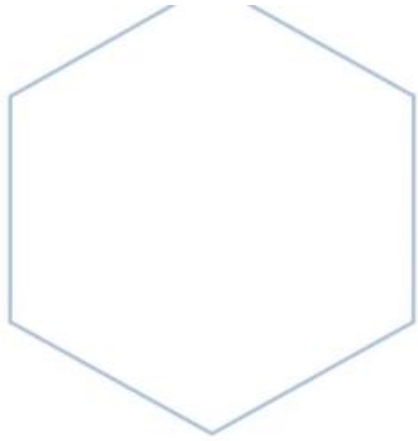# Science of Reading

PSCC Meeting Tuesday, November 21, 2023

Ms. Wendy Moore NBCT

The Science of Reading

A "Preponderance of Evidence"

- How reading & writing develop
- Why some have difficulty
- How we can most effectively teach reading

Vast Body of Research

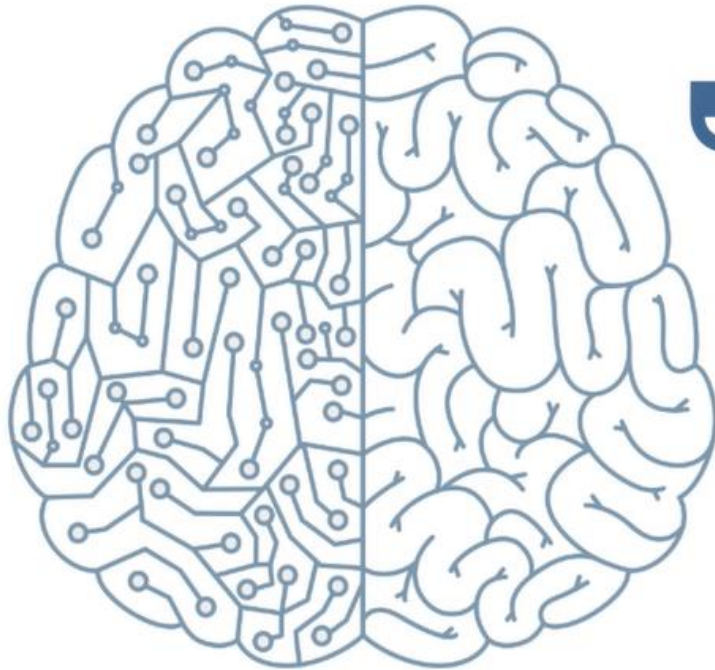Research from multiple fields of expertise

Information Derived from Thousands of Studies

Conducted in Multiple Languages

Over 5 Decades of Research Across the World

https://vimeo.com/849185211

# What does the Science of Reading tell us about the human brain and reading?

" ...a snapshot of a person's brain activity while reading shows that most of the brain is involved: areas involved in vision and language ... but also neural systems that control action, emotion, and decision making; several memory systems; and much of the rest... "

https://vimeo.com/849185211

(Seidenberg, 2017)

What does the Science of Reading tell us about the human brain and reading?
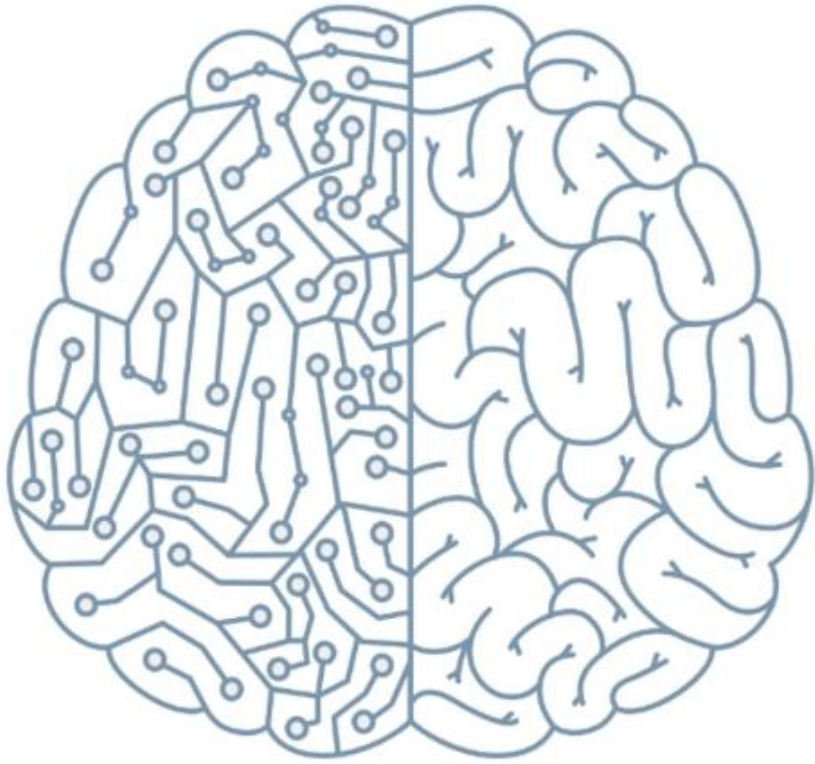
- Learning to read
- Supporting skilled reading
- Causes of reading difficulties
- Predictors of reading ability
- Reading universals
- Neural circuits involved in reading

https://vimeo.com/849185211

(Seidenberg, 2017)

The Simple View of Reading (SVR)

Word Recognition ✖ **Language Comprehension** = **Reading Comprehension**

(Gough & Tunmer, 1986)

Scarborough's Reading Rope

Language Comprehension

- Background Knowledge
- Vocabulary Knowledge
- Language Structures
- Verbal Reasoning
- Literacy Knowledge

Increasingly Strategic

Skilled Reading
Fluent execution and coordination of word recognition and text comprehension.

Word Recognition

- Phonological Awareness
- Decoding (and Spelling)
- Sight Recognition

Increasingly Automatic

Scarborough, H. 2001. Connecting early language and literacy to later reading (dis)abilities: Evidence, theory, and practice. Pp. 97-110 in S. B. Neuman & D. K. Dickinson (Eds.) *Handbook of Early Literacy*. NY: Guilford Press.

