



A4LE Learning **SCAPES**
2024
PORTLAND

Biophilic Design The Research, Design And Assessment

October 18, 2024

Speakers



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•Architecture

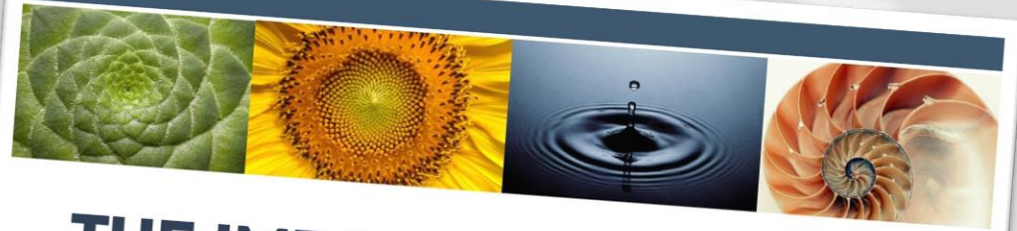




Agenda

- › Research
- › Application
- › Assessment

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THE IMPACT OF BIOPHILIC LEARNING SPACES ON STUDENT SUCCESS

Jim Determan, FAIA
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Valerie Caruolo, AIA
Hord Coplan Macht

October 2019

This study is a collaboration of Craig Gauden Davis, Morgan State University, The Salk Institute for Biological Studies and Terrapin Bright Green.

The purpose of this study is to examine to what extent the design of the physical learning space, enhanced with biophilic design, contributes to student stress reduction and improved learning outcomes for a middle school Math class at a public charter school in West Baltimore. The study presents findings of data collected from a biophilic classroom and a control classroom, where the physical design of each space varies—one is a traditional classroom while the biophilic classroom is enriched with views to nature, dynamic and diffuse daylight and biomorphic patterns. Data was collected by monitoring students' HRV (heart rate variation) as a measure of stress, comparing academic performance, student surveys, and student and instructor interviews.

CRAIG GAULDEN DAVIS

Architecture Planning Interiors



salk
Where cures begin.

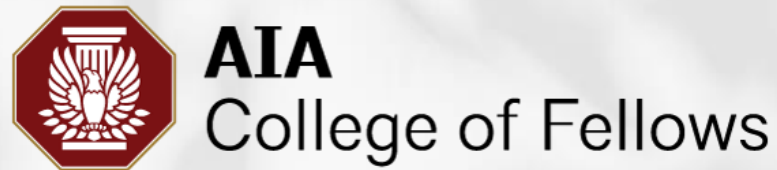
TERRAPIN
BRIGHT GREEN

Citation: Determan, J., Akers, M. A., Albright, T., Browning, B., Martin-Dunlop, C., Archibald, P., & Caruolo, V. (2019). The impact of biophilic learning spaces on student success. Retrieved from <https://cgdarch.com/wp-content/uploads/2019/12/The-Impact-of-Biophilic-Learning-Spaces-on-Student-Success.pdf>

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AIA Board Knowledge Committee

