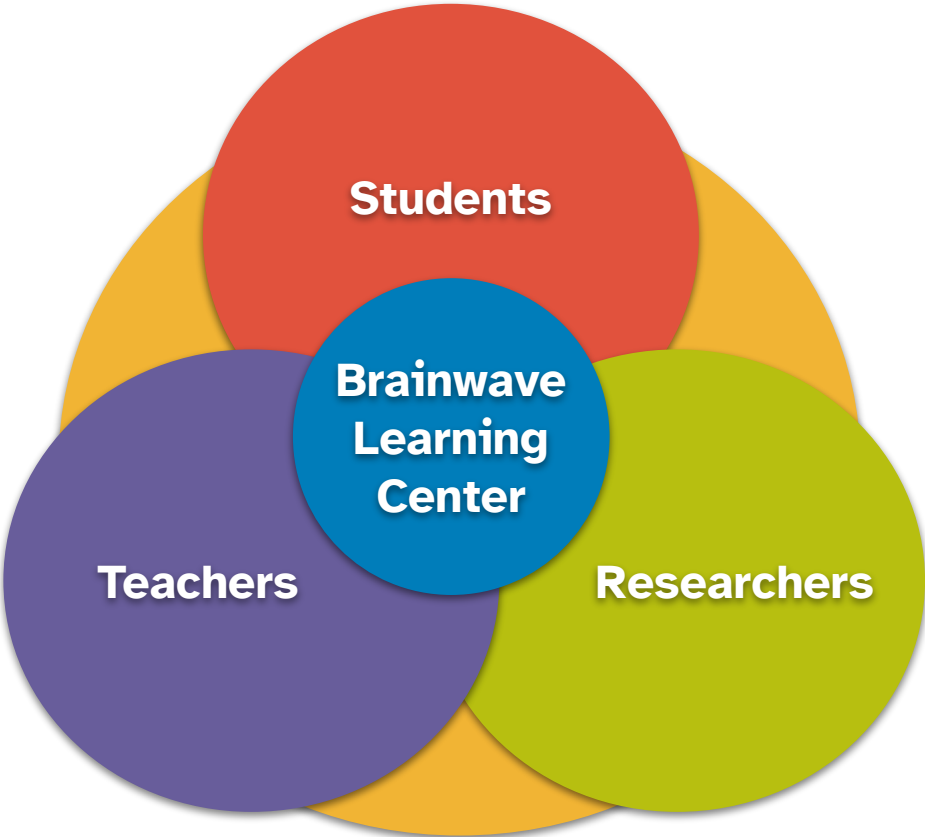


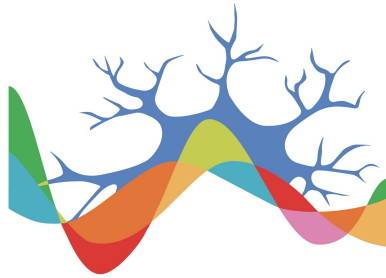
The Brainwave Learning Center

A Research-Practice Partnership in Educational Neuroscience









BRAINWAVE
LEARNING CENTER
Stanford University
@synapseschool



Liz Toomarian, PhD
Director



Radhika Gosavi, PhD
Assoc. Director



Ailey Crow, PhD
Research Specialist

Educational Neuroscience Initiative

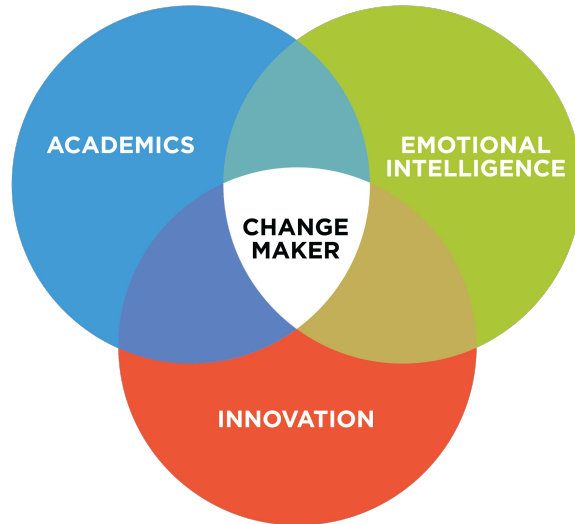
- Housed in Stanford University's Graduate School of Education
- Typical research lab structure
- Linking school-based educational innovation with advances in the neuroscience of emerging math and reading
 - Visual word recognition
 - Audio-visual integration
 - Math skills



Prof. Bruce McCandliss
Director, Stanford
Educational Neuroscience
Initiative (SENSI)

