Adam Boxer
@adamboxer1

Following

What I've loved about the #writinginscience symposium is that normally "literacy in science" means "use science to teach literacy." This symposium uses words, sentences and writing to teach science, not the other way around.
thescienceteacher.co.uk/writing-in-sci…

7:11 pm - 14 Nov 2018

17 Retweets **44** Likes

3 17 44

Paradigm TRUST

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We teach the right things, efficiently

Literacy in Science

Contents

- Words and Knowledge
  - Examples and non-examples
  - Frayer Model
  - Relationships between words
  - Similar/Different
- Writing:
  - But, Because, So
  - Write/Discuss/Rewrite
- Judge Don't Mark

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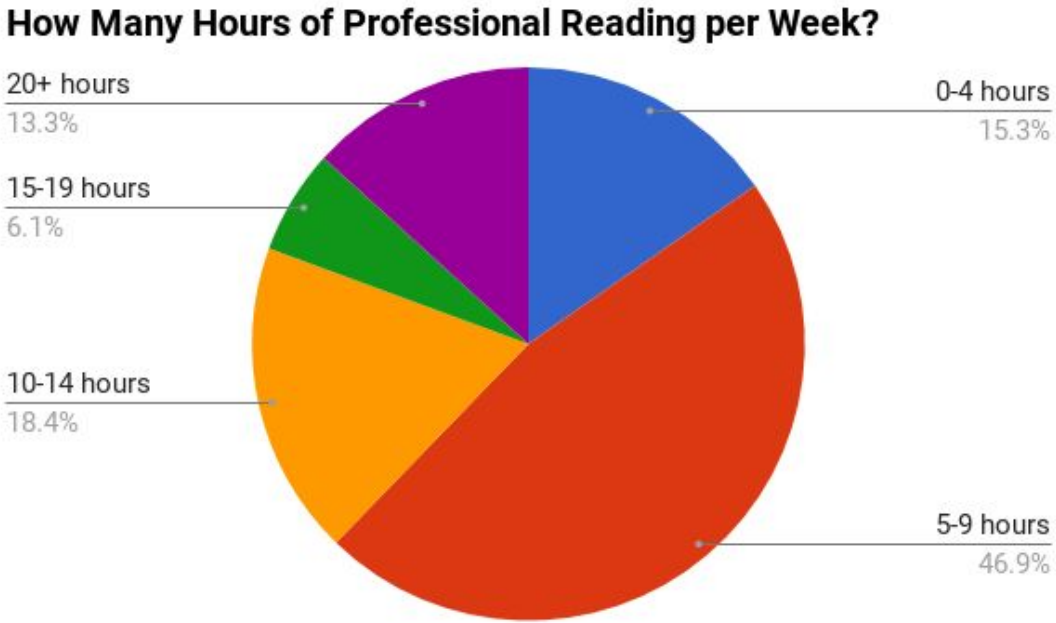
Is reading and writing important in science?

