at 2.8 points.

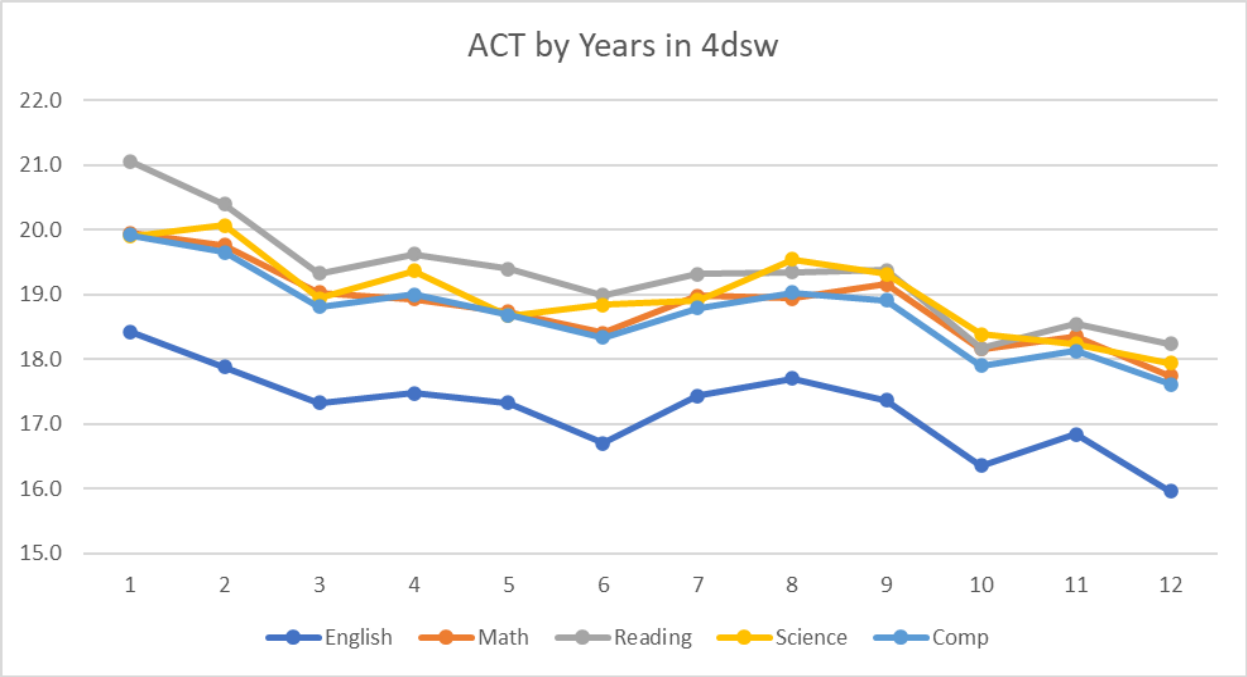


Figure 14. ACT Student Achievement Score by Number of Years School Districts Utilized the 4dsw Schedule

Average ACT Scores for 4dsw Students in the First Year and in the Twelfth Year

	English	Math	Reading	Science	Comp
1	18.4	19.9	21.1	19.9	19.9
12	16.0	17.7	18.2	17.9	17.6
Difference	-2.5	-2.2	-2.8	-2.0	-2.3

Figure 15. Average ACT Scores for Students Attending School Districts Utilizing the 4dsw Schedule for the First Year and for the Twelfth Year

Conclusions and Recommendations

Policymakers have questioned whether the 4dsw schedule provides the same level of educational quality as a 5dsw schedule (Irving, 2023). As more and more Montana school districts transition to the 4dsw schedule, policymakers at the local and state level need to understand the implications for educational quality. Policy decisions regarding school scheduling need to be based on empirical evidence. Data revealed that the 4dsw schedule has not been beneficial to most students in the state of Montana. The problems reside at the local level, but the solution will require state level action. The authors of this study recommend the revision of 20-1-301 MCA to mandate 180 school days.

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Data sharing statement

No additional data are available.

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