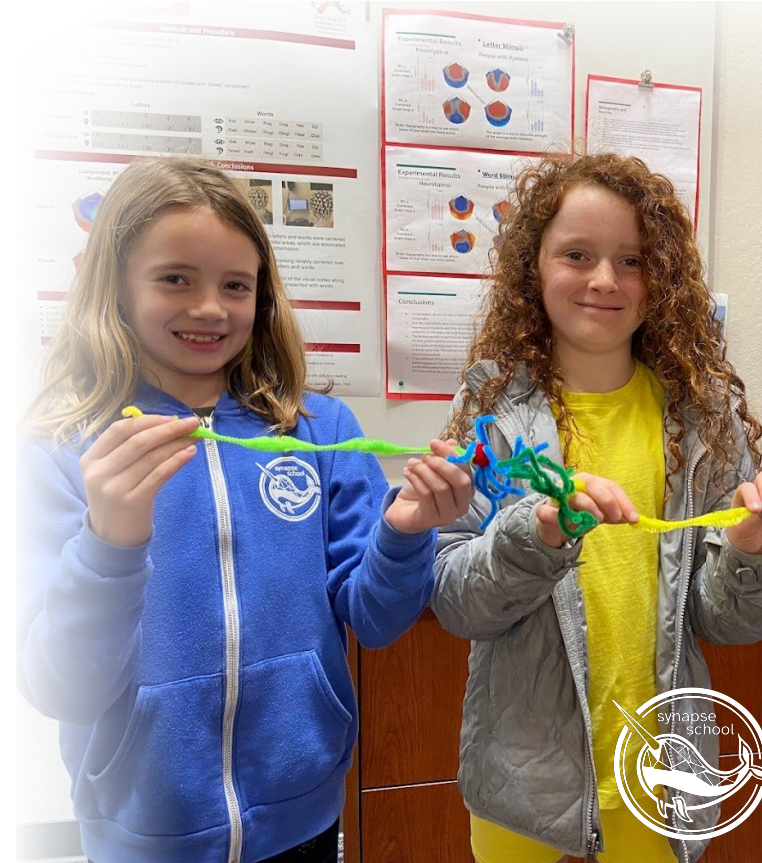


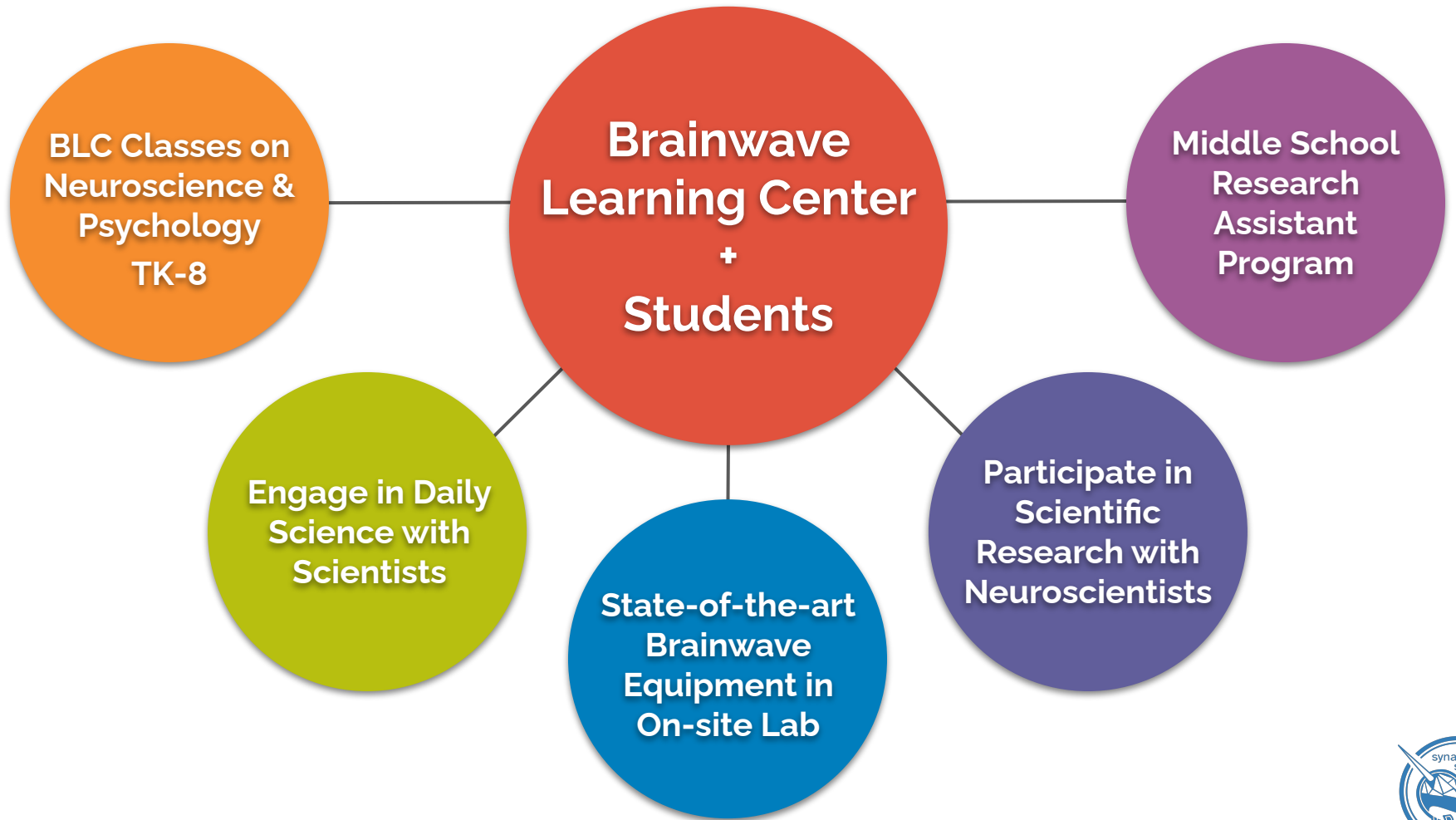
- Independent, TK-8 school, ~310 students
- Educating a community of change makers
- Project-based learning, SEL, innovation
- Mixed grade levels; no grades, no high-stakes tests
- Located in Silicon Valley



