## OVERVIEW

Duval County Public Schools (DCPS) utilized Penda Learning as instructional support in the division's Response to Intervention (RTI) model. The instructional support provided standards-based content for Grade 5 Science, Grade 8 Science, and High School Biology aligned to DCPS curricula in the form of online gamified activities. Activities were assigned weekly to students by Penda Learning to boost student performance as measured by the district's Grade 5 Statewide Science Assessment (SSA) mock assessment, the Grade 8 SSA mock assessment, and the High School Biology End of Course (EOC) mock assessment.

The purpose of the study was to determine if there was a relationship between student performance on the mock assessments and Penda Learning usage metrics. Analysis of results of the seven-month study in 2018 indicated that Penda Learning had a positive, measurable impact on student performance. Additionally, the performance gap between Turn Around School and Non-Turn Around School students decreased as hours of engagement using Penda Learning increased.

## METHODOLOGY

DCPS provided raw student performance outcomes of 20,157 students who were administered a district mock assessment (Grade 5 SSA, Grade 8 SSA, and High School Biology EOC) in March/April 2018. Student performance outcomes were sorted for each of the curricula of which Penda Learning was implemented and then paired with Penda Learning usage metrics before being analyzed to determine the relationship between the time students were engaged completing Penda Learning activities and performance on the district mock assessments.

Penda Learning usage data was sorted and analyzed based on the time students were engaged completing science activities both in and outside of school hours throughout the seven-month study period and was defined as hours of engagement. Review of usage data indicated hours of engagement patterns sorted into five categories: less than one hour, more than one hour but less than three hours, more than three hours but less than six hours, more than six hours but less than 10 hours, and more than 10 hours.

Usage data was also sorted and analyzed based on the number of science activities in which students achieved mastery. Mastery measured a student's ability to answer 80% or more of the activity questions correctly on the first attempt and was defined as activity mastery.

Lastly, Penda Learning usage data was sorted and analyzed at the school level between Turn Around Schools (all tiers) and Non-Turn Around Schools, as identified by DCPS district administrators.

## RESULTS

Analysis of 20,157 students over the seven-month study period indicated a positive relationship between Penda Learning usage metrics and student performance outcomes for students who took the Grade 5 SSA, Grade 8 SSA, and High School Biology EOC district mock assessment. Results of the analysis are displayed and discussed individually for each district mock assessment.

### Grade 5 SSA District Mock Assessment Performance Outcomes

Usage metrics, the time students were engaged in Penda Learning science activities, and the number of science activities in which students achieved mastery were compared to student performance on the Grade 5 SSA district mock assessment. Performance outcomes of 7,074 5th grade students were included in the analysis.

### *Is there a relationship between hours of engagement and student performance outcomes?*

A positive relationship was found between the time students engaged in Penda Learning and performance outcomes on the Grade 5 SSA district mock assessment. Students who used Penda Learning for more than 10 hours over the study period scored, on average, seven percentage points higher on the assessment compared to students who used Penda for less than one hour. Equally important, averaged assessment scores increased as hours of engagement in Penda Learning increased.
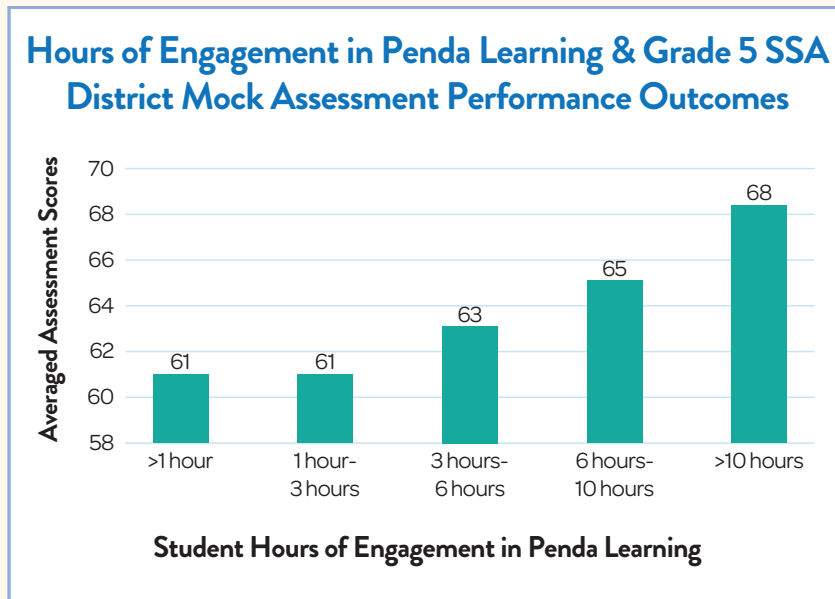
## Hours of Engagement in Penda Learning & Grade 5 SSA District Mock Assessment Performance Outcomes