ACKNOWLEDGEMENTS

The Impact of Biophilic Learning Spaces on Student Success





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RESEARCH TEAM

The Impact of Biophilic Learning Spaces on Student Success



THE NATURAL WORLD TAPS INTO ORGANIZATIONAL PROPERTIES OF THE VISUAL BRAIN



15 EXPERIENCES OF NATURE

1. VISUAL CONNECTION W/ NATURE



2. NON-VISUAL CONNECTION W/ NATURE



3. NON-RHYTHMIC SENSORY STIMULI



4. THERMAL & AIR FLOW VARIABILITY



5. PRESENCE OF WATER



6. DYNAMIC & DIFFUSE LIGHT



7. CONNECTION W/ NATURAL SYSTEMS



8. BIOMORPHIC FORMS & PATTERNS



9. MATERIAL CONNECTION W/ NATURE



10. COMPLEXITY & ORDER



11. PROSPECT



12. REFUGE



13. MYSTERY



14. RISK/PERIL



15. AWE

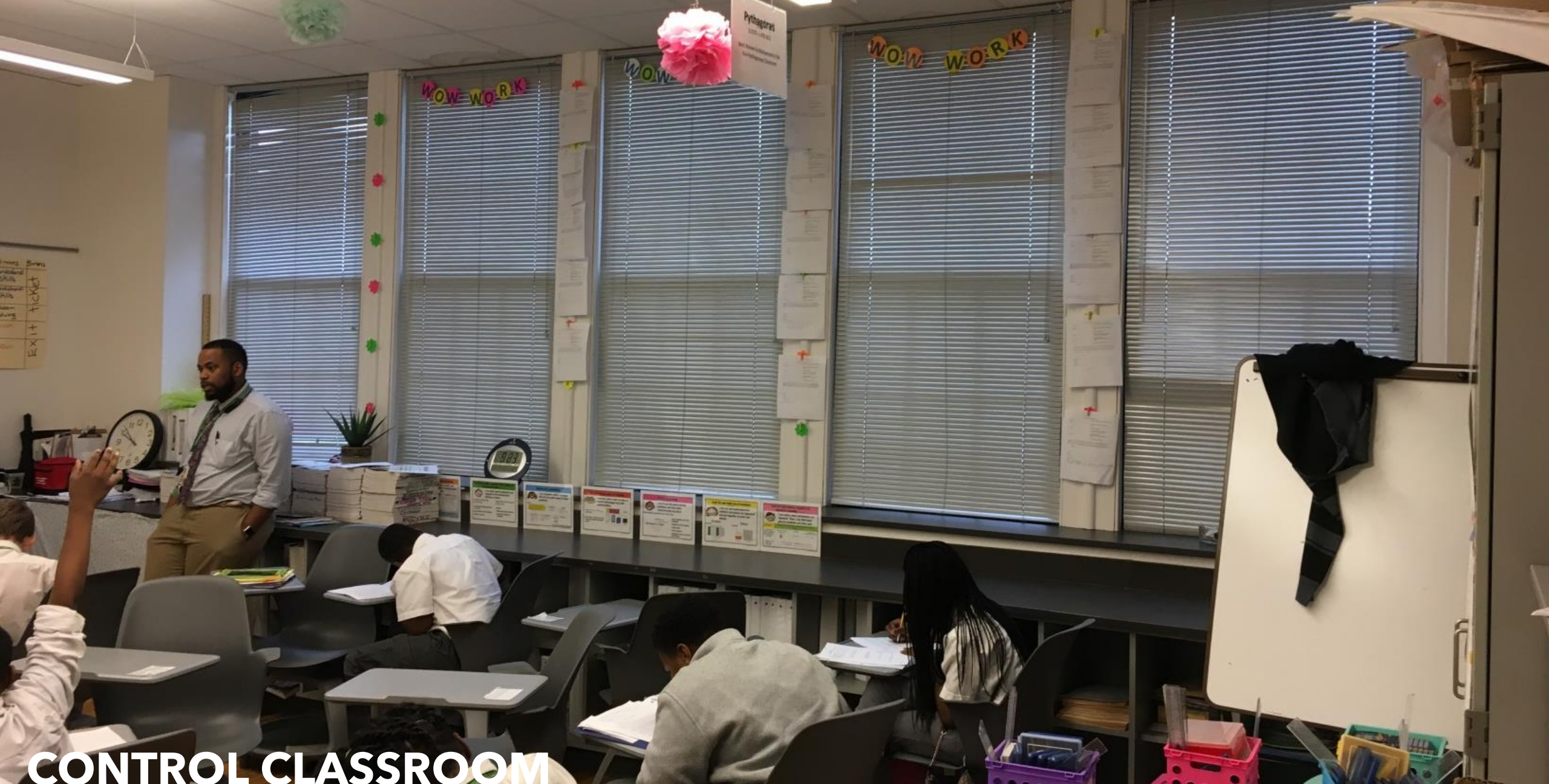




GREEN STREET ACADEMY

The Impact of Biophilic Learning Spaces on Student Success





CONTROL CLASSROOM

The Impact of Biophilic Learning Spaces on Student Success



Divide Decimals
 To divide by a decimal
 If the divisor is not a whole number, move decimal point to right to make it a whole number and move decimal point in dividend the same number of places. Divide as usual.

Multiply Decimals
 Multiply Decimal numbers as you would whole numbers then place the decimal point in the answer

Order of Operations
 P: Parentheses
 E: Exponents
 M: Multiply
 D: Divide
 A: Add
 S: Subtract

Archimedes
 Try MATH Language Frames

Area of a Rectangle
 $l \times w$
 $6\text{cm} \times 5\text{cm} = 30\text{cm}^2$

Perimeter of a Rectangle
 $P = 2l + 2w$
 $P = 2(6) + 2(5) = 22\text{cm}$

Finding Unknown sides when Given Area
 $A = l \times w$
 $48 = l \times 4$
 $12\text{cm} = l$

Finding Unknown Sides when Given Perimeter
 $P = 2l + 2w$
 $18 = 2(5) + 2w$
 $8 = 2w$
 $4 = w$

Area of a Parallelogram
 $A = b \times h$
 $b = 12\text{cm}$
 $h = 5\text{cm}$
 $A = 12 \times 5 = 60\text{cm}^2$

Area of a Trapezoid
 $A = \frac{1}{2}(b_1 + b_2) \times h$
 $A = \frac{1}{2}(10 + 14) \times 5 = 62.5$

Area of a Triangle
 $A = \frac{1}{2}bh$
 $b = 8\text{cm}$
 $h = 6\text{cm}$
 $A = \frac{1}{2} \times 8 \times 6 = 24\text{cm}^2$

Finding the unknown side when given Area of triangle
 $A = \frac{1}{2}bh$
 $32 = \frac{1}{2} \times 8 \times h$
 $32 = 4h$
 $8 = h$

Today I: Working with dependent and independent variables

So that I: Recognize that a change in independent variable causes a change in dependent variable

I'll know: I can recognize the dependent and independent variable in the following
 Taylor's computer can download movies at a rate of 16.2 megabytes per minute

Math Vocabulary:
 Plus: Add, Total of, Sum
 Minus: Subtract, Take Away, Decrease By, Fewer, Minus, Less, Difference
 Multiply: Times, Product
 Divide: Divided, Divided By, Per

FREE CHOICE
 You are FREE to choose... NOT FREE TO...
 CONSEQUENCES OF CHOICE

CONTROL CLASSROOM

The Impact of Biophilic Learning Spaces on Student Success





BIOPHILIC CLASSROOM

The Impact of Biophilic Learning Spaces on Student Success



- 1. Stress (Heart Rate Variability)**
- 2. Student Survey**
- 3. Student/ Instructor interviews**
- 4. Learning Outcomes**



ASSESSMENT





"It's like a nice bright light, so it gives me a more purpose to learn, knowing that I'm in a good environment. I'm sitting by the light so it's better for me to understand and I'm more comfortable in the classroom."

- Shavon



"Along with the floors, the lighting and stuff, it just makes it easier for me to focus more and get back into what I'm doing."

- Kendall



"Well, the windows are solar panel. Now would be like cool if you do that for every classroom. It's cool. They relax you. Because with the light of the sun makes you concentrate better, Instead of having regular lights".

"...the ceiling has like little-- it's look like waves...that makes me feel good..."