B

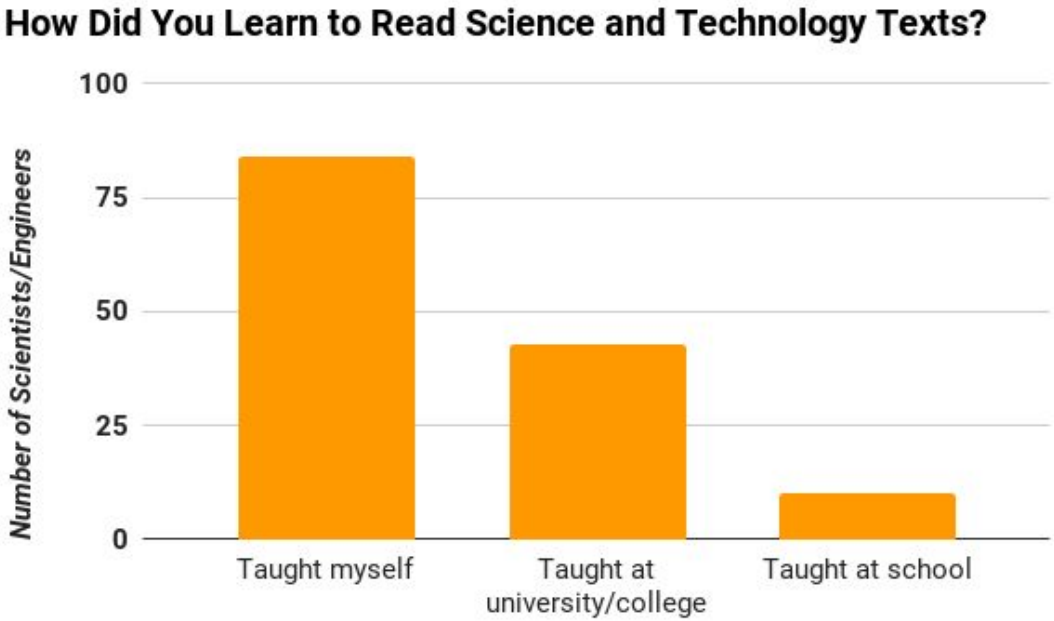


https://eic.rsc.org/analysis/reading-lessons-for-scientists/2010065.article

Paradigm TRUST

Is reading and writing important in science?

B



https://eic.rsc.org/analysis/reading-lessons-for-scientists/2010065.article

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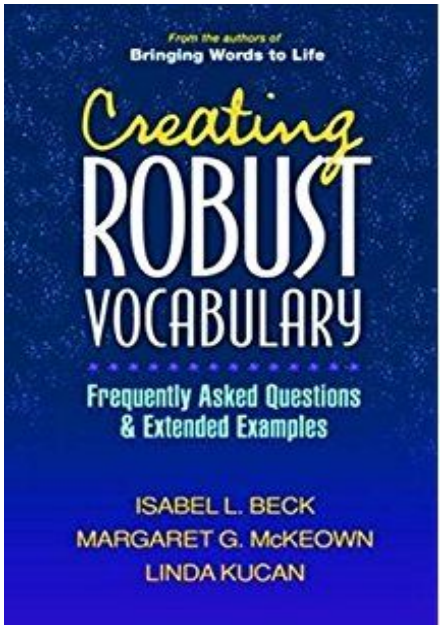
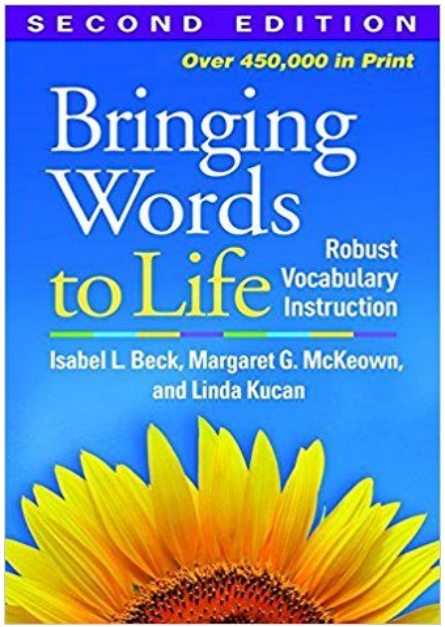
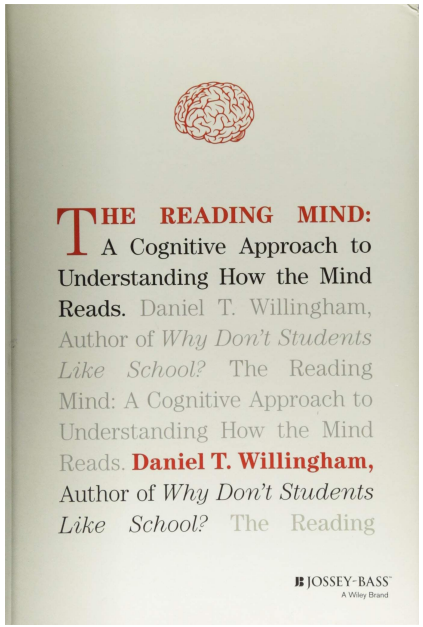
Vocabulary