Averaged Assessment Scores

| Student Hours of Engagement | Averaged Assessment Score |
|---|---|
| >1 hour | 61 |
| 1 hour–3 hours | 61 |
| 3 hours–6 hours | 63 |
| 6 hours–10 hours | 65 |
| >10 hours | 68 |

Student Hours of Engagement in Penda Learning

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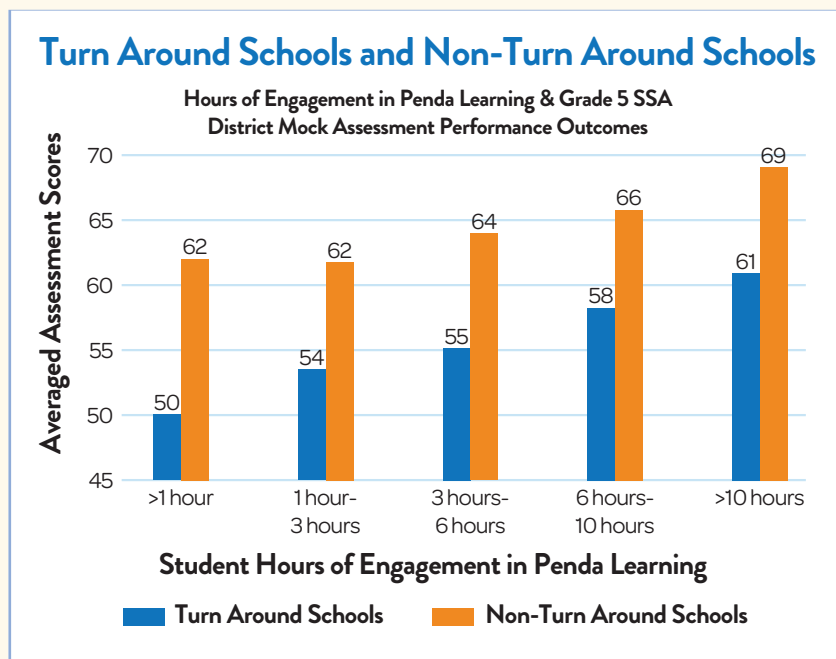High Quality Content for Exceptional Learning

*Does the relationship between hours of engagement and student performance outcomes change when looking at school-level data?*

When usage data was analyzed at the school level, a positive relationship was found between the time students were engaged in Penda Learning and performance on the Grade 5 SSA district mock assessment.

Students enrolled in Turn Around Schools (n= 649) who used Penda Learning for more than 10 hours over the study period performed, on average, 11 percentage points higher on the mock assessment compared to students who used Penda Learning for less than one hour. Furthermore, performance increased for all students as hours of engagement increased.

A positive relationship exists between hours of engagement and student performance among students attending Non-Turn Around Schools (n= 6,424). Performance increased by seven percentage points for students who used Penda for more than 10 hours when compared to students who used Penda for less than one hour.
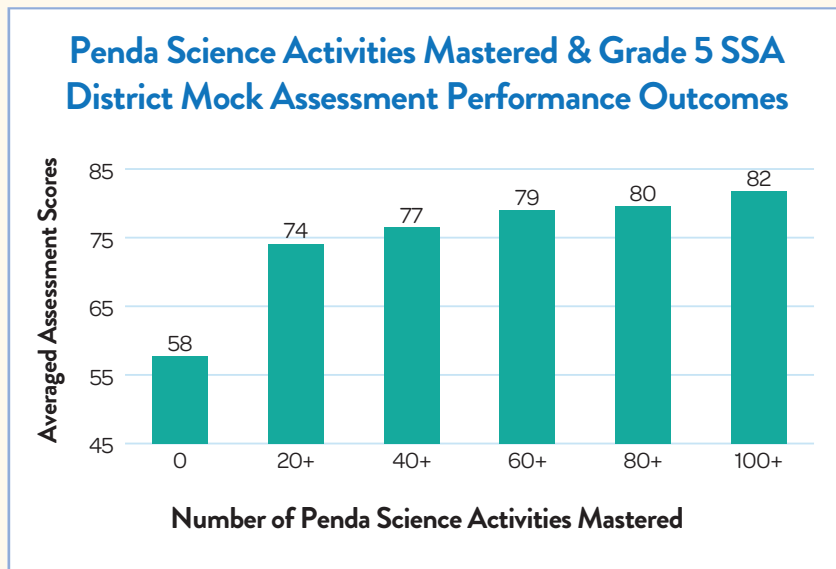
The performance gap between Turn Around School and Non-Turn Around School students decreased as hours of engagement increased. The performance gap for students who used Penda for less than one hour reflected a 12-percentage point difference between Turn Around Schools and Non-Turn Around Schools. Whereas, the performance gap between students who used Penda for more than 10 hours resulted in an eight-percentage point difference in student performance.