Scarborough's Reading Rope

Language Comprehension

- Background Knowledge
- Vocabulary Knowledge
- Language Structures
- Verbal Reasoning
- Literacy Knowledge

Focus in grades 6-12

Word Recognition

- Phonological Awareness
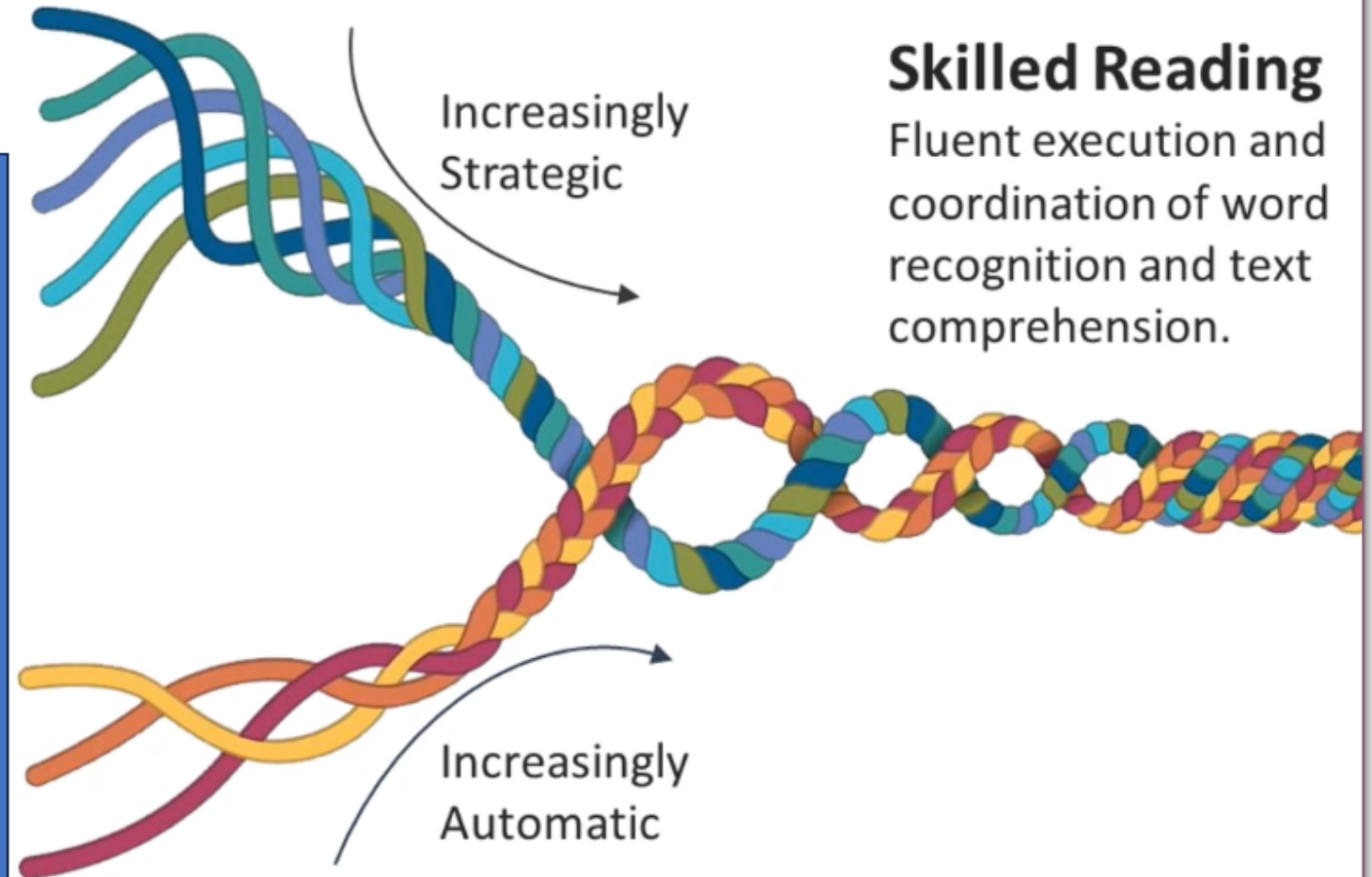- Decoding (and Spelling)
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Scarborough's Reading Rope

Language Comprehension

| Background Knowledge

| Vocabulary Knowledge

For our presentation today, we are focusing on the two above as these are the items most students need to build. All teachers (not just English) can help students with these two items.

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Fluent execution and coordination of word recognition and text comprehension.

Increasingly Automatic

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Background Knowledge

The Knowledge GAP

"THE MOST IMPORTANT FACTOR IN DETERMINING WHETHER READERS CAN UNDERSTAND A TEXT IS HOW MUCH **RELEVANT VOCABULARY** OR **BACKGROUND KNOWLEDGE** THEY HAVE."

THE KNOWLEDGE GAP | Natalie Wexler

THE HIDDEN CAUSE OF AMERICA'S BROKEN EDUCATION SYSTEM— AND HOW TO FIX IT

Natalie Wexler

"THE TEST-SCORE GAP IS, AT ITS HEART, A KNOWLEDGE GAP."

#KnowledgeGap

"Here's what is *important: cultivating a desire and thirst for knowledge and the ability to seek it out and acquire it."*
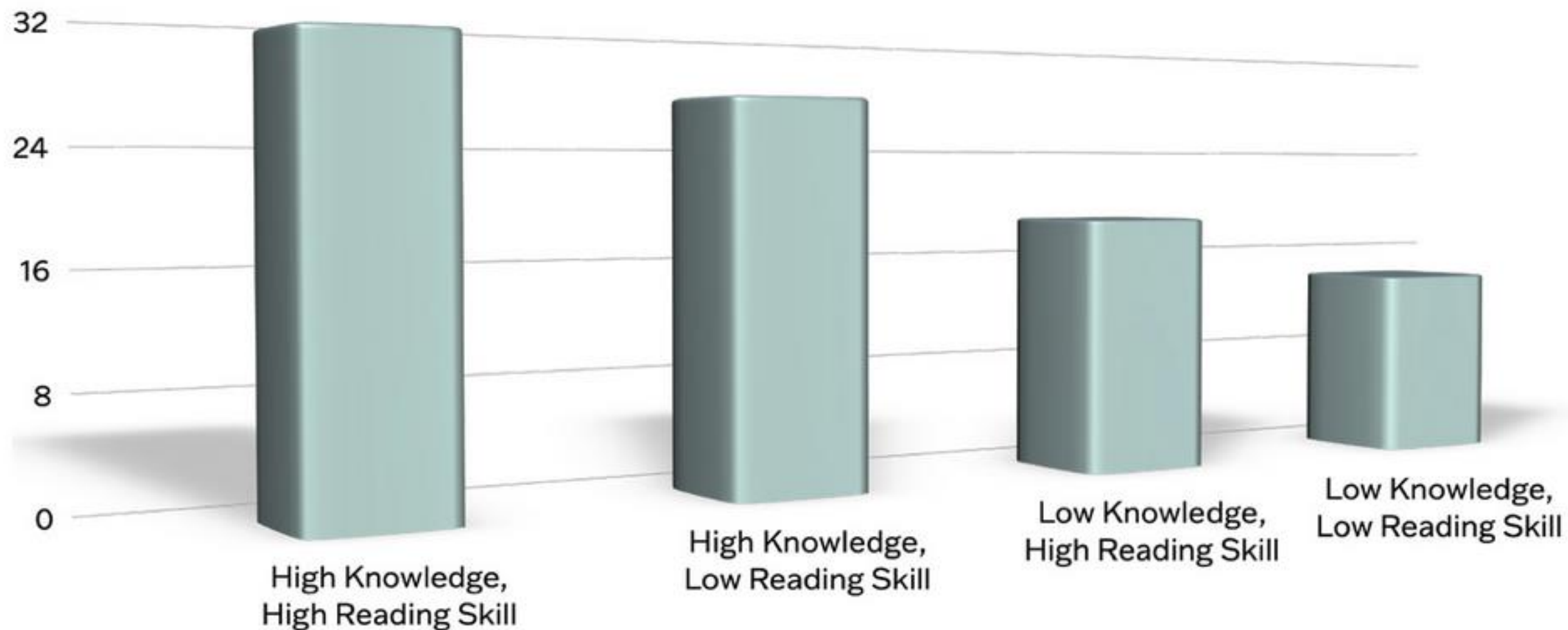
WWW.MYCUPRUNSOVER.CA

This video focuses on the change in focus for elementary schools which created a lack of background knowledge. It explains the reasons we have seen a major change in comprehension in high schools in recent years.