BLC Goals

- Forge new partnerships between learners, teachers, and researchers
- Explore how brain activity is transformed through learning experiences AND how insights into our brainwaves can enrich how we experience education
- Inform evidence-based educational interventions for learning differences
- Inspire a sense of awe and wonder around the brain and neuroscience



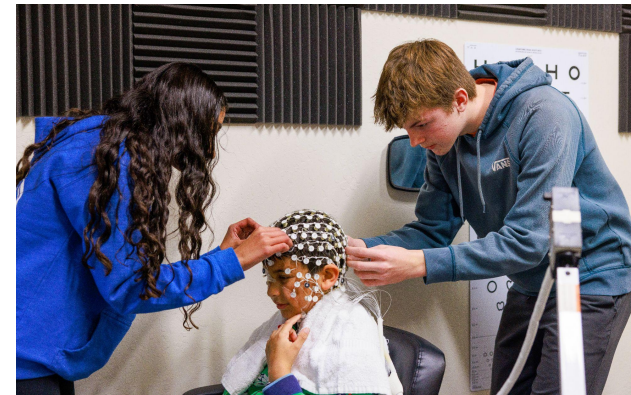




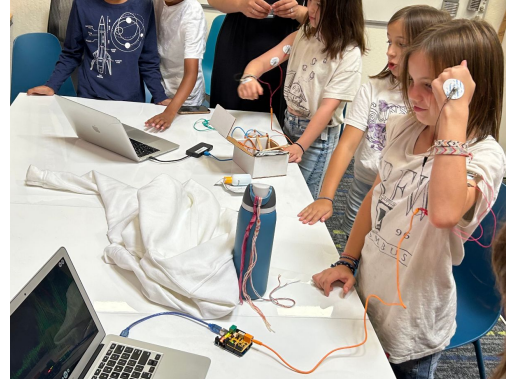
TK-8 BLC Classes on Neuroscience & Psychology

Middle School Research Assistant Program

Brainwave Lab Onsite Engage in Scientific Research with Neuroscientists



BLC Elective for all 5th Graders



All 5th graders have a trimester class with the BLC. Students ...

- Learn about electrical signals in the brain
- Use BCI (Brain Computer Interface) technology to explore their own brainwaves
- Design and build their own brainwave-controlled devices!