## Turn Around Schools and Non-Turn Around Schools

**Hours of Engagement in Penda Learning & Grade 5 SSA District Mock Assessment Performance Outcomes**

| Student Hours of Engagement | Turn Around Schools | Non-Turn Around Schools |
|---|---|---|
| >1 hour | 50 | 62 |
| 1 hour–3 hours | 54 | 62 |
| 3 hours–6 hours | 55 | 64 |
| 6 hours–10 hours | 58 | 66 |
| >10 hours | 61 | 69 |

*Averaged Assessment Scores*

*Student Hours of Engagement in Penda Learning*

■ Turn Around Schools  ■ Non-Turn Around Schools

***Is there a relationship between Penda Learning science activity mastery and student performance outcomes?***

A positive relationship was found between the number of Penda Learning science activities in which a student achieved mastery, and performance outcomes on the Grade 5 SSA district mock assessment. Activity mastery was defined as a student's ability to answer 80% or more of activity questions correctly on the first attempt. Averaged district mock assessment performance outcomes increased by 16% for students who achieved mastery on 20 or more Penda Learning science activities compared to students who did not achieve mastery. Students who achieved mastery on 100 or more Penda Learning science activities achieved the highest averaged performance outcomes.

### Penda Science Activities Mastered & Grade 5 SSA District Mock Assessment Performance Outcomes

Averaged Assessment Scores

| Number of Penda Science Activities Mastered | Averaged Assessment Score |
|---|---|
| 0 | 58 |
| 20+ | 74 |
| 40+ | 77 |
| 60+ | 79 |
| 80+ | 80 |
| 100+ | 82 |

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### Grade 8 SSA Mock Assessment Performance Outcomes

Like the analysis conducted for Grade 5 SSA District Mock Assessment Performance Outcomes, Penda Learning usage metrics, specifically hours of engagement and the number of Penda Learning science activities in which students obtained mastery, were compared to student performance outcomes on the Grade 8 SSA district mock assessment. Performance outcomes of 6,613 8th grade students were included in the analysis.

#### *Is there a relationship between hours of engagement and student performance outcomes?*

A positive relationship was found between the time students engaged in Penda Learning and performance outcomes on the Grade 8 SSA district mock assessment. Students who used Penda Learning for more than 10 hours during the study period scored, on average, ten percentage points higher when compared to students who used Penda Learning for less than one hour. Similarly, performance increased as hours of engagement increased.
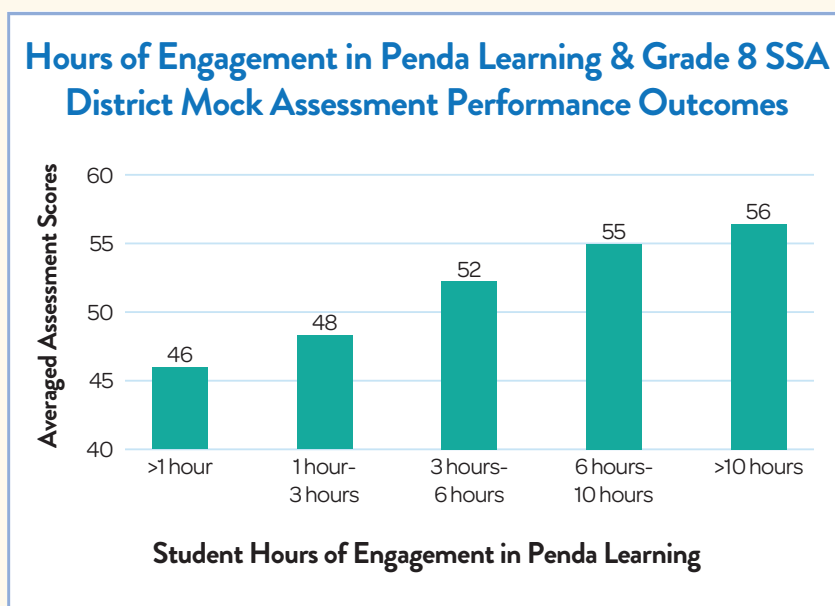
## Hours of Engagement in Penda Learning & Grade 8 SSA District Mock Assessment Performance Outcomes

Averaged Assessment Scores

| Student Hours of Engagement | Score |
|---|---|
| >1 hour | 46 |
| 1 hour–3 hours | 48 |
| 3 hours–6 hours | 52 |
| 6 hours–10 hours | 55 |
| >10 hours | 56 |