Support: Hear from an expert explaining it differently

Extension: Summary of new study on the importance of Background knowledge

For Comprehension, Knowledge Matters More than Reading Ability

Method(s) SciTech Teachers are using

Quad Text Set	
A visual text, consisting of still images or a video clip, requiring little reading but contributing quickly to background knowledge in a way that not only *tells* but also *shows*.	**One or more accessibly written factual texts** can fill gaps in knowledge that the author of the target text assumes readers possess.
A young adult text or a more informal source such as a blog, which could be either fiction or an information source, piques interest by demonstrating how the target text is relevant.	**Central complex text** from the model lesson.

Biology or E&E

Intellect: What is the impact of disrupting the photosynthesis process?

Criticality: Influence public policy about the dangers of the new air pollutant (Microplastics) by **outlining a strategy to combat this danger** in student's community.

Identity: As an activist for the environment complete ONE of the following **-** PSA, Letter to Congress, Research Application (Skills)

Skill: Student needs to know and explain.

- photosynthesis

- micropollutants

- Interaction between all three

Joy: Working towards solving complex environmental problems

Central complex text from the model lesson.

PLANT RESPONSE TO AIR POLLUT

Citation:

Weber, J., D. Tingey, AND C. Andersen. PLANT RESPONSE TO AIR POLLUTION. U.S. Environmental Protection Agency, Washington, DC, EPA/600/A-93/050 (NTIS PB93167260).

Impact/Purpose:

n/a

Description:

Air pollutants have a negative impact on plant growth, primarily through interfering with resource ac contact with the atmosphere, many air pollutants, such as O3 and NOx, affect the metabolic function carbon fixation by the plant canopy. Air pollutants that are first deposited on the soil, such as heavy n roots and interfere with soil resource capture by the plant. These reductions in resource capture (pro photosynthesis, mineral nutrient uptake and water uptake from the soil) will affect plant growth thro the various plant structures. When air pollution stress co-occurs with other stresses, e.g. water stress, on a complex interaction of processes within the plant. At the ecosystem level, air pollution can shift t species present and may lead to changes in the composition of the plant community. In agroecosyste reduced economic yield.

A **visual text**, consisting of still images or a video clip, requiring little reading but contributing quickly to background knowledge in a way that not only *tells* but also *shows*.

Process of Photosynthesis

Sunlight

Oxygen

Carbon dioxide

Sugars

Water
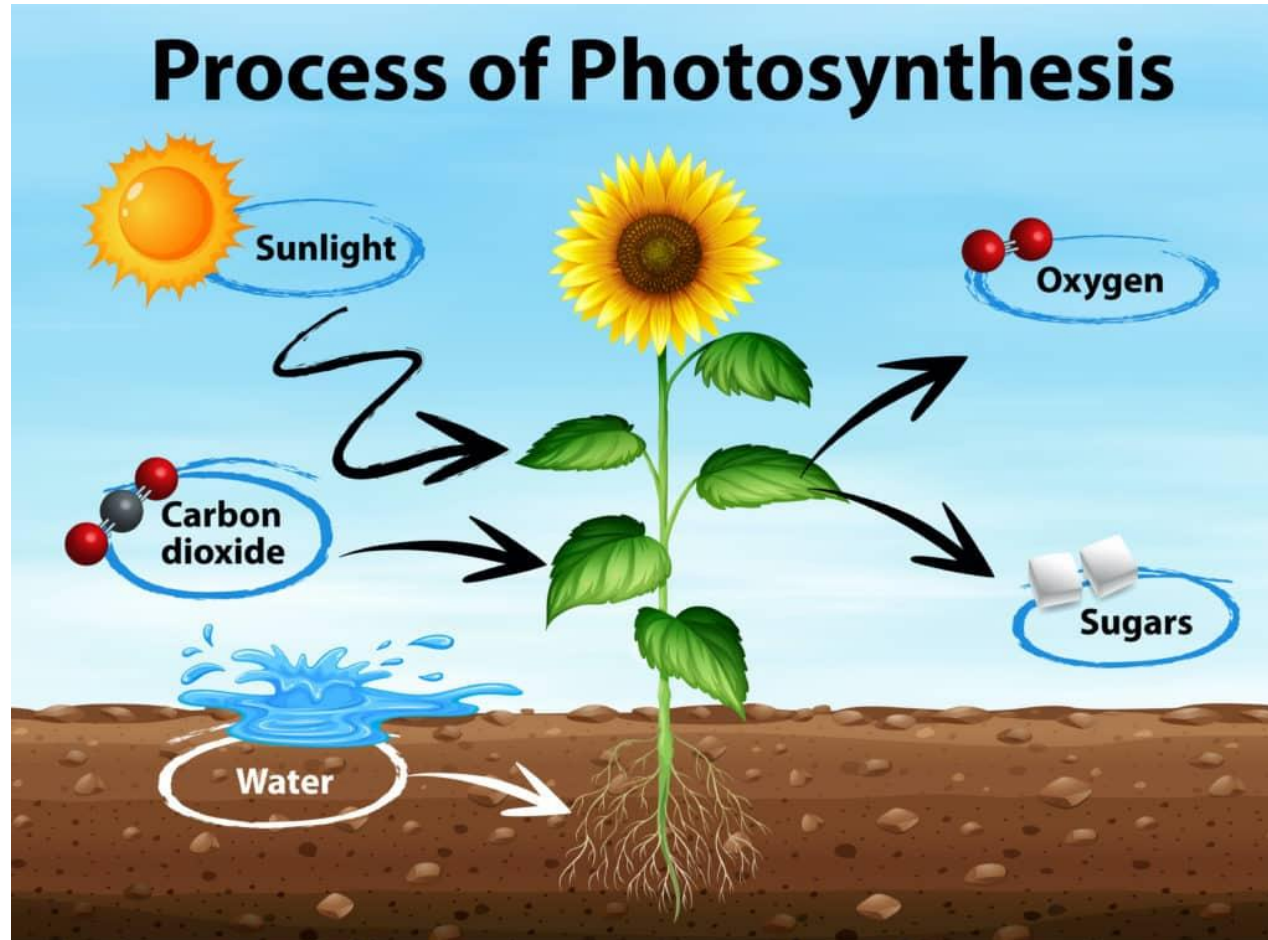
This does several items:

1. Activates prior knowledge.
2. Creates student experts
3. Creates a visual in students minds
4. Creates discussions in small groups

One or more **accessibly written factual texts** can fill gaps in knowledge that the author of the target text assumes readers possess.