From the authors of
Bringing Words to Life
Creating
ROBUST
VOCABULARY
Frequently Asked Questions
& Extended Examples
ISABEL L. BECK
MARGARET G. McKEOWN
LINDA KUCAN


SECOND EDITION
Over 450,000 in Print
Bringing
Words
to Life
Robust
Vocabulary
Instruction
Isabel L. Beck, Margaret G. McKeown,
and Linda Kucan


THE READING MIND:
A Cognitive Approach to
Understanding How the Mind
Reads. Daniel T. Willingham,
Author of Why Don't Students
Like School? The Reading
Mind: A Cognitive Approach to
Understanding How the Mind
Reads. Daniel T. Willingham,
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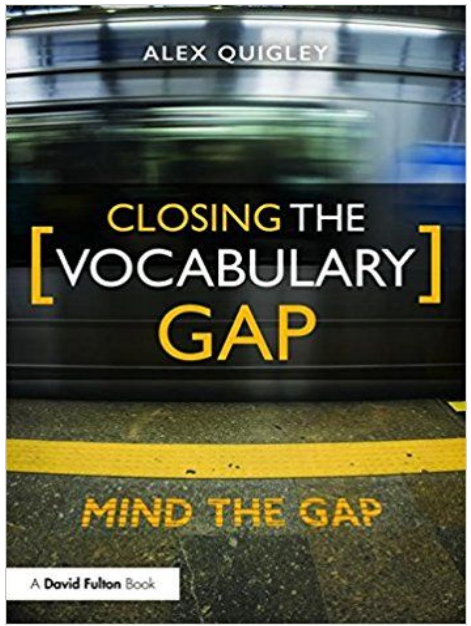
Like School? The Reading
JOSSEY-BASS
A Wiley Brand


ALEX QUIGLEY
CLOSING THE
[VOCABULARY]
GAP
MIND THE GAP
A David Fulton Book

Definitions or examples?

Definition of a chemical store of energy:

Definitions or examples?

Definition of a chemical store of energy:

The energy store associated with chemical bonds, such as those between molecules.

Definitions or examples?

Definition of a chemical store of energy:

The energy store associated with chemical bonds, such as those between molecules.

☐ 

☐ 

☐ 

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Definitions or examples?

Definition of a chemical store of energy:

The energy store associated with chemical bonds, such as those between molecules.

Instead...