**Student Hours of Engagement in Penda Learning**

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*Does the relationship between hours of engagement and student performance outcomes change when looking at school-level data?*
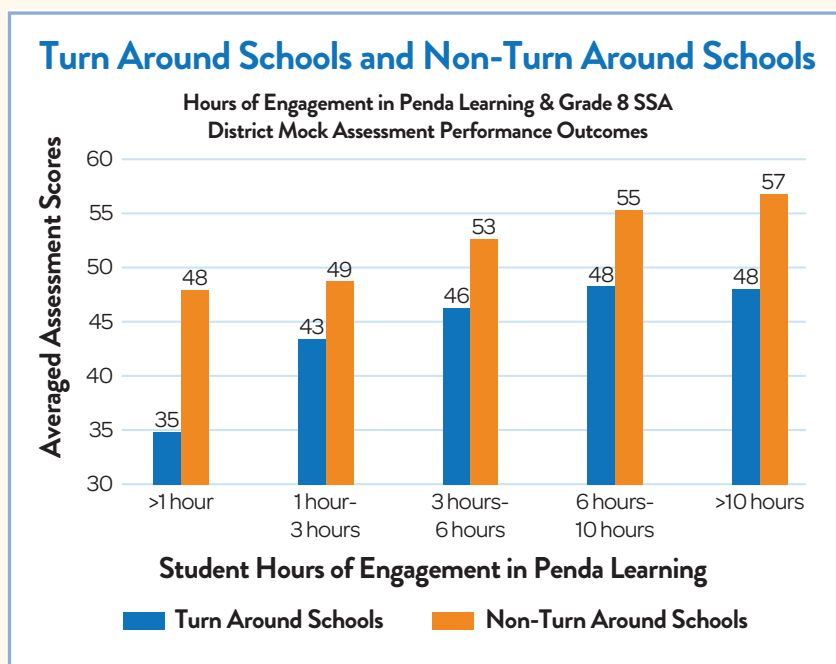
When Penda Learning student usage data was analyzed for middle schools identified as Turn Around Schools and Non-Turn Around Schools, a positive relationship was found between student hours of engagement in Penda Learning and Grade 8 SSA district mock assessment performance outcomes.

Middle school students who used Penda Learning for less than one hour had the lowest averaged scores in both Turn Around and Non-Turn Around Schools.

Students enrolled in Turn Around Schools (n= 513) who engaged in Penda Learning for more than 10 hours over the study period scored, on average, 13 percentage points higher on the mock district assessment compared to students who used Penda Learning for less than one hour.

The positive relationship between hours of engagement and performance held true for students enrolled in Non-Turn Around Schools (n= 6,100).
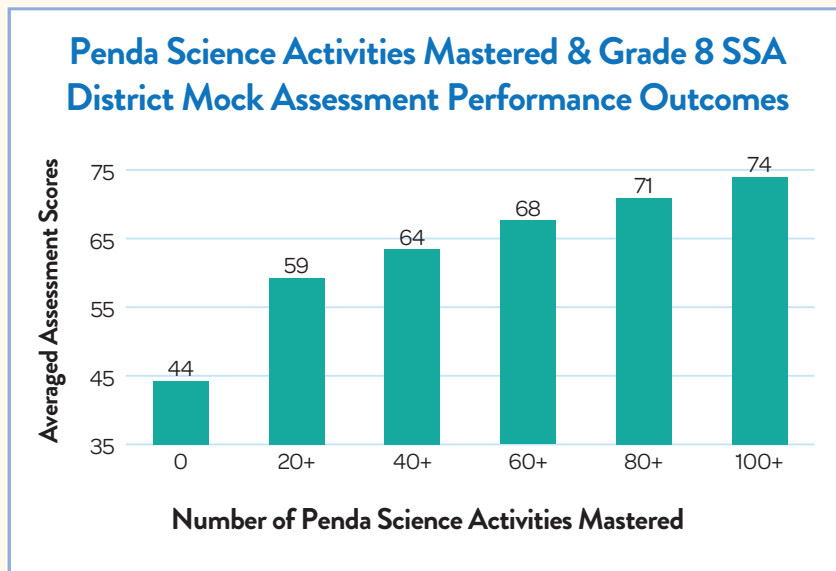
The performance gap changed between Turn Around Schools and Non-Turn Around Schools based upon the time students engaged in Penda Learning. For those students who used Penda Learning for less than one hour, the performance gap was a difference of 13 percentage points, which narrowed to nine percentage points for those students who engaged in Penda Learning for more than 10 hours.

## Turn Around Schools and Non-Turn Around Schools

**Hours of Engagement in Penda Learning & Grade 8 SSA District Mock Assessment Performance Outcomes**

| Student Hours of Engagement in Penda Learning | Turn Around Schools | Non-Turn Around Schools |
|---|---|---|
| >1 hour | 35 | 48 |
| 1 hour–3 hours | 43 | 49 |
| 3 hours–6 hours | 46 | 53 |
| 6 hours–10 hours | 48 | 55 |
| >10 hours | 48 | 57 |

Averaged Assessment Scores

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*Is there a relationship between Penda Learning science activity mastery and student performance outcomes?*

A positive relationship was found between the number of Penda Learning science activities in which a student achieved mastery and performance outcomes on the Grade 8 SSA district mock assessment. Activity mastery was defined as a student's ability to answer 80% or more of activity questions correctly on the first attempt. Performance outcomes increased by 15% for students who achieved mastery on 20 or more Penda Learning science activities compared to students did not achieve mastery on any Penda Learning science activities. A 30% performance outcome difference was found between students who achieved mastery on 100 or more Penda Learning science activities compared to those who did not achieve mastery.