Middle School Research Assistant Program

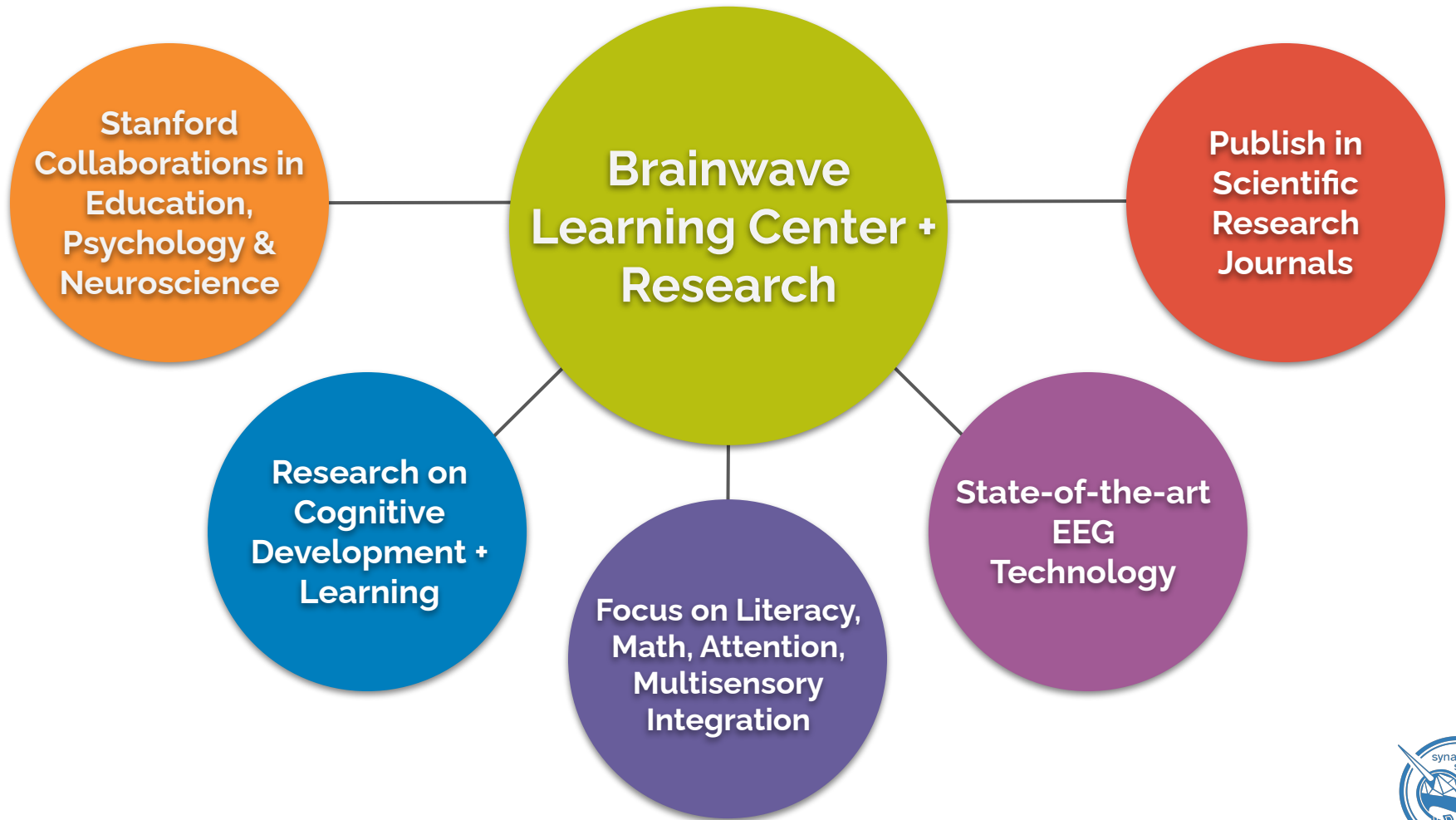
Program Pillars

- 7th & 8th grade students
- 1-2 year program
- 10 students '24-'25
- Development of students as researchers



Gosavi & Toomarian, 2024





Co-creating with students & teachers

- Everyone has a “seat at the table”
- Based on built relationships & trust
- Students and teachers actively involved in the research process
- Student and teacher knowledge shapes and contextualizes research questions and approaches



Research Studies

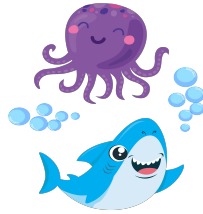
Magic Words Study Fall 21 & Spring '22



How does two weeks of in-class learning help our brain change when we learn new vocabulary?

1st & 2nd grade
3rd & 4th grade

Deep Sea Spellers Fall '23



What strategies lead to successful spelling in English?

1st & 2nd grade

Tides in Engagement Spring '24



Can a few weeks of classroom experience change how students listen to narratives?

7th & 8th grade

FRAME Fall '24 & Spring '25



The **FRAME** Study
Focusing on Real-life
Attention using Mobile EEG

How does attention work in classroom learning environments?

5th & 6th grade



Classroom-based activities

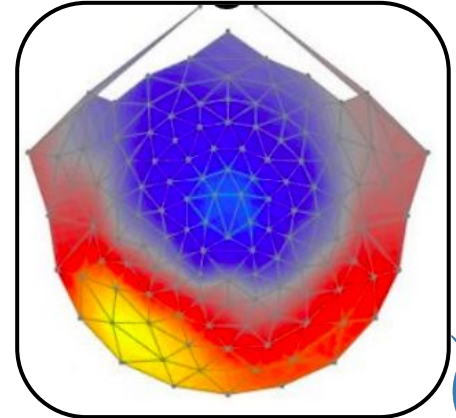
- Paper-and-pencil or iPad based tasks
- Observing behavior on these tasks to understand learning and development
- Intertwined with educational experience



Our In-School Lab: EEG

Electroencephalography (EEG)

- Safe and non-invasive
- Sensors lightly rest on the scalp, capture naturally-occurring electrical activity (brainwaves)



How do students split their attention between sounds and sights?