- Examples and non-examples
- Frayer model

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B

chemical store of energy

B

Paradigm TRUST

B

chemical store of energy

B

Paradigm TRUST

B

Paradigm TRUST

B

Paradigm TRUST

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chemical store of energy

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chemical store of energy

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Paradigm TRUST

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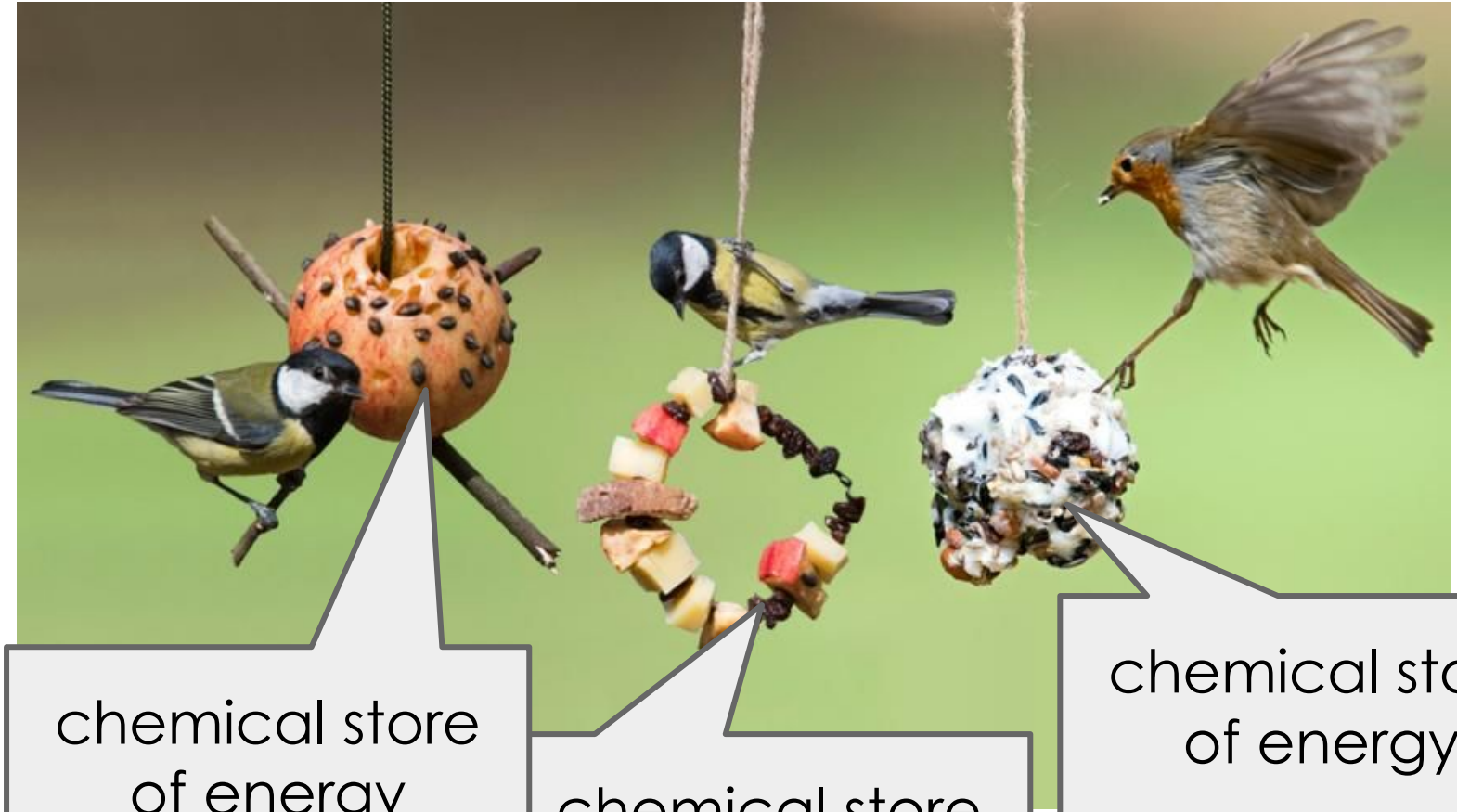

chemical store of energy

chemical store of energy

chemical store of energy

Paradigm TRUST

B

Paradigm TRUST

chemical store of energy

B

Paradigm TRUST

B

Paradigm TRUST

B

chemical store of energy

Paradigm TRUST

B

Paradigm TRUST

B

not a chemical store of energy

Paradigm TRUST

B

Paradigm TRUST

B

B

Paradigm TRUST

B

chemical stores of energy

Paradigm TRUST

Paradigm TRUST

not a chemical store of energy

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Definition: The energy store associated with chemical bonds, such as those between molecules.

In other words: _____

_____

_____

_____

_____

Characteristics:

_____

_____

_____

_____

_____

_____

stores of chemical energy

Examples:

_____

_____

_____

_____

_____

_____

Non-examples:

_____

_____

_____

_____

_____

_____

stores of chemical energy

Definition: The energy store associated with chemical bonds, such as those between molecules.