### Penda Science Activities Mastered & Grade 8 SSA District Mock Assessment Performance Outcomes

Averaged Assessment Scores

| Number of Penda Science Activities Mastered | Averaged Assessment Score |
|---|---|
| 0 | 44 |
| 20+ | 59 |
| 40+ | 64 |
| 60+ | 68 |
| 80+ | 71 |
| 100+ | 74 |

**Number of Penda Science Activities Mastered**

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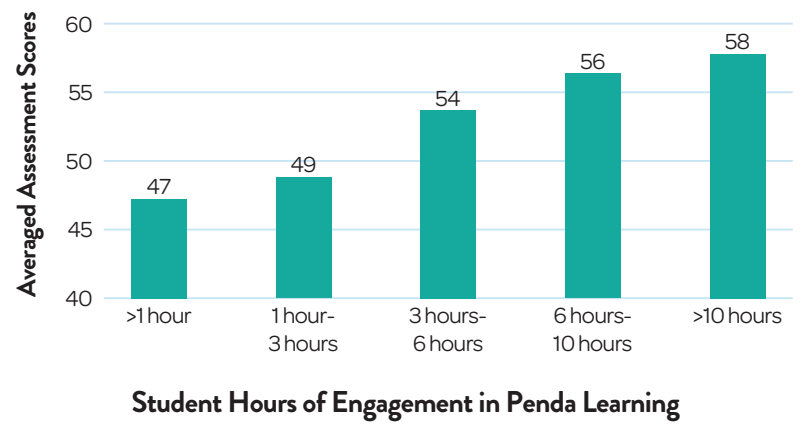### High School Biology EOC Mock Assessment Performance Outcomes

Performance outcomes from the High School Biology EOC district mock assessment of 6,472 students were compared with Penda Learning usage metrics of hours of engagement and the number of Penda Learning science activities in which students obtained mastery. Results of the analysis indicated a positive relationship between the time students engaged in Penda Learning, the number of science activities in which students achieve mastery, and performance outcomes on the High School Biology EOC district mock assessment.

*Is there a relationship between hours of engagement and student performance outcomes on the High School Biology EOC district mock assessment?*

A positive relationship was found between hours of engagement and performance outcomes on the High School Biology EOC district mock assessment.

Students who engaged in Penda Learning for more than 10 hours over the study period scored, on average, 11 percentage points higher on the mock assessment when compared to students who engaged in Penda Learning for less than one hour. Performance outcome averages increased as hours of engagement in Penda Learning increased.
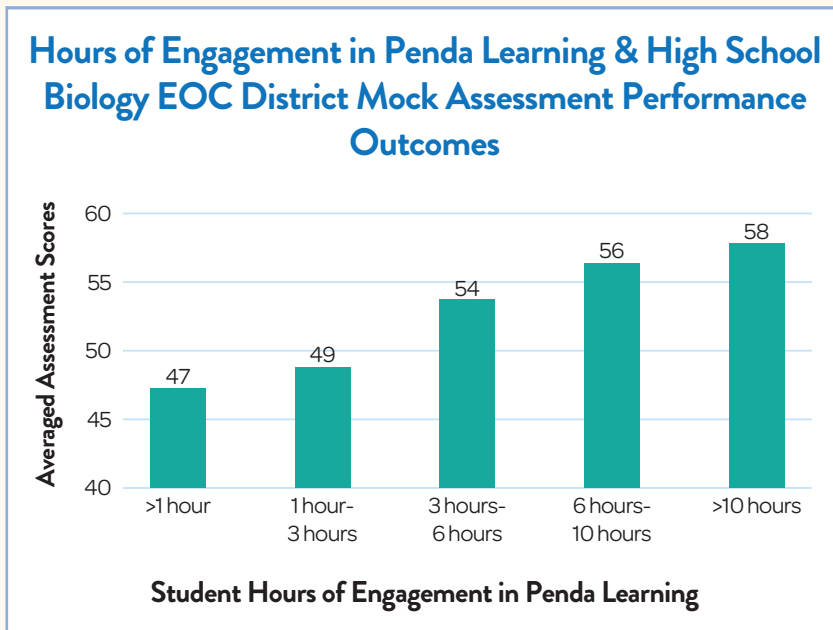
**Hours of Engagement in Penda Learning & High School Biology EOC District Mock Assessment Performance Outcomes**