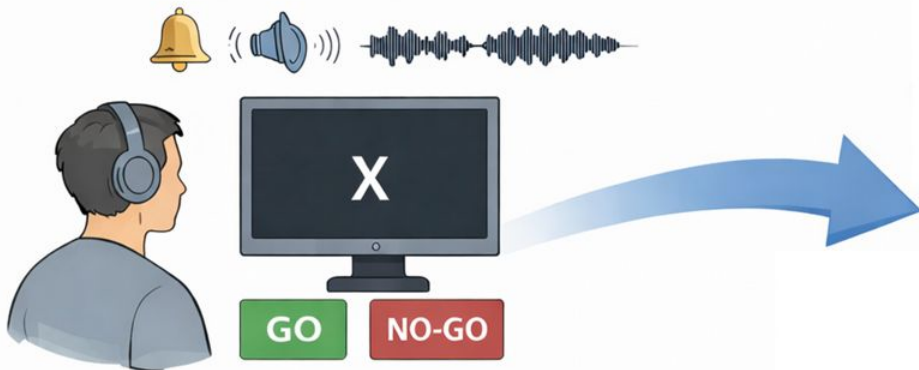
Dr. Adi Korisky

Postdoc, SENSI, Stanford University





Study 1: Examining in-lab attentional dynamics during learning

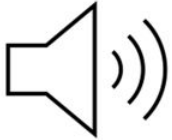


Translational Approach



**Students learning in THEIR own school,
from THEIR own teacher, about things
that are truly relevant to them**

Learning by Looking Vs. Learning By Listening



“Let me tell you about Steve McCurry, a famous photographer who was born in Philadelphia, Pennsylvania, in the United States. Steve McCurry is renowned for his stunning photographs that capture the rich and vibrant cultures of people...**listen carefully now**, one of his most famous photos is called “Afghan Girl,” which features a young girl with piercing green eyes...”



+



Ansel

+

Adams

+



Learning Outcomes

Which of these pictures was taken by
Steve McCurry

1



2



3



4



- Picture matrices
- Confidence level
- **Verbal description** of photography style (0-3)

“Uhhhh, he took pictures with colors... focus on culture and portraits.”

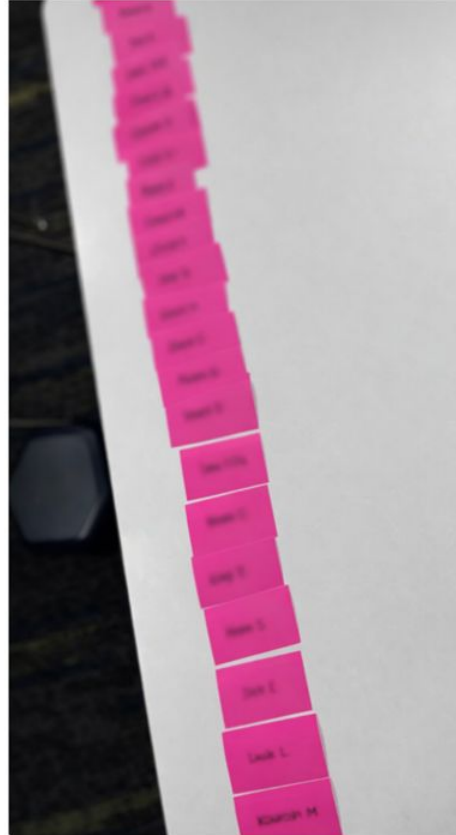
“show stuff from other places.”



Insights from Our Co-Creator Teacher

Highest rating

- Kids who typically show **body language** in class that they are listening (looking at me, not wobbling around, not side talking much)
- Kids who **process instructions** and can then go do the thing, don't ask questions about instructions already given
- Kids who show **stronger memory** recall and talk about information previously discussed don't need as many tools to remember what to do (i.e. written checklist) or remember to use those tools on their own if they do
- Appear intrinsically **motivated to learn and do well** – put more depth/care into projects/work