In other words: some chemicals can store energy which they can release when they react.

Characteristics:

- Substances which will burn.
- Foods which give us energy
- The chemicals in batteries/cells

Examples:

- Sugary energy drinks
- Petrol
- Candle wax
- Crisps
- Starchy foods
- Diesel
- Firewood
- batteries/cells

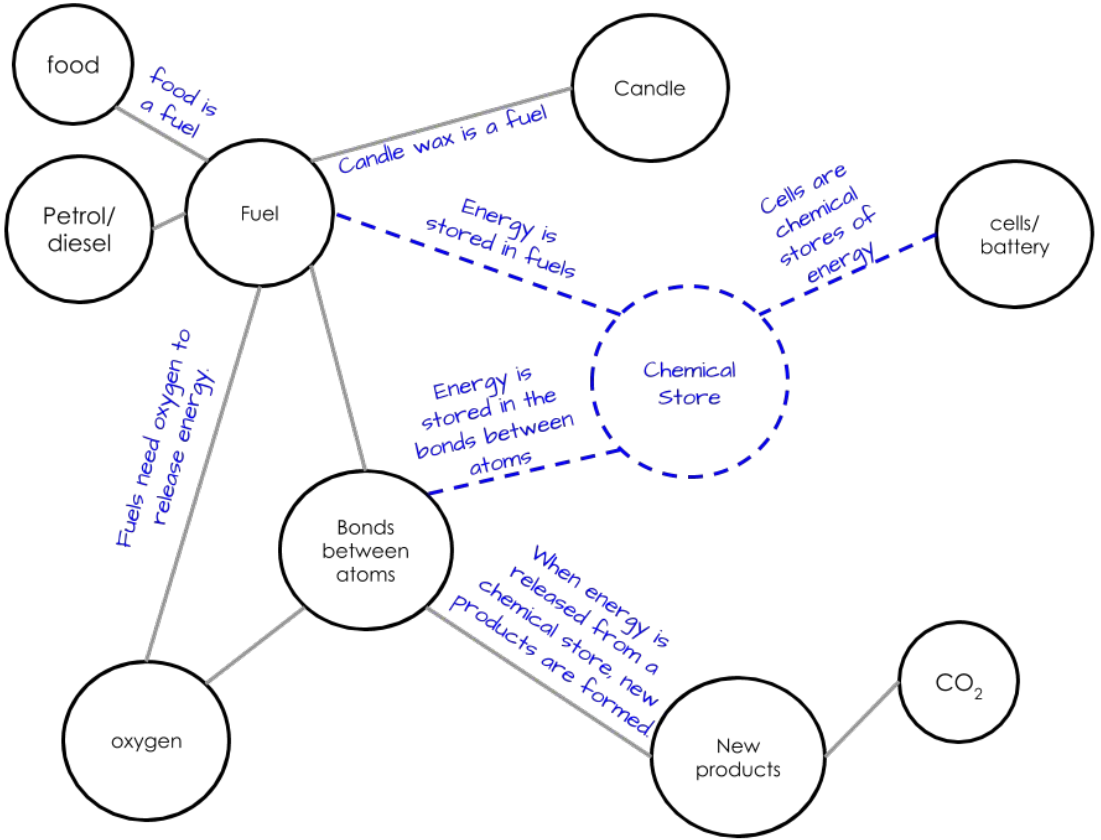
Non-examples:

- Water
- Diet drinks
- Substances which won't react

Make Context Explicit

B

Show learners how knowledge is related



Make Context Explicit

B

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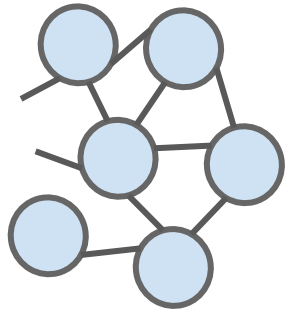