Averaged Assessment Scores

| Student Hours of Engagement | Score |
|---|---|
| >1 hour | 47 |
| 1 hour–3 hours | 49 |
| 3 hours–6 hours | 54 |
| 6 hours–10 hours | 56 |
| >10 hours | 58 |

**Student Hours of Engagement in Penda Learning**

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*Is there a relationship between Penda science activity mastery and student performance outcomes?*

A positive relationship was found between mastery of Penda Learning science activities and performance outcomes on the High School Biology EOC district mock assessment. Activity mastery was defined as a student's ability to answer 80% or more of activity questions correctly on the first attempt. Performance outcomes on the assessment increased as the number of Penda Learning science activities mastered increased. Students who achieved mastery on 100 or more Penda Learning science activities experienced the highest assessment performance outcome averages. Averaged performance outcomes on the High School Biology EOC district mock assessment increased as the number of Penda Learning science activities mastered increased.

## Hours of Engagement in Penda Learning & High School Biology EOC District Mock Assessment Performance Outcomes

Averaged Assessment Scores

| Student Hours of Engagement | Score |
|---|---|
| >1 hour | 47 |
| 1 hour-3 hours | 49 |
| 3 hours-6 hours | 54 |
| 6 hours-10 hours | 56 |
| >10 hours | 58 |

**Student Hours of Engagement in Penda Learning**

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## CONCLUSION

The purpose of the study was to determine if there was a relationship between Penda Learning usage metrics and student performance outcomes on the Grade 5 SSA, the Grade 8 SSA, and the High School Biology EOC district mock assessment. DCPS provided raw performance outcome data on the three district mock assessments. Penda Learning provided student usage metrics. The two data sets were used to observe data patterns to assess relationships between Penda Learning usage metrics and performance outcomes of 20,157 DCPS students who took the district mock assessments in March/April 2018.

Data analysis found a positive relationship between hours of engagement and student performance outcomes on district mock assessments. It was also found that averaged assessment scores for all assessments increased as hours of engagement in Penda Learning increased.

Data analysis also found a positive relationship between the number of Penda Learning science activities a student mastered and student performance outcomes on the DCPS Grade 5 SSA, Grade 8 SSA, and High School Biology EOC district mock assessments. Performance outcomes increased across all assessments as the number of Penda Learning science activities in which a  student achieved mastery in increased. Additionally, performance outcomes of students who achieved mastery on 100 or more Penda Learning science activities scored, on average, 20% higher than students who did not achieve mastery, suggesting that hours of engagement are only part of the relationship between Penda Learning and improved student performance outcomes.

School-level data analysis for elementary and middle schools identified as Turn Around Schools and Non-Turn Around Schools revealed a positive relationship between Penda Learning time metrics and student performance outcomes on the DCPS Grade 5 SSA and Grade 8 SSA district mock assessments, respectively. Although averages for students enrolled in Non-Turn Around Schools were higher than students enrolled in Turn Around Schools, a difference in the performance gap decreased by as much as four percentage points for 5th grade students who engaged in Penda Learning for 10 hours or more. Similarly, the performance gap decreased for 8th grade students as hours of engagement increased. In fact, the performance gap decreased by seven percentage points for the 8th grade students who used Penda Learning for a minimum of three hours.
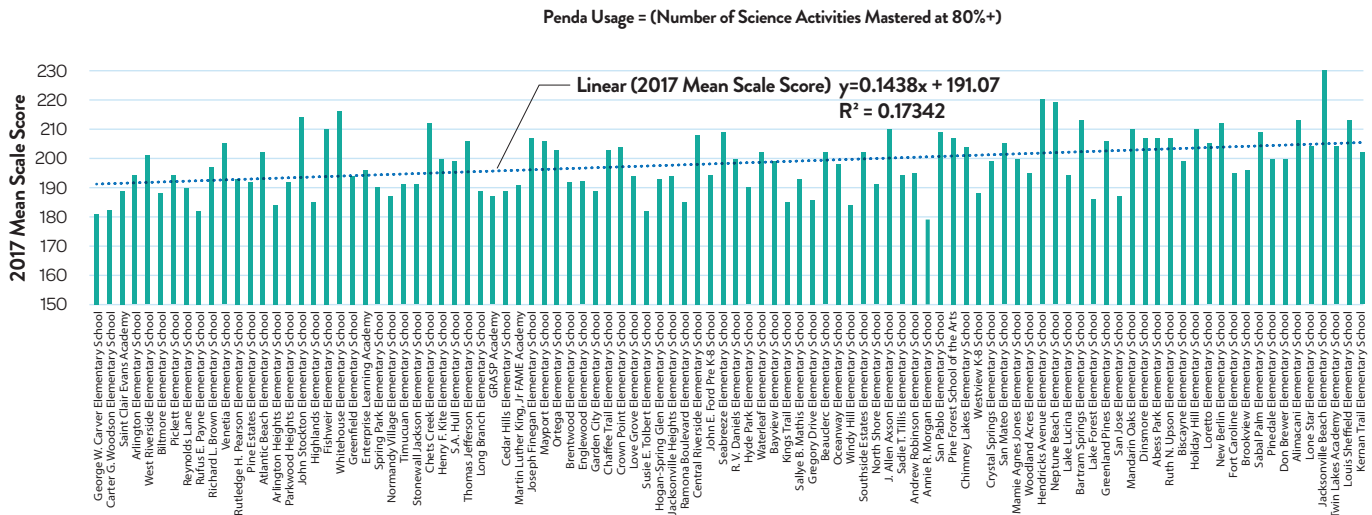
# PUTTING PENDA LEARNING TO THE TEST