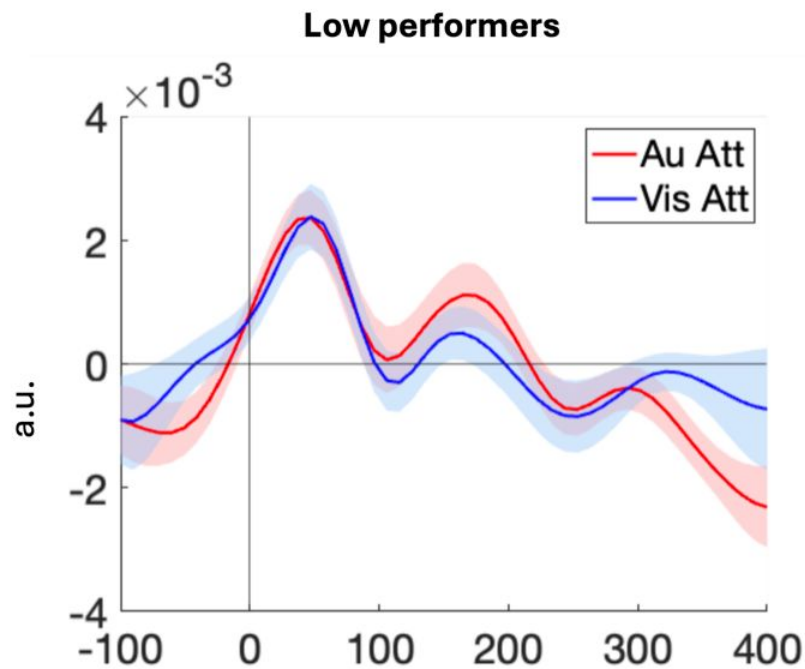
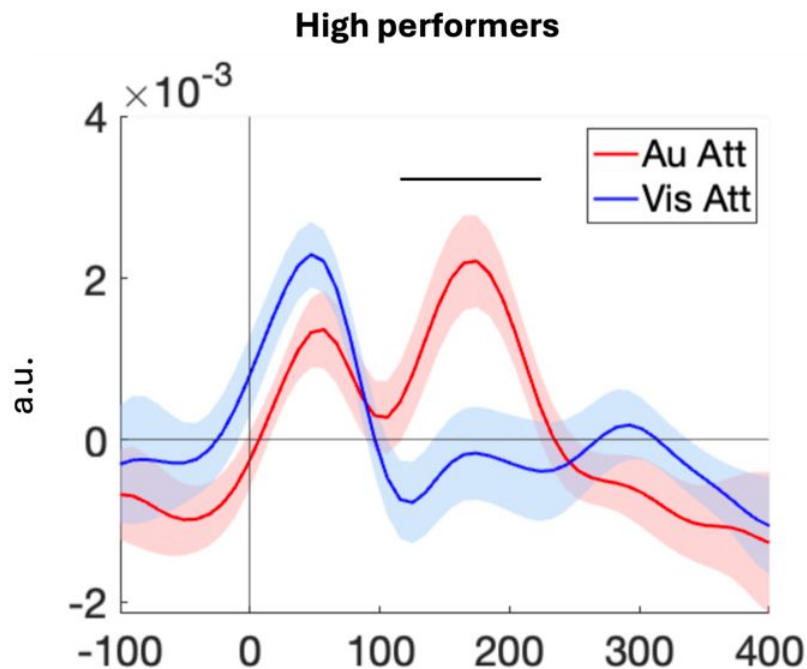


Predicts **HIGH** chance of succeeding in the task




Predicts **LOW** chance of succeeding in the task

TRF Results – Encoding - Fz (model):



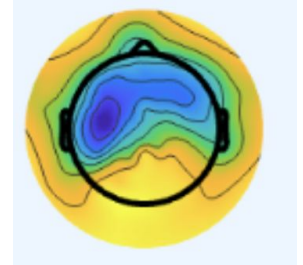
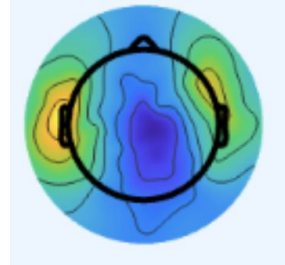
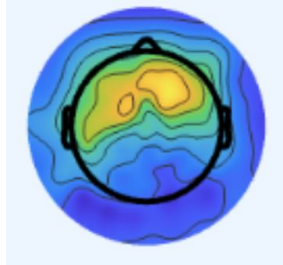
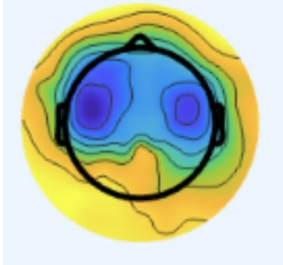
High performers are able to flexibly switch attention between informational streams!

Auditory Attention: *Consistent but Different Strategies*

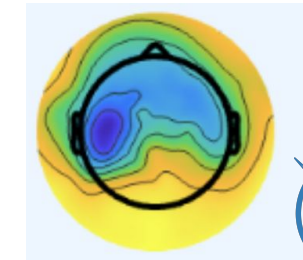
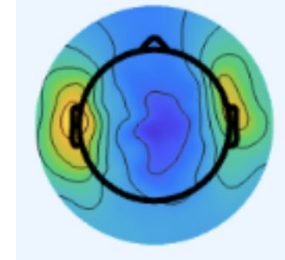
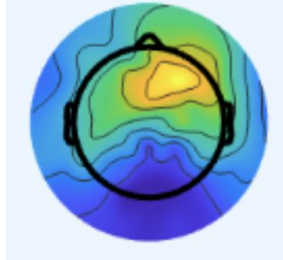
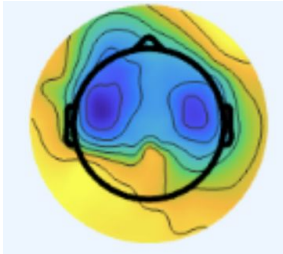
 *Ba-Bo*