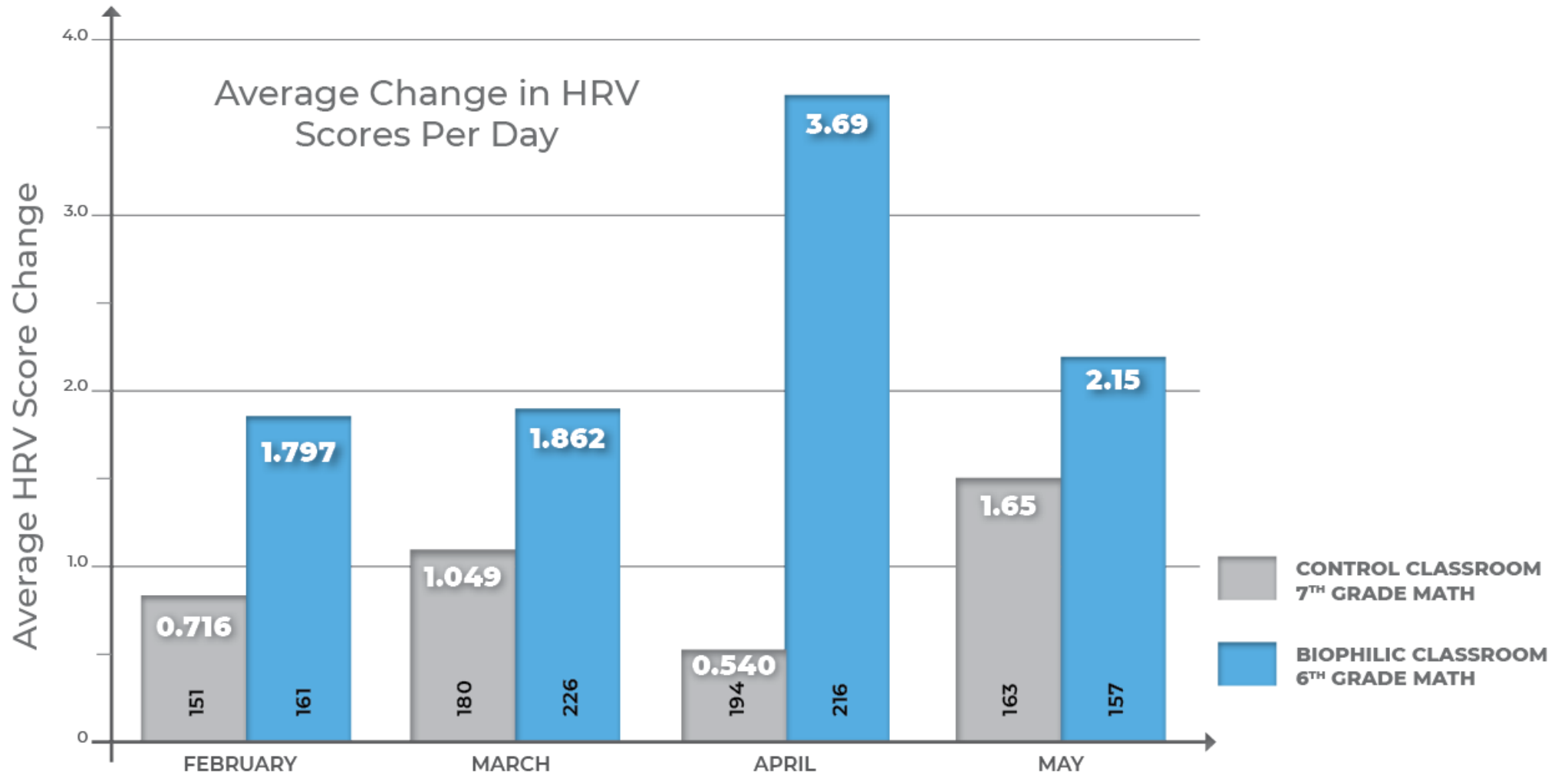
- Kervin



HRV TESTING

The Impact of Biophilic Learning Spaces on Student Success





STRESS REDUCTION

The Impact of Biophilic Learning Spaces on Student Success



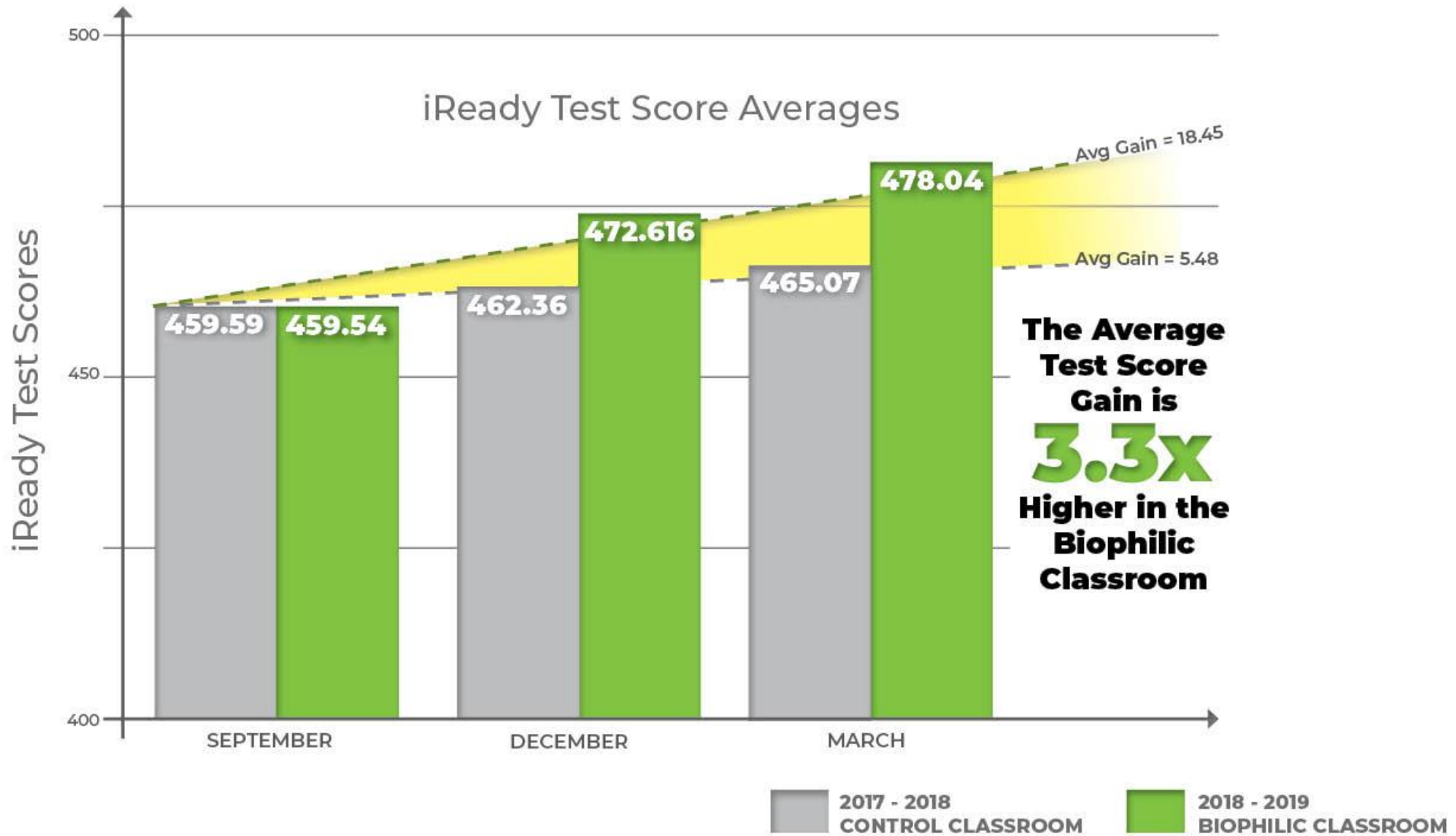


Adaptive Assessment Test
that gives a picture of
student performance and
growth

LEARNING OUTCOMES

The Impact of Biophilic Learning Spaces on Student Success





LEARNING OUTCOMES

The Impact of Biophilic Learning Spaces on Student Success



Download the full research report



Jim Determan, FAIA
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The Application

Bethel-Hanberry Elementary School