In addition to producing positive results on SSA mock assessments, Penda Learning has proven effective in improving science scores on high-stakes exams. In 2016-2017, DCPS analyzed the impact of Penda Learning science activities on Grade 5 science, Grade 8 science, and High School Biology 1 performance on Florida Comprehensive Assessment Tests (FCAT) and state End-of-Course (EOC) exams in schools across the district.

Overall, 76 schools increased mean scale scores. In addition, 82 schools increased their percent of Level 3 and above. DCPS saw growth in schools at each grade/subject as well.

## Grade 5 Science

### Schools Organized from Lowest Penda Usage to Highest with Mean Scale Score Plotted

Penda Usage = (Number of Science Activities Mastered at 80%+)



Linear (2017 Mean Scale Score) $y=0.1438x + 191.07$
$R^2 = 0.17342$

**Penda Subscribing Schools:** 100 (Title I: 69 schools)

For those schools where students used Penda on average *less than 10 hours* **(goal)**, average mean scale score was 196.21 and average 2017 Percent of level 3 and above was 44.31%.

For those schools where students used Penda on average *equal to or more than 10 hours* **(goal)**, the average mean scale score was 199.63 and average 2017 Percent of level 3 and above was 50.46%.
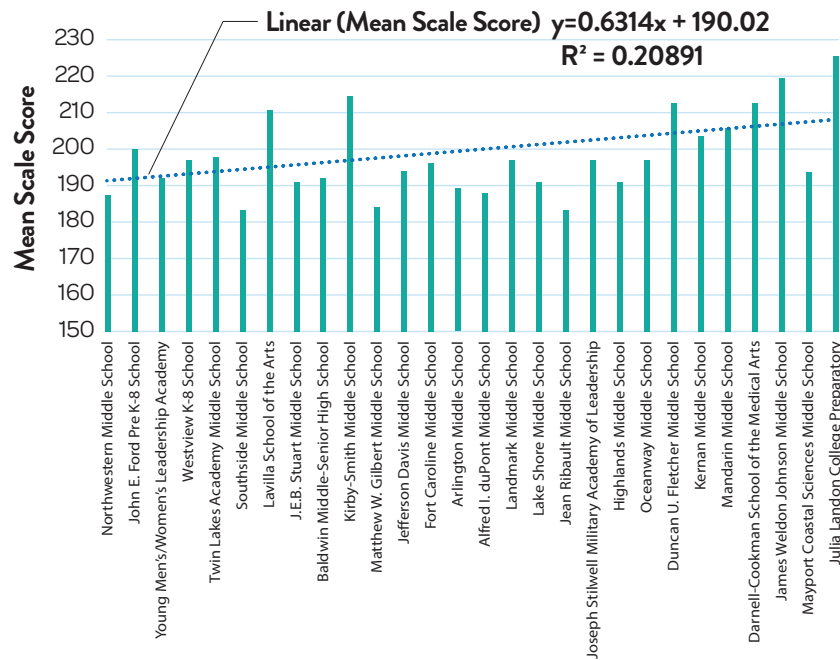
**Net Mean Scale Score: +3.42 points**
**Net Percent of Level 3 and Above +6.15%**

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## Grade 8 Science

### Schools Organized from Lowest Penda Usage to Highest with Mean Scale Score Plotted

**Penda Usage = (Number of Science Activities Mastered at 80%+)**

Linear (Mean Scale Score)  $y=0.6314x + 190.02$
$R^2 = 0.20891$



**Mean Scale Score** (y-axis: 150–230)

Schools (x-axis): Northwestern Middle School, John E. Ford Pre K-8 School, Young Men's/Women's Leadership Academy, Westview K-8 School, Twin Lakes Academy Middle School, Southside Middle School, Lavilla School of the Arts, J.E.B. Stuart Middle School, Baldwin Middle-Senior High School, Kirby-Smith Middle School, Matthew W. Gilbert Middle School, Jefferson Davis Middle School, Fort Caroline Middle School, Arlington Middle School, Alfred I. duPont Middle School, Landmark Middle School, Lake Shore Middle School, Jean Ribault Middle School, Joseph Stilwell Military Academy of Leadership, Highlands Middle School, Oceanway Middle School, Duncan U. Fletcher Middle School, Kernan Middle School, Mandarin Middle School, Darnell-Cookman School of the Medical Arts, James Weldon Johnson Middle School, Mayport Coastal Sciences Middle School, Julia Landon College Preparatory

**Penda Subscribing Schools:** 28 (Title I: 17 schools)

For those schools where students used Penda on average *less than 10 hours* **(goal)**, average mean scale score was 197.42 and average 2017 Percent of level 3 and above was 42.63%.