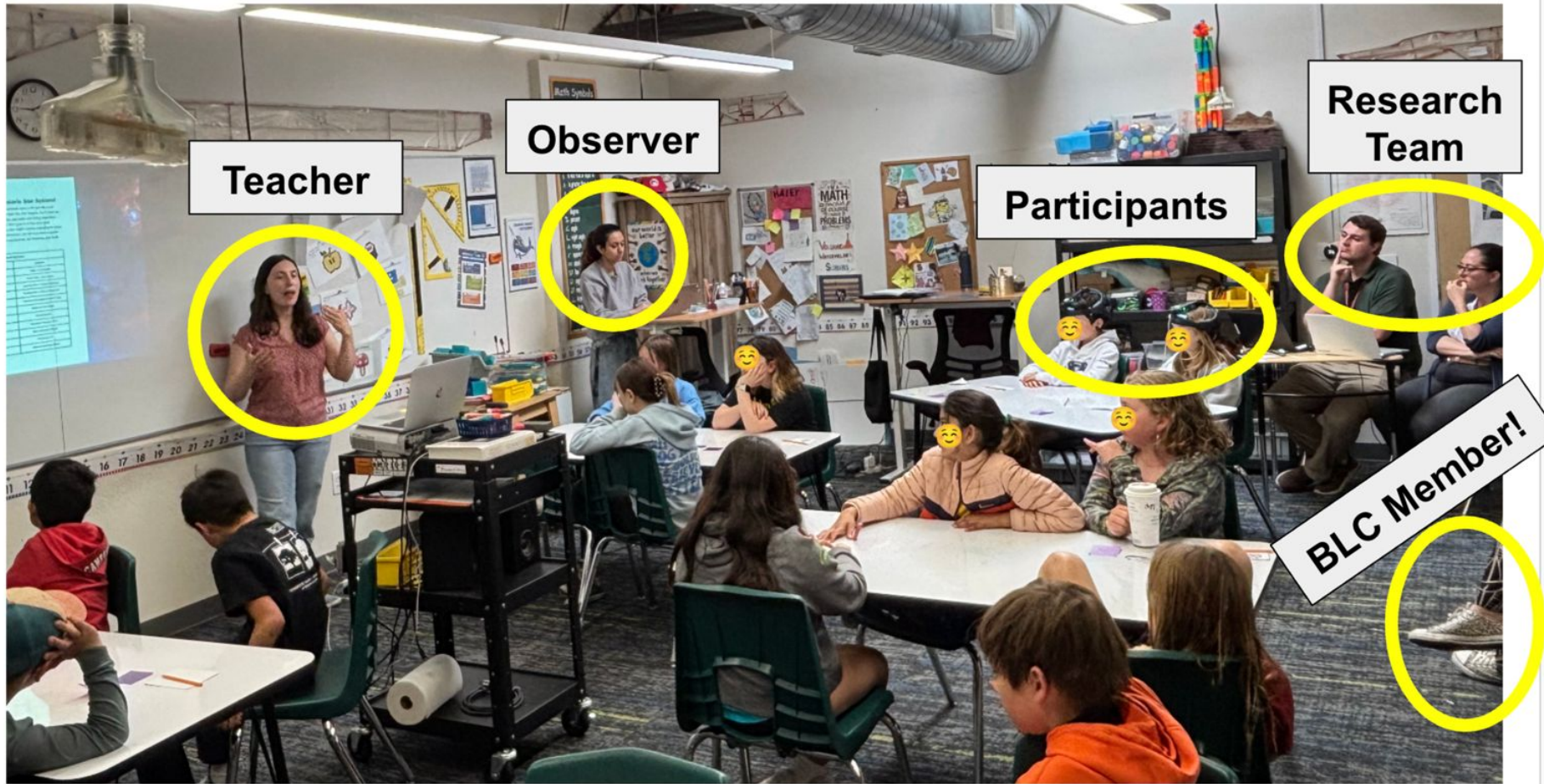


Session 1



Session 2





Teacher

Observer

Participants

Research Team

BLC Member!