Richland School District Two

Bethel-Hanberry Elementary School



Solar Orientation



Biomorphic Shapes



Prospect



Dappled Light



Refuge | Prospect



Learner-Centered Learning



Views to Nature



Awe

What is the Impact?
Collaborative Process
Survey Data
State Data
Personal Interviews

Interview Video

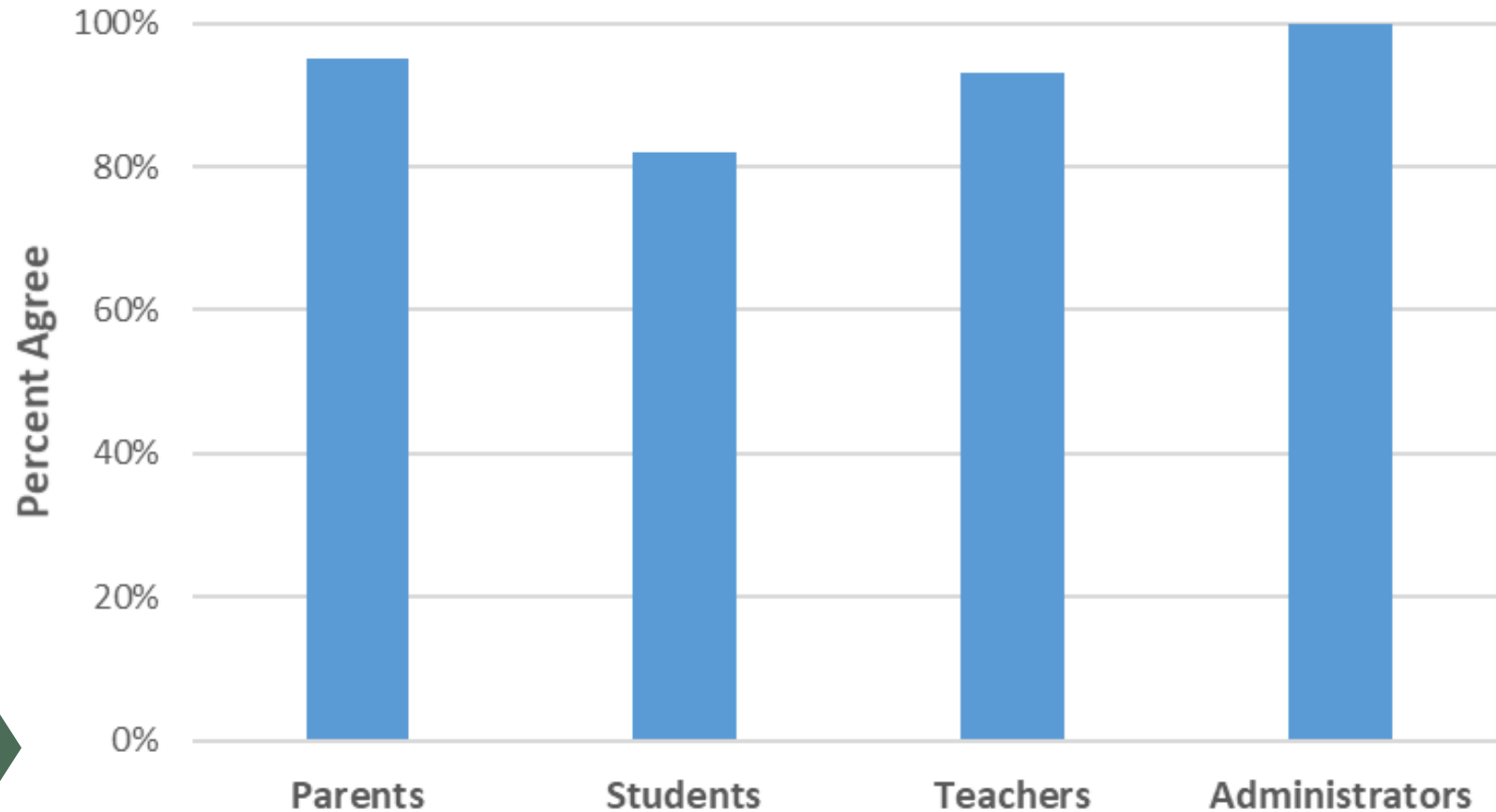
The use of biophilic design elements contributes positively to the learning and teaching environment.

98%

of teachers agree “the building design fosters a sense of wonder and curiosity.”

90%

of parents agree they like how “the new school feels connected to nature.”