Resources:

- NewsELA (tons of Science) – will change grade level

- Achieve3000 (Literacy)

- Science News

- Find articles on your own at various levels
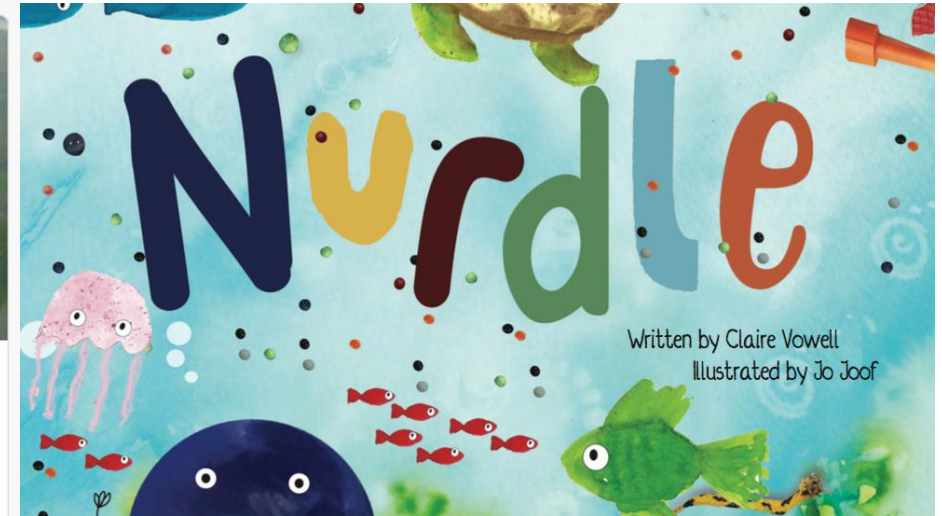
- Chatgpt to reduce reading levels

ARTICLE

How to grow your plants effectively

ARTICLE

Learn the photosynthesis formula

Nurdle

Written by Claire Vowell
Illustrated by Jo Joof

Read aloud a children's picture book on microplastics.

> **A young adult text or a more informal source** such as a blog, which could be either fiction or an information source, piques interest by demonstrating how the target text is relevant.

Use of formally known "Twitter" looking on Microplastics in the news.

- Blogs

- Tik Toks

- Headlines

- Memes

- News

← **Microplastic news**
450 posts

Microplastic news
@Microplastic_

Regular tweets +RTs about #microplastics / #microbeads / #microfibers – one of the most damaging marine pollutants.

Follow

Central complex text from the model lesson.

Practice Reading strategies for the complex Text Reading (Next session)

- Close Reading

- Paragraph Summaries

- Text Structure

PLANT RESPONSE TO AIR POLLUTION

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Weber, J., D. Tingey, AND C. Andersen. PLANT RESPONSE TO AIR POLLUTION. U.S. Environmental Protection Agency, Washington, DC, EPA/600/A-93/050 (NTIS PB93167260).

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Air pollutants have a negative impact on plant growth, primarily through interfering with resource accumulation. Once leaves are in close contact with the atmosphere, many air pollutants, such as O3 and NOx, affect the metabolic function of the leaves and interfere with net carbon fixation by the plant canopy. Air pollutants that are first deposited on the soil, such as heavy metals, first affect the functioning of roots and interfere with soil resource capture by the plant. These reductions in resource capture (production of carbohydrate through photosynthesis, mineral nutrient uptake and water uptake from the soil) will affect plant growth through changes in resource allocation to the various plant structures. When air pollution stress co-occurs with other stresses, e.g. water stress, the outcome on growth will depend on a complex interaction of processes within the plant. At the ecosystem level, air pollution can shift the competitive balance among the species present and may lead to changes in the composition of the plant community. In agroecosystems, these changes may be manifest in reduced economic yield.

Contact

ORD Science Inventory Contact
http://cfpub.epa.gov
/si/si_public_comments.cfm

Length of Time

Review Photosynthesis: 5 minutes (end of Class)

Accessible Text: 15 minutes (Homework)

Twitter: 5-15 minutes (Warm-up)

Central Complex Text: 30-50 minutes

Integrating Vocabulary

Preview: Direct Instruction of key words in Complex Reading

Connect: Sematic Mapping: Words from all three resources and out they tie together

In-Depth: Agroeconsystems

Morphology: Photo – Light Sythesis – To put together

Micro- Small

Agro-Farming

Word Consciousness: Key words from all readings on Word Wall

Selected Statistics for Major Sources of Spoken and Written Language

Source	Rare Words Per 1,000
Abstract of Scientific Articles	128.0
Newspapers	68.3
Popular Magazines	65.7
Adult books	52.7
Comic Books	53.5
Children's Books	30.9
Preschool Books	16.3
Popular Prime-time Adult Shows	22.7
Popular Prime-Time Children's Show	20.2
Cartoon Shows	30.8
Witness Testimony	28.4
College graduates to friends, spouses	17.3

The need for wide reading

Minutes Per Day Spent Reading Outside of School	Words Read per Year in Books
65	4,358,000
21.2	1,823,000
14.2	1,146,000
9.6	622,000
4.6	432,000
3.2	200,000
1.8	106,000
.1	8,0000

Vocabulary

Keys to Literacy

The Key Vocabulary Routine

Joan Sedita

1. Preview for Difficult Vocabulary
2. Use activities to Connect Vocabulary
3. Select Specific Words to Teach In-Depth
4. Identify Opportunities to Teach Word Learning Strategies
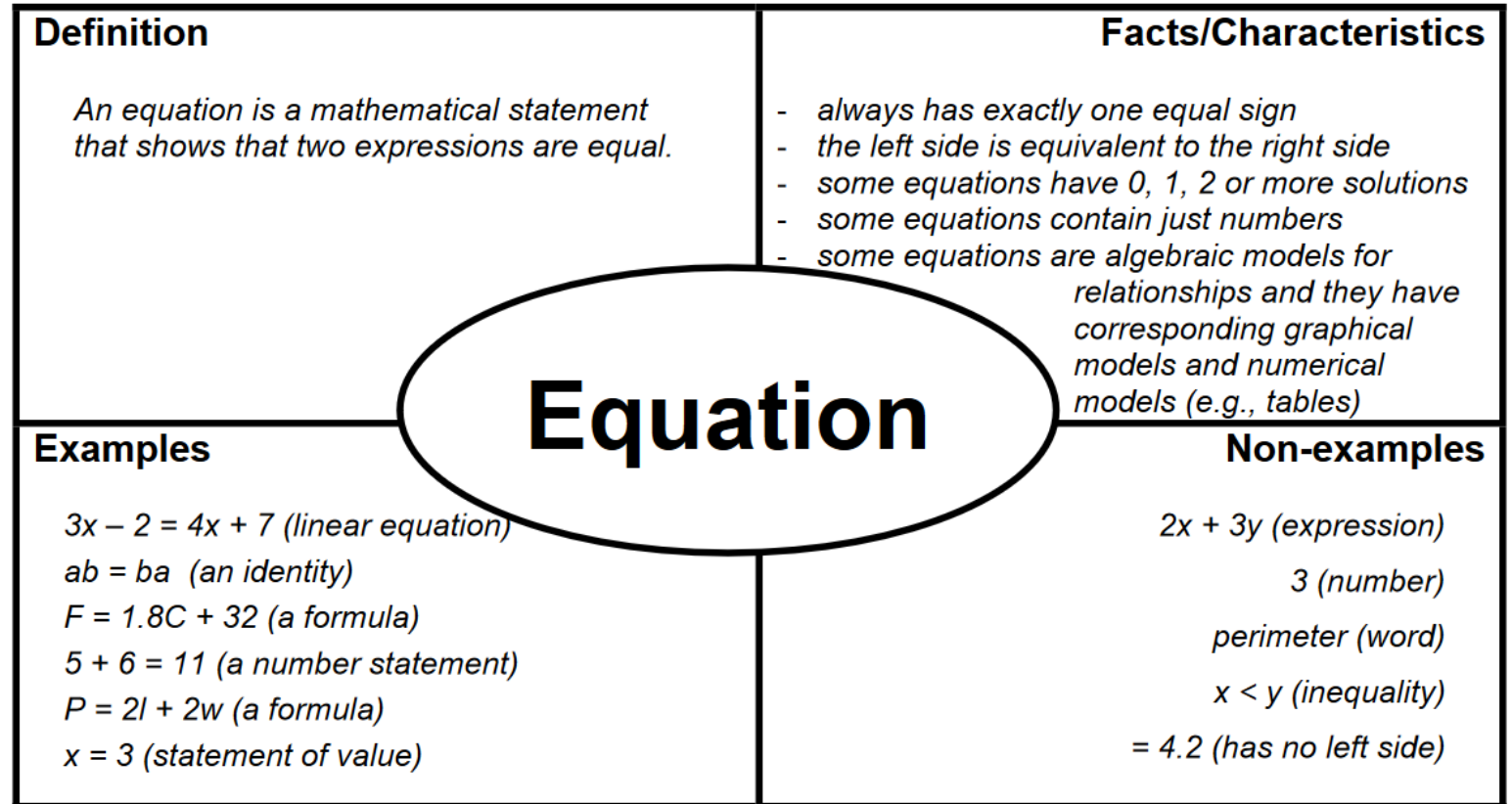5. Promote Word Consciousness