**MIND, BRAIN,
AND EDUCATION**

Commentary

Impacts of Involving Young Learners in Mind, Brain, and Education Research

Radhika S. Gosavi , Elizabeth Y. Toomarian

First published: 05 May 2024 | <https://doi.org/10.1111/mbe.12412>

RESEARCH ARTICLE

Developmental Science

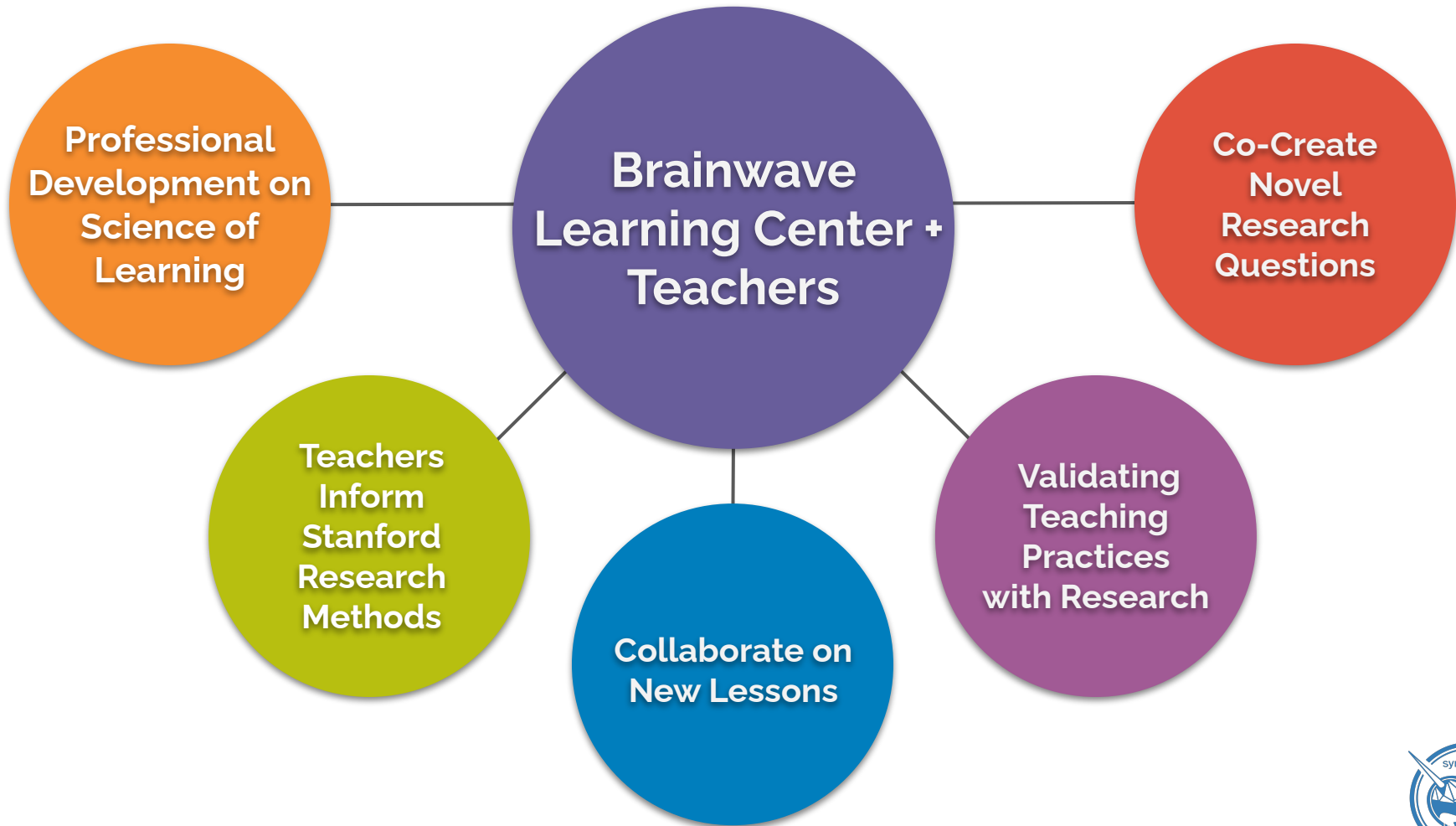


WILEY

Progress in elementary school reading linked to growth of cortical responses to familiar letter combinations within visual word forms

Fang Wang¹ | Blair Kaneshiro¹  | Elizabeth Y. Toomarian^{1,2} | Radhika S. Gosavi^{1,2} | Lindsey R. Hasak¹ | Suanna Moron¹ | Quynh Trang H. Nguyen¹ | Anthony M. Norcia^{3,4} | Bruce D. McCandliss¹





Teachers Engage with the Science of Learning

- Professional development with teachers around science of learning topics
- Infused into daily teaching and learning experiences
- Best practices for learning and retaining information based on research



Unique Professional Learning

- Stanford Graduate Course hosted at Synapse School
- Teachers & students interacted with Stanford researchers and PhD students on a weekly basis





“... [The BLC is a] part of the community, you're part of what we do in the classroom, and the kids are part of it too. It's a whole community endeavor ... [to] bring more understanding about how we learn.”

- Teacher



The BLC Model

Opportunities

- Authentic relationships between researchers and educators/students/parents
- Access to young participants → rapid prototyping and student/teacher voice in research design
- Reduce barriers to participation
- More informed research questions and methodology

Challenges

- Separation between school and research (IRB)
- Schools are dynamic! Schedule flexibility, noise, behavior, etc.
- RPP liaisons simultaneously part of “both” and “neither” community



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Considerations

- Provide financial resources/infrastructure
- School leadership and teachers are “bought-in”
- Innovation and iteration at the core of the school’s mission
 - Space to explore
- Would this model work in a school that is less well-resourced?
- How might we adapt it so it works in other contexts? What does that look like?
- How can we get other school communities interested in such partnership? Other research groups?





Thanks for listening!

BLC@synapseschool.org