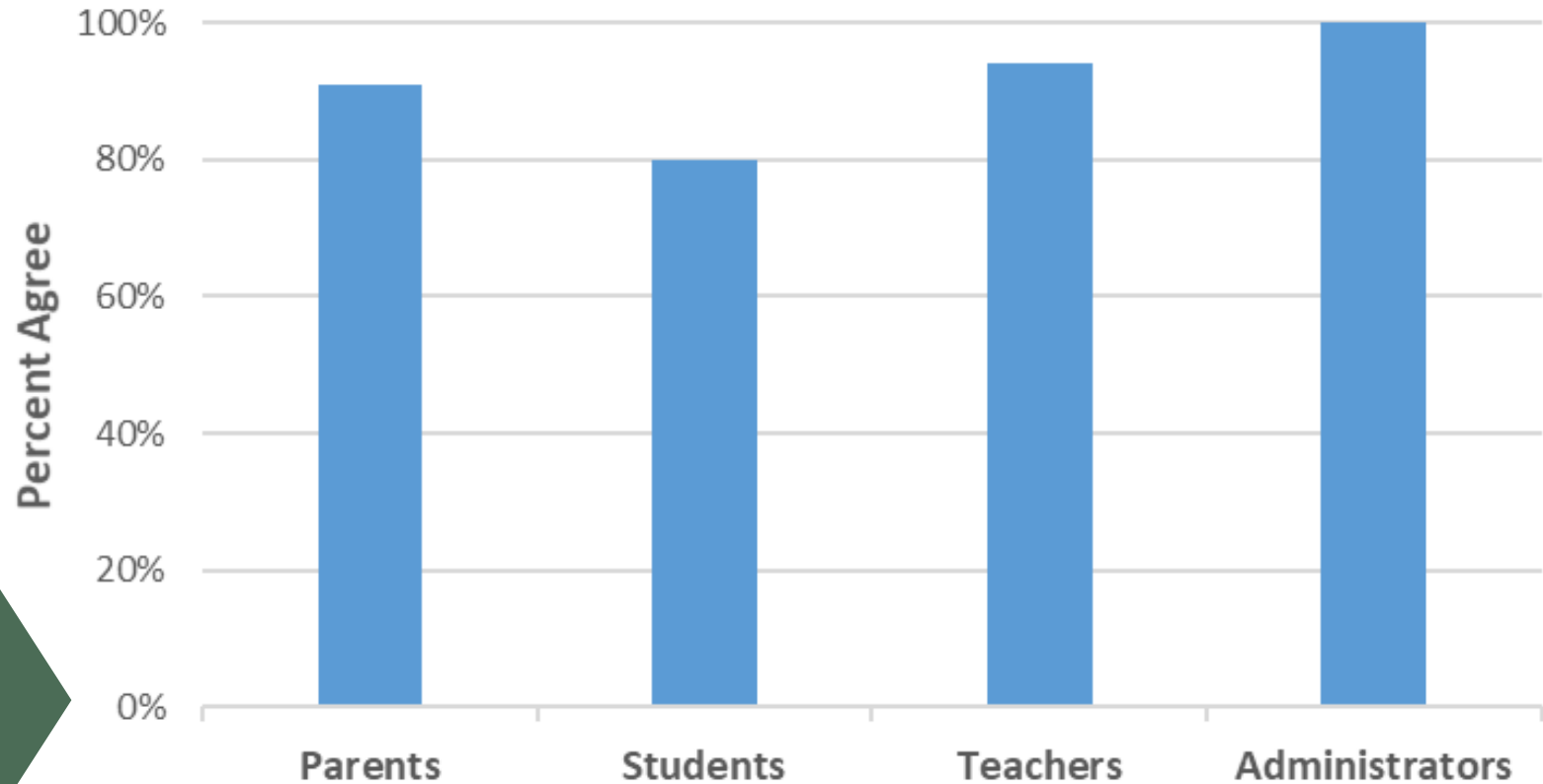
The school design is student-centered, offering flexibility in spaces and approaches, contributing positively to the learning and teaching environment.

88%

of students agree "I like having space outside of my classroom to work together with my classmates."

98%

of teachers agree "the new school facilities facilitate improvement(s) in student learning."



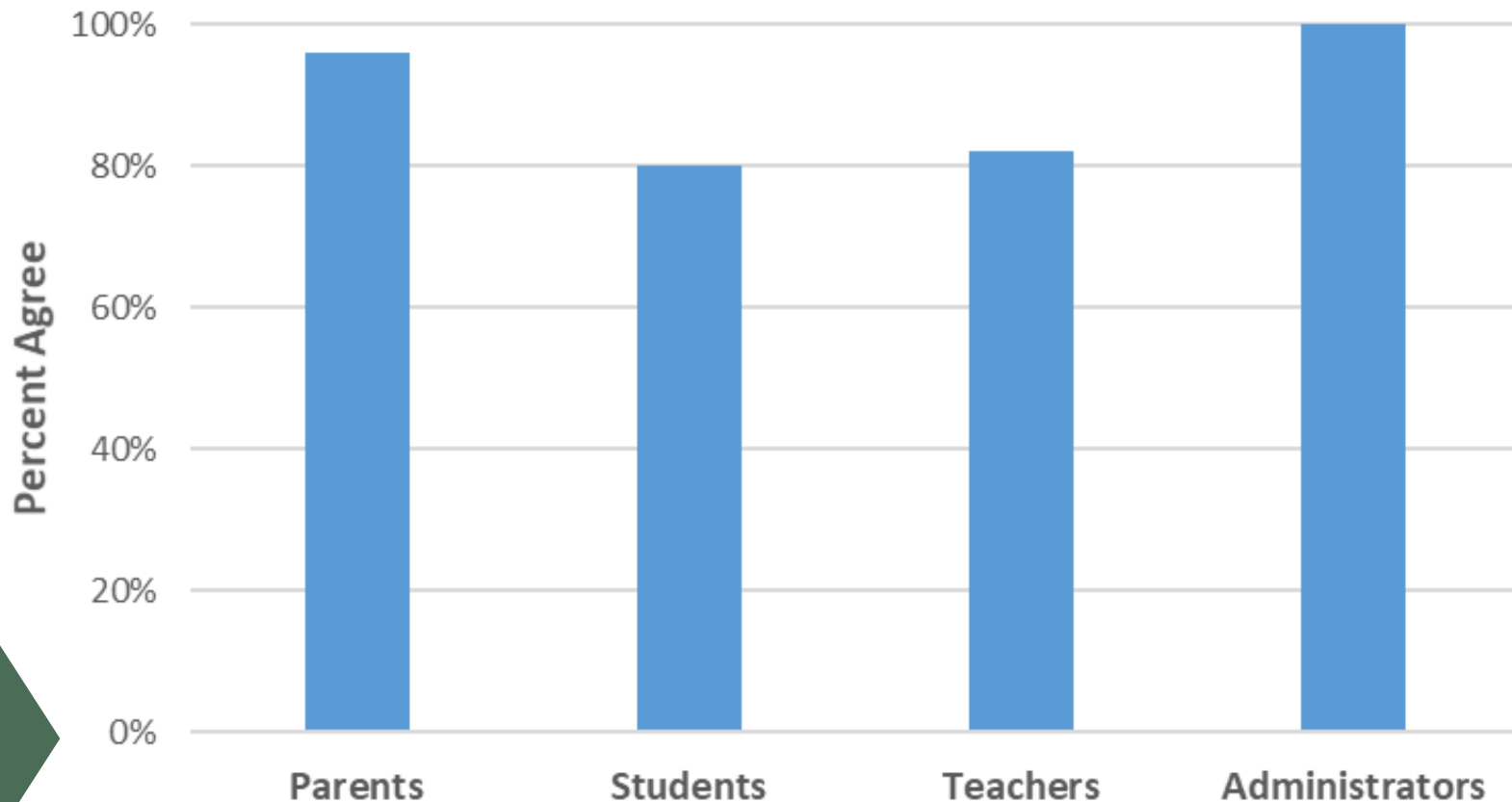
The school design contributes positively to safety and security in the learning environments.