"Vocabulary instruction needs to enable students to develop an interest and curiosity about learning words, provide students with rich and varied language experiences, provide instruction on specific words, and teach students strategies for approaching new words."
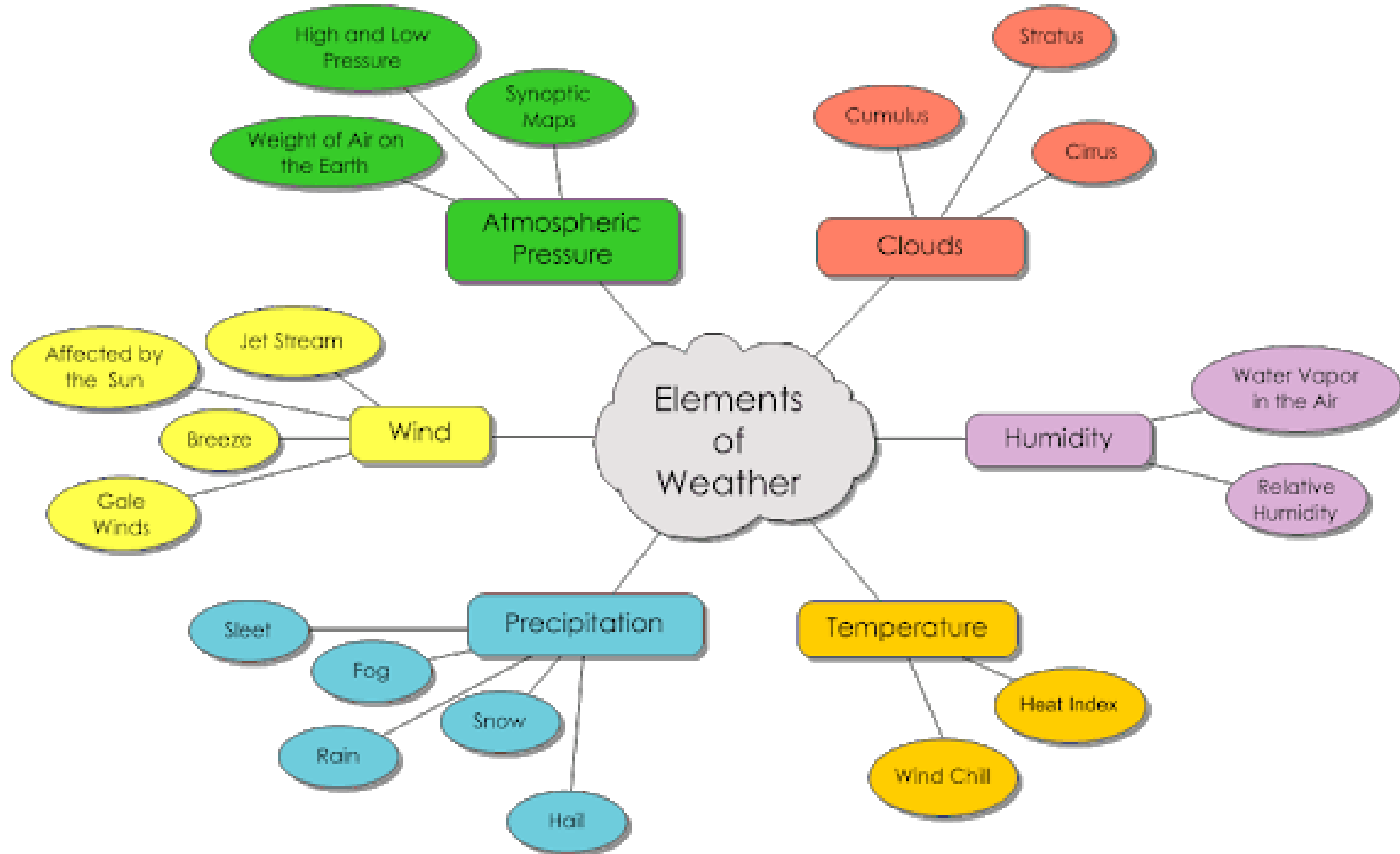
– Camille Blachowicz & Charlene Cobb in Ed Week Teacher

Preview for Difficult Vocabulary :Frayer Model

Time: 10 minutes

Great for use when a word is being used repetitively in class

Definition

An equation is a mathematical statement that shows that two expressions are equal.