For those schools where students used Penda on average *equal to or more than 10 hours* **(goal)**, average mean scale score was 202.88 and average 2017 Percent of level 3 and above was 52.55%.
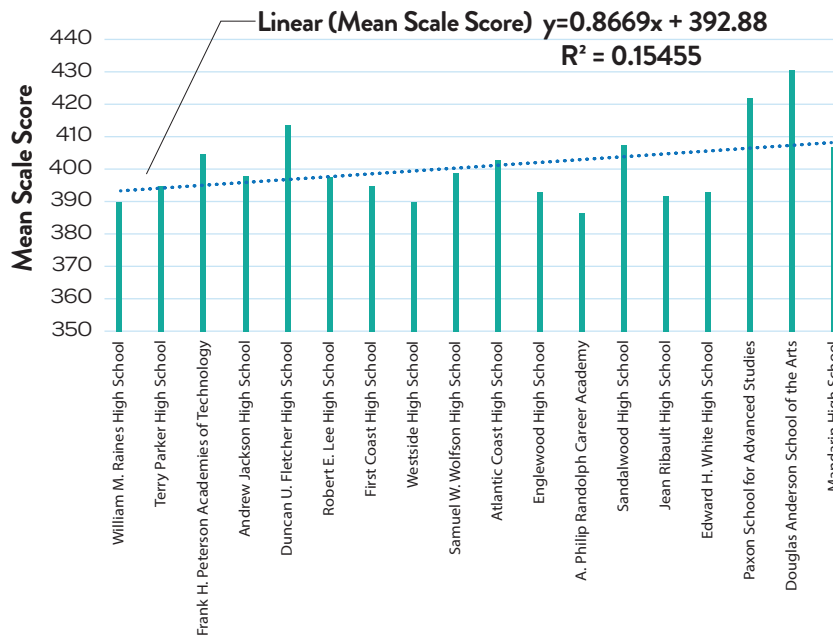
**Net Mean Scale Score: +5.46 points**
**Net Percent of Level 3 and Above: +9.92%**

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## High School Biology



**Schools Organized from Lowest Penda Usage to Highest with Mean Scale Score Plotted**

Penda Usage = (Number of Science Activities Mastered at 80%+)

Linear (Mean Scale Score)  y=0.8669x + 392.88

$R^2 = 0.15455$

**Penda Subscribing Schools:** 18 (Title I: 12 schools)

For those schools where students used Penda on average *less than 10 hours* **(goal)**, average mean scale score was 399.66 and average 2017 Percent of level 3 and above was 61.33%.

For those schools where students used Penda on average *equal to or more than 10 hours* **(goal)**, average mean scale score was 408.33 and average 2017 Percent of level 3 and above was 72.66%.

**Net Mean Scale Score: +8.67 points**
**Net Percent of Level 3 and Above: +11.33%**

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## ABOUT THE RESEARCHER

Dr. Brenda Conway is an experienced assessment and evaluation professional currently serving with Spotsylvania County Public Schools, VA. Dr. Conway independently examined Penda Learning usage metrics and student performance outcomes of 20,157 Duval County Public Schools students who were administered a mock high-stakes assessment (DCPS Grade 5 SSA, Grade 8 SSA, High School Biology EOC) in March/April 2018.

## ABOUT PENDA LEARNING

Penda Learning is an effective science intervention tool rooted in efficacy that supports Response to Intervention (RTI), data-driven instruction, and differentiated instruction. Built by educators for educators, Penda Learning creates standards-based content for grades 3–10 built on a highly engaging student gaming platform. Districts and schools partner with Penda Learning by providing their custom scope and sequence documents. Penda Learning's Pacing Assistance Service (PAS) automatically aligns standards-based activities to district/school scope and sequence without any effort needed by district or school staff. Penda Learning's PAS feature then automatically assigns activities to students weekly on the teacher's behalf. Students receive instant feedback as they complete activities, earning points that unlock gaming features, including customizing their avatar, challenging friends, and moving through virtual Penda Worlds. Teachers receive standards-based Class Mastery Reports weekly via emails automated by the Penda Learning platform. Reports are designed to help teachers proactively employ targeted intervention and remediation using Penda Learning intervention features/functionality.