100%

of administrators agree “the safety and security measures have helped to create a safe and secure learning environment.”

95%

of parents agree “I feel that my child(ren) is(are) safe in the new school.”



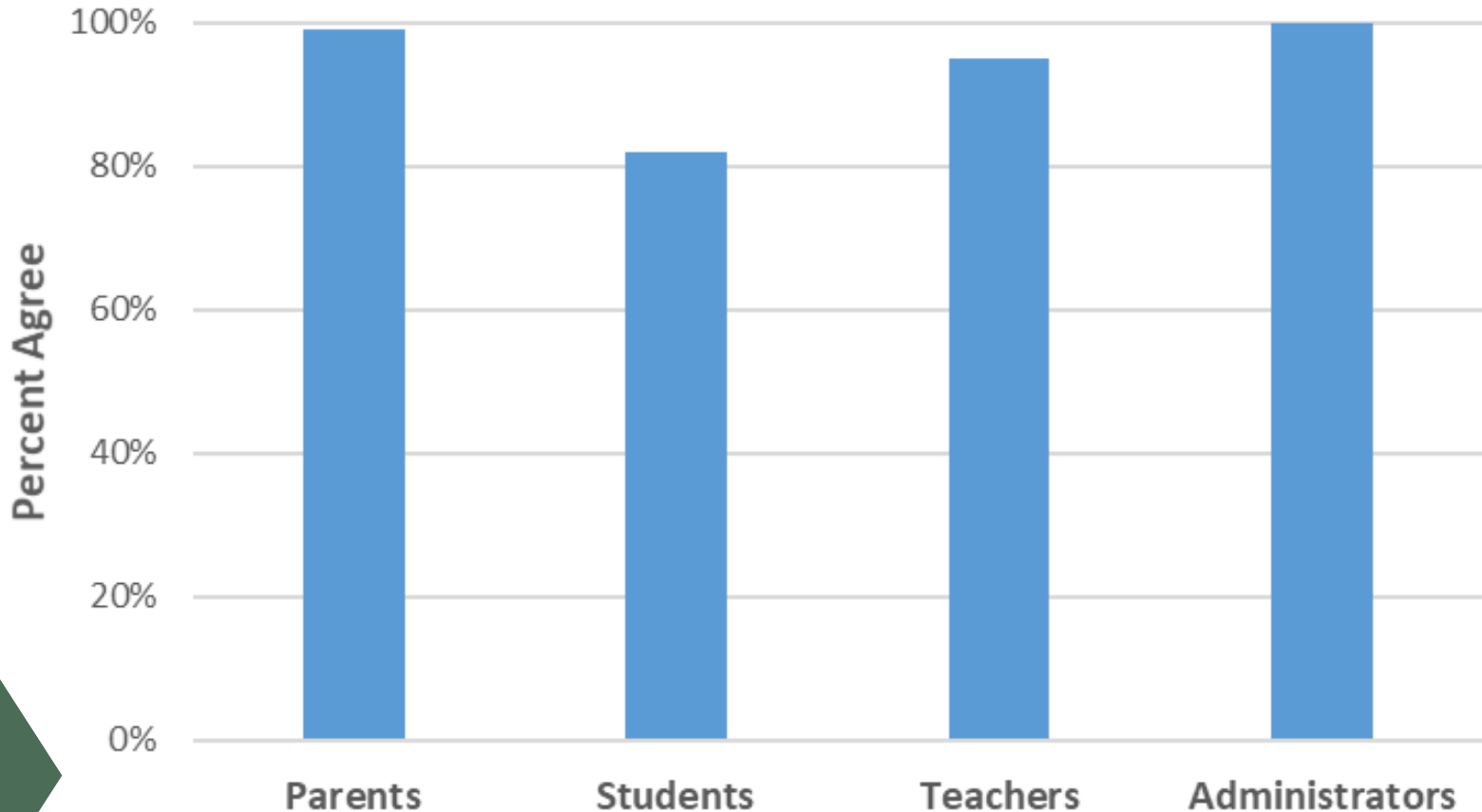
The school design contributes positively to student well-being and belonging.

98%

of teachers agree “the colors in the school promote a positive learning environment for the students.”

100%

of parents agree “I feel welcome in the building.”