Facts/Characteristics

- always has exactly one equal sign
- the left side is equivalent to the right side
- some equations have 0, 1, 2 or more solutions
- some equations contain just numbers
- some equations are algebraic models for relationships and they have corresponding graphical models and numerical models (e.g., tables)

Equation

Examples

$3x - 2 = 4x + 7$ (linear equation)

$ab = ba$ (an identity)

$F = 1.8C + 32$ (a formula)

$5 + 6 = 11$ (a number statement)

$P = 2l + 2w$ (a formula)

$x = 3$ (statement of value)

Non-examples

$2x + 3y$ (expression)

3 (number)

perimeter (word)

$x < y$ (inequality)

$= 4.2$ (has no left side)

Templates and examples of Frayer Model

Use activities to Connect Vocabulary

Select Specific Words to Teach In-Depth
Concept Definition Map
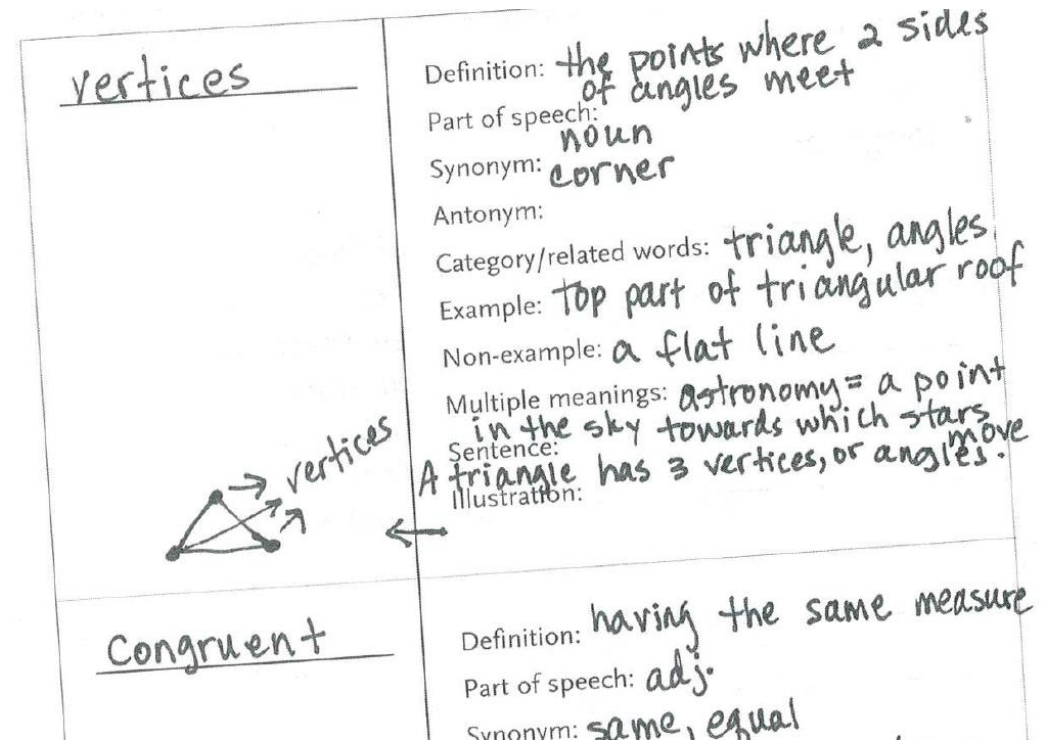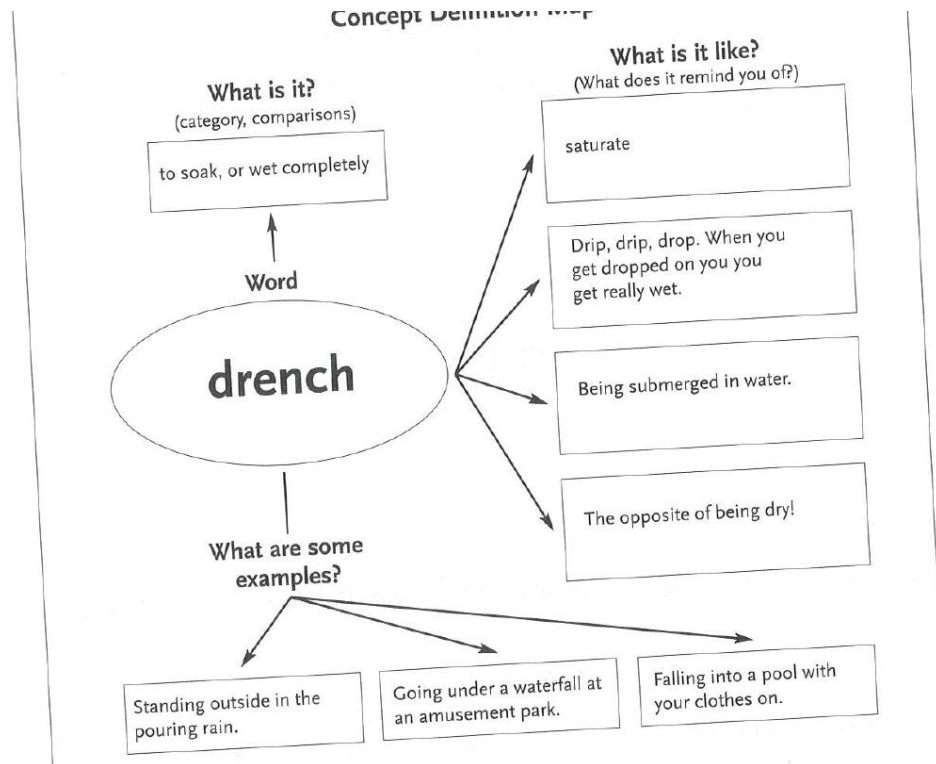
Identify Opportunities to Teach Word Learning Strategies

Photography Unit.
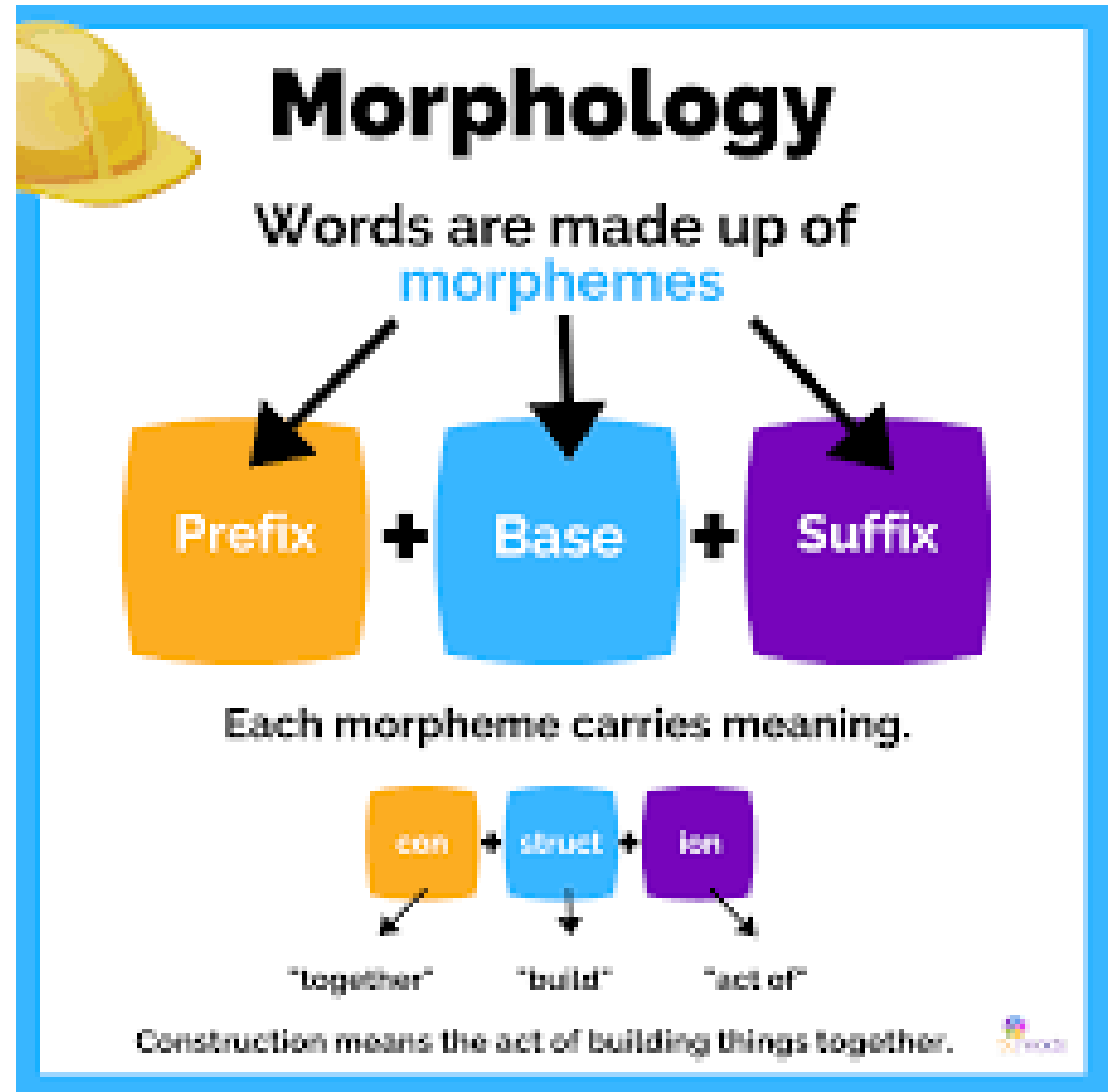
Break down the word photograph