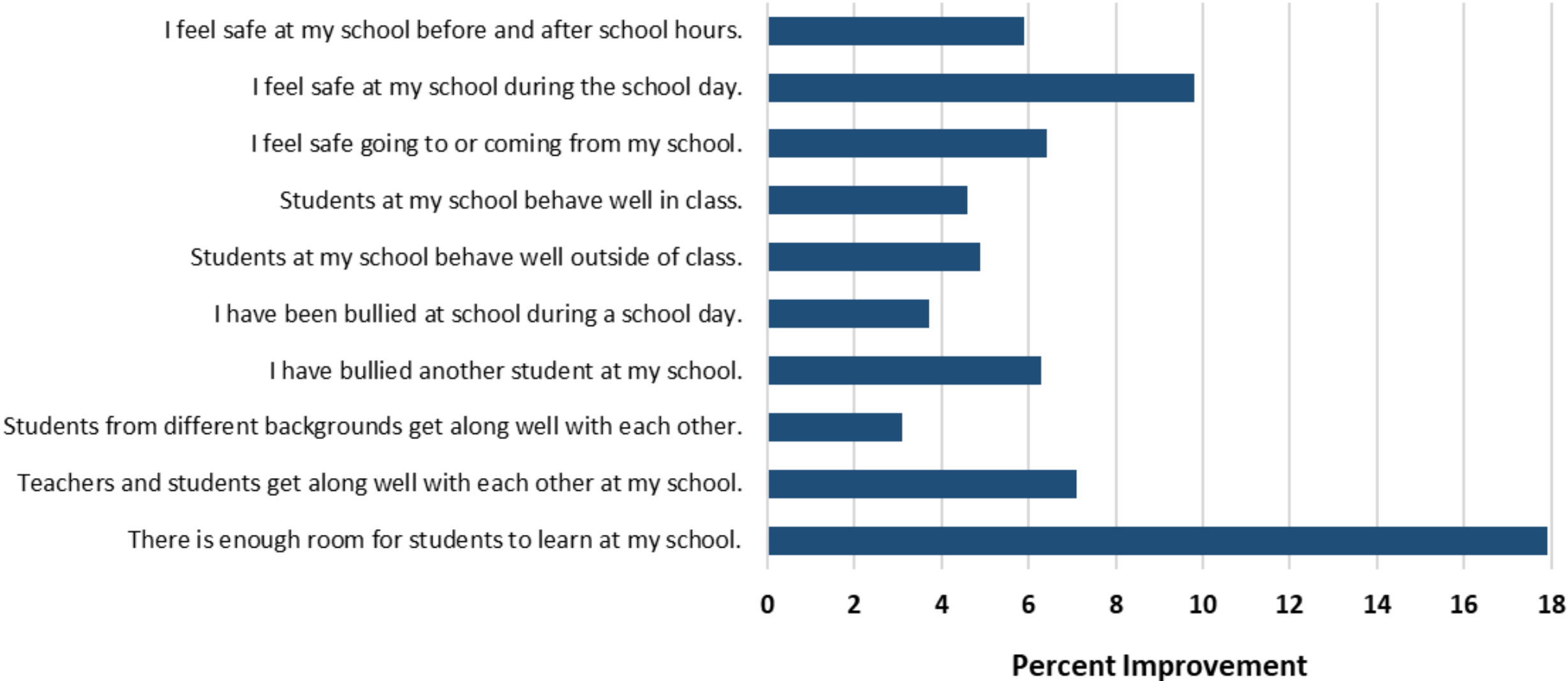


”
We accomplished everything we intended and more than we hoped.

Students feel like this is a school that was designed for them to get whatever they need and learn how they learn best.”

”Every day when I’m walking through the halls it feels like I’m walking under trees when the sun comes through. There is a little reflection on the floors and I jump in the sunlight because I like playing in nature.

State Climate Survey - Safety and Behavior





Teacher Retention

BHE experienced among the highest increases in teacher retention of the 24 elementary schools in the district.

Districtwide teacher retention increased from 81.2 % to 81.9%

↑ **10x**
Retention

BHE teacher retention from 83.7% to 91.5% from prior year.

Absenteeism

5%

REDUCTION

BHE tied for having the greatest reduction in chronic absenteeism, from 17.3% to 12.3%.

SC Dept. of Education reports that Chronic Absenteeism was 14% before COVID and 24.73% for the 2021-2022 school year.

Student Behavior

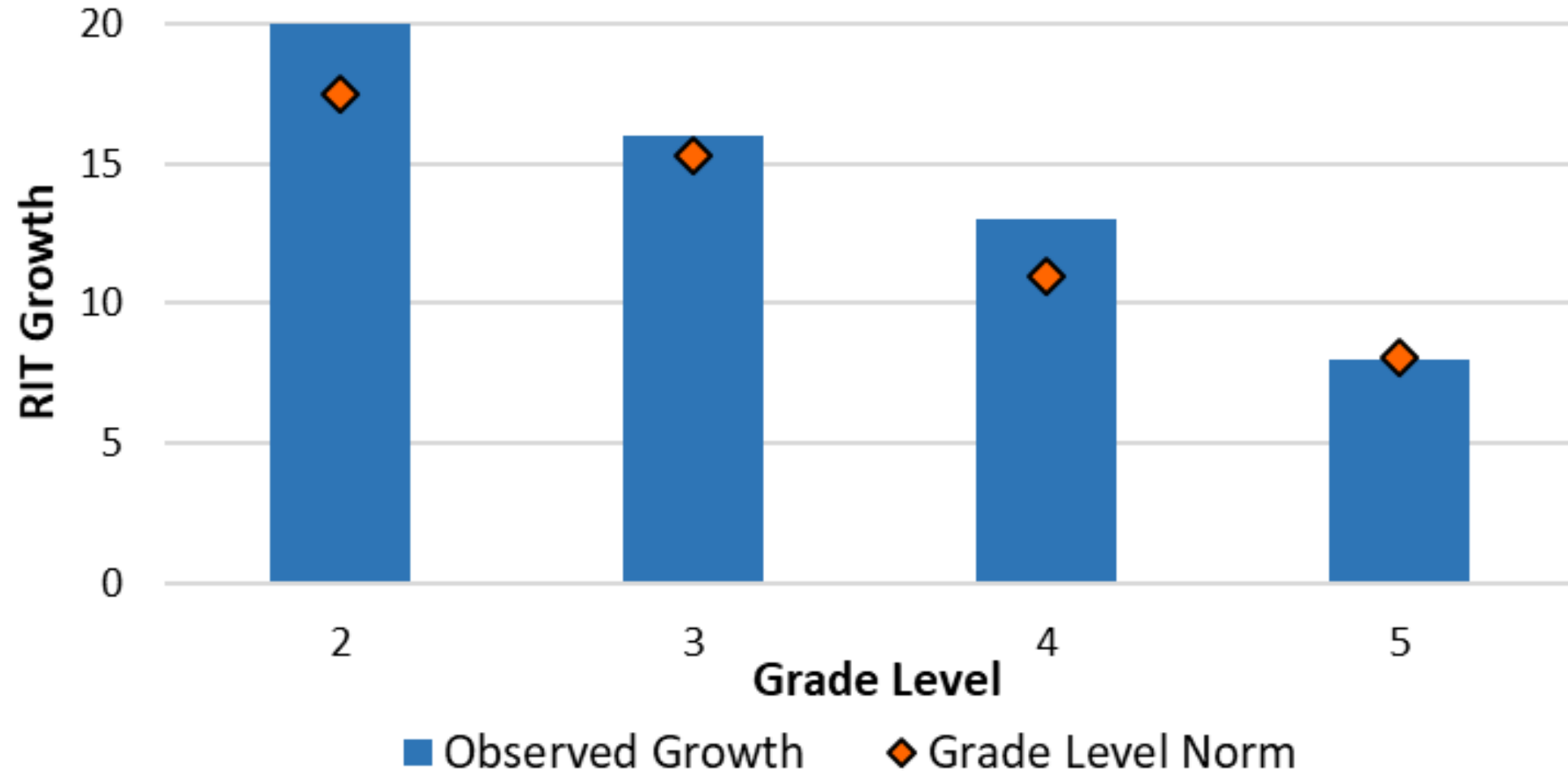
Out of school suspensions went from

22 down to **17**

“There's been a decrease in the in the overall number of referrals and the intensity of the infractions. I think the sense of calm that's promoted throughout the building makes a difference. And I think it manifests in the behaviors that we do and do not see.”

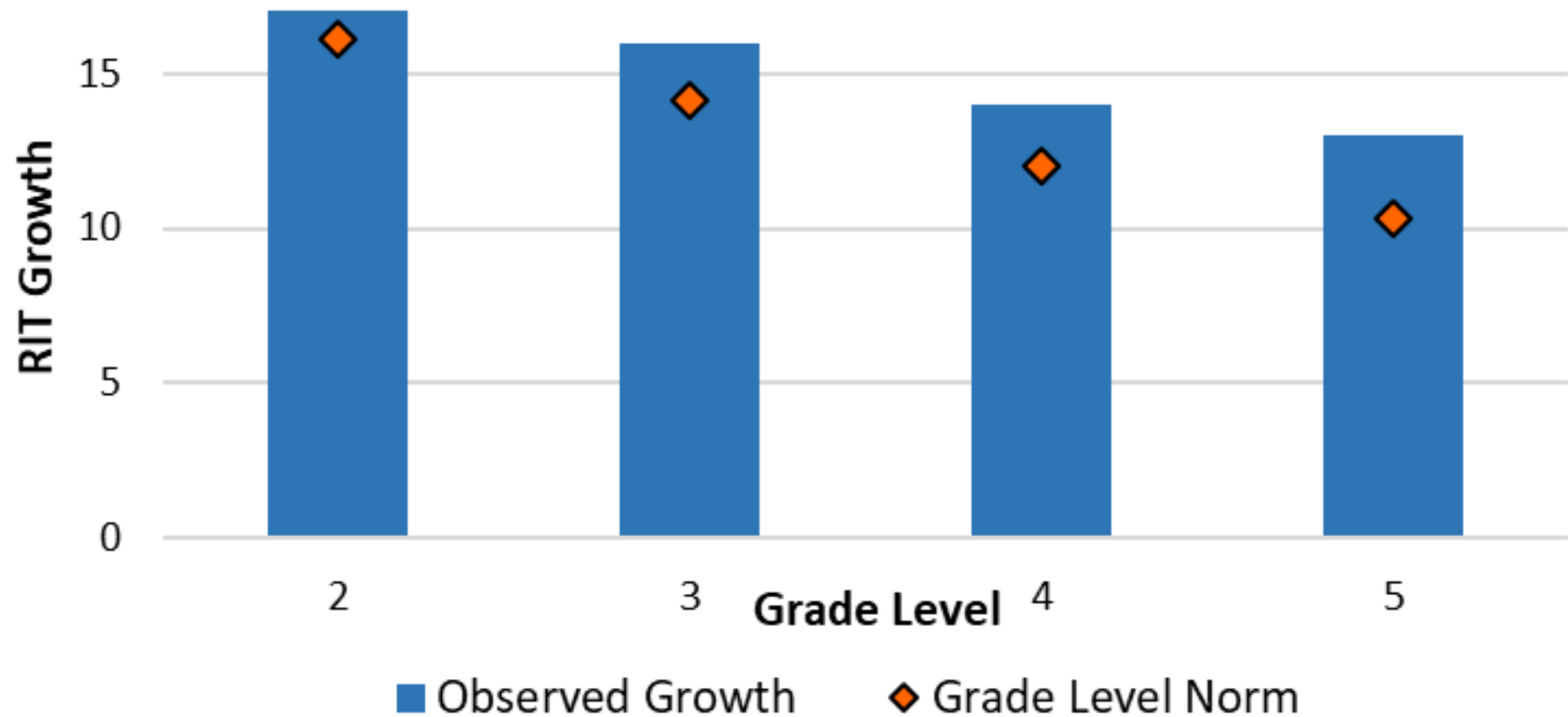
- BHES Assistant Principal

MAP Test - Language Arts: Reading Performance 2022-23 vs. 2021-22



MAP Test - Math Performance

2022-23 vs. 2021-22





↑ 2%

on the
SC Ready
Assessment

“The academic performance improvement the first year in the new school was “fantastic and highly motivating!”

It is amazing that we met all and exceeded seven of eight growth projections on MAP.

This is a great accomplishment which we celebrate and are energized to continue.”

- BHES Principal

Where did we see improvement?

- ✓ Student Achievement
- ✓ Mental Health
- ✓ Safety
- ✓ Well-being



Download the full research report



Design@cgdarch.com

THANK YOU

CRAIG
GAULDEN
DAVIS

• Architecture