Photo: Light
Graph: Write

Morphology

Words are made up of **morphemes**

Prefix + Base + Suffix

Each morpheme carries meaning.

con + struct + ion

"together"   "build"   "act of"

Construction means the act of building things together.

Photo – LIGHTS (Greek)

What are some other words that use "photo"?

Graph – write/record (Latin)

What are some other words that us "graph"?

Promote Word Consciousness
Word Walls

Benefits:

- Helps with word recognition
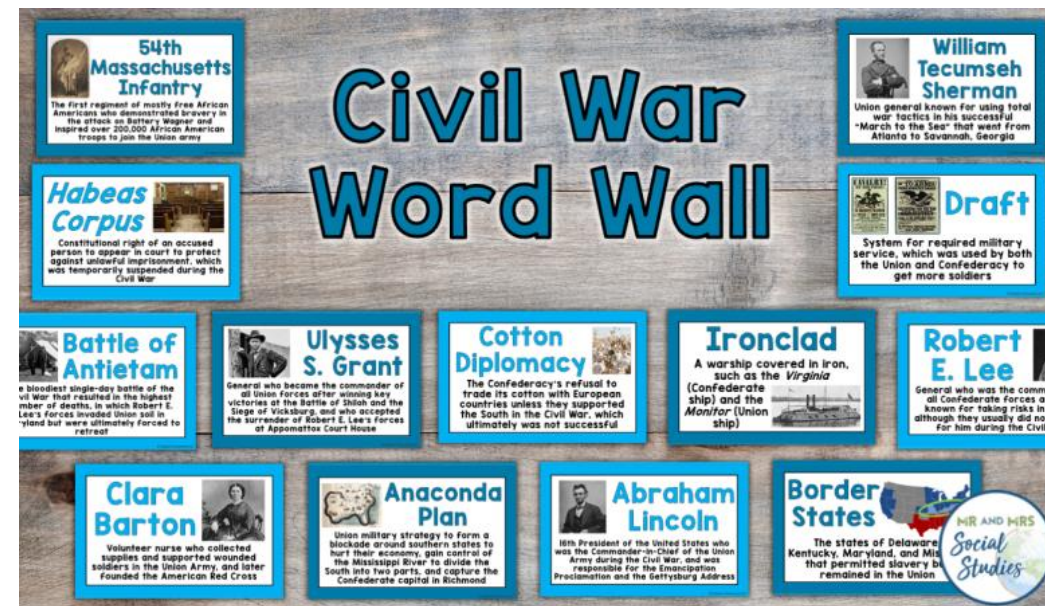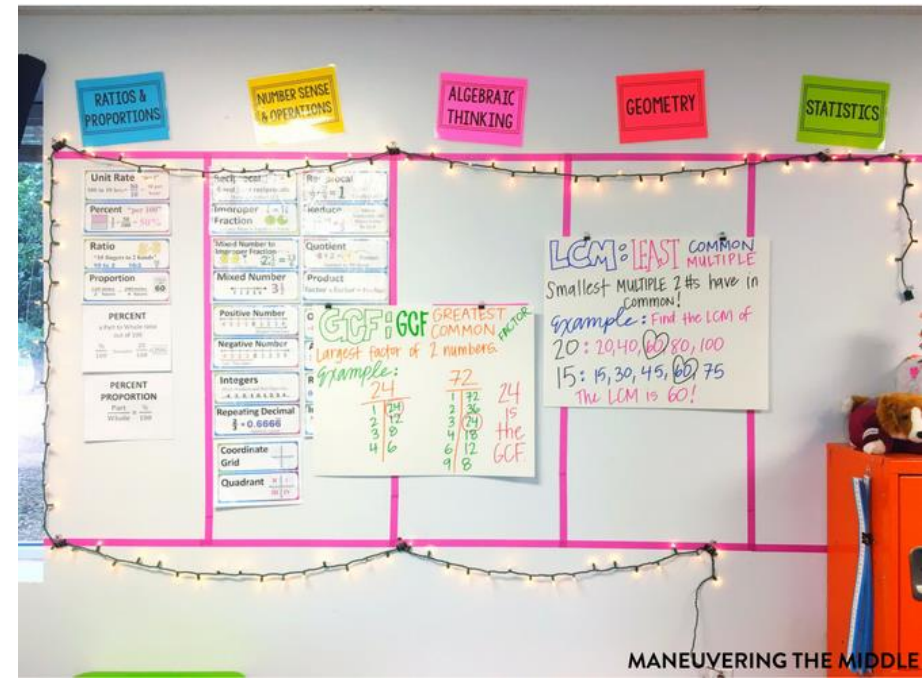- Use as games and activities

Directions:

Area of any wall space that is devoted to displaying words

Words can have definitions/images OR be individual

Differentiation

Support: Include in warm-up/exit slip – must incorporate two words from word wall in response.

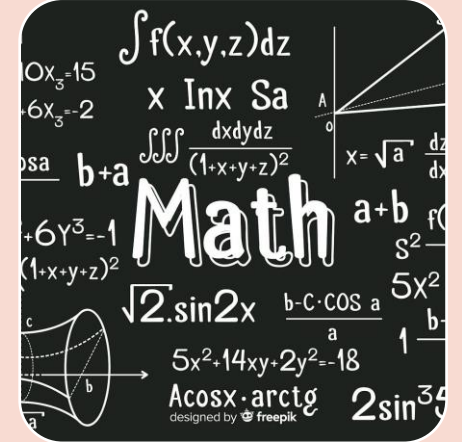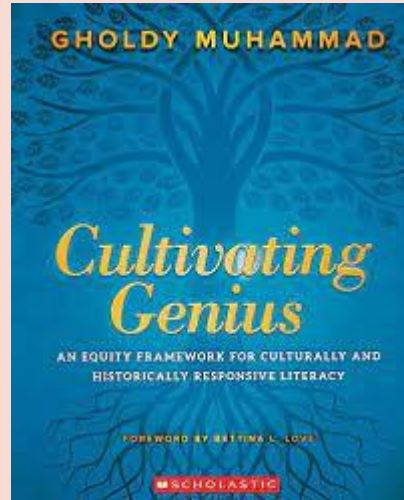Challenge: Students create and categorize the words

SciTech Vocabulary Examples

- History: Uses the **Frayer Model** in his AP US History Class and Semantic Maps (plus definitions) as Daily Exit Slips to connect key terms in History

- Government: Preteaches vocabulary weekly

- Math: Math word wall

- English/Math: Incorporate Morphology

- Art/Music: has students discuss new vocabulary terms and use when discussing art

PBIS — Positive Behavioral Interventions and Supports

GHOLDY MUHAMMAD
Cultivating Genius
AN EQUITY FRAMEWORK FOR CULTURALLY AND HISTORICALLY RESPONSIVE LITERACY
FOREWORD BY BETTINA L. LOVE
SCHOLASTIC

Math

High Standards | Supplemental Support | Intensive Support Supplemental

| Climate and Culture | MTSS | CULTIVATING GENIUS | Reading | Math |

Connections to School Improvement Plan
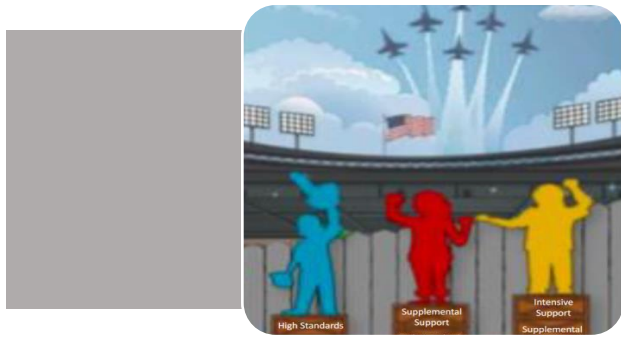
MTSS

OUTCOME: Less than 5% of the total student population will be failing 2 or more classes.

GOAL: As a result of educator professional development, operational changes, and changes in the MTSS meetings and implementation, all educators will understand how to refer a student to MTSS and support will be in alignment with subgroups of students.

Reading

OUTCOME: 80% of students will make statistically significant growth on the Classroom Diagnostic Tools (CDT) English 6-12 Exam between benchmark #1 and benchmark #3.

GOAL: As a result of targeted instruction on background knowledge and vocabulary development aligned with the Science of Reading, 80% of students will make statistically significant growth on the Classroom Diagnostic Tools (CDT) English 6-12 exam between benchmark #1 and benchmark #3.

The SCIENCE of READING

is a *body* of *research* that investigates how children *learn to read* and what *instructional approaches* are most effective.

Language Comprehension
- Background Knowledge
- Vocabulary Knowledge
- Language Structures
- Verbal Reasoning
- Literacy Knowledge

Word Recognition
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More training on Science of Reading is upcoming for Humanities, .

For Grades 6-12 – FOCUS ON Language Comprehension via vocabulary and background knowledge

TOP TWO EASIEST ITEMS
1. Have students read key vocabulary words out-loud prior to lesson.
2. Show a short video on the topic prior to reading about it.

Extension: Science of Reading Podcast:
https://podcasts.apple.com/us/podcast/science-of-reading-the-podcast/id1483513974
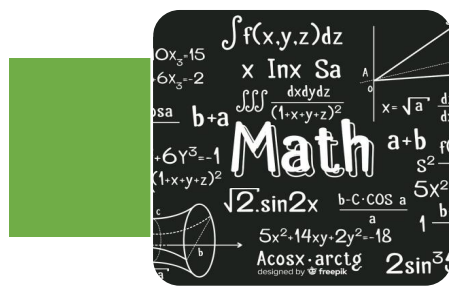
Math

PRIORITY STATEMENT: If we provide professional learning that focuses on culturally responsive pedagogy that challenges inequalities and emphasizes creating authentic connections between students and staff, then we will see an increased level of mutual trust and respect that will help students rise to higher expectations in all areas and be empowered as agents of social change.

OUTCOME: 80% of students will make statistically significant growth on the Classroom Diagnostic Tools (CDT) Math 6-12 Exam between benchmark #1 and benchmark #3.

GOAL: As a result of targeted instruction in mathematics, 80% of students in Math will demonstrate statistically significant growth in achievement demonstrated in the Classroom Diagnostic Tool (CDT) Overall scores between Benchmark #1 and Benchmark #3 (or achieving the middle of the green score) or through the adaptive learning programs (ALEKS, IXL, Study Island, Khan Academy, Pearson, etc.).

If we implement a **universal system of supports** for students based on preventative practices that **emphasize teaching** and reinforcing **desired student learning dispositions**, then **we will see increased rigor, student voice, engagement and achievement for all students.**

Priority Statements
2023-2024

If we implement a **universal system of supports** for students based on preventative practices that **emphasize teaching** and reinforcing **desired student learning dispositions**, then **we will see increased rigor, student voice, engagement and achievement for all students.**

- PBIS Rewards
- MTSS
- Targeted academic Tier 2 and 3 supports
- Co-teaching Algebra
- Universal Screener

- Classroom Culture Plans
- Targeted lesson Skills
- Grade Level Rewards
- SMART Goal creation
- CDT Testing

- Science of Reading
- Cultivating Genius
- Spiral Reviews
- Weekly Adaptive Programs

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- **Science of Reading**
- Cultivating Genius
- Spiral Reviews
- Weekly Adaptive Programs

- Cultivating Genius
- Antiracist Math
- **Science of Reading**
- Book Study
- PLC
- MTSS Weekly Meetings

Priority Statements 2023-2024

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- Cultivating Genius: Criticality
- Social Justice

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GOAL OF EDUCATION At SCITECH

THUNDER SHARKS

Priority Statements 2023-2024

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GOAL OF EDUCATION

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- Cultivating Genius: Criticality
- Social Justice

Teacher Training: Professional Development

Plan Subject to change and modification without notice

October: Introduction and Vocabulary

December: Background Knowledge

January: Language Structure

February: Verbal Reasoning

February: Literacy Knowledge

March: Science of Reading on WRITING (March)

April: Teacher Choice (April)

May: Science of Reading Reflection

June: Plan for 2024-2025 School Year

For Further Exploration of Topic

For your knowledge

- Read *The Knowledge Gap* (Available at Carnegie Library)
- Sold A Story Podcast: https://features.apmreports.org/sold-a-story/

Help Students:

- Increase Vocabulary: Smart Novels – YA books that focus on incorporating SAT vocabulary (Amazon) OR   List of books that incorporate the most high level words
- Tons of games with morphology: https://www.rootwords.io/
- Background Knowledge: Watch documentaries, listen to podcasts, discuss a variety of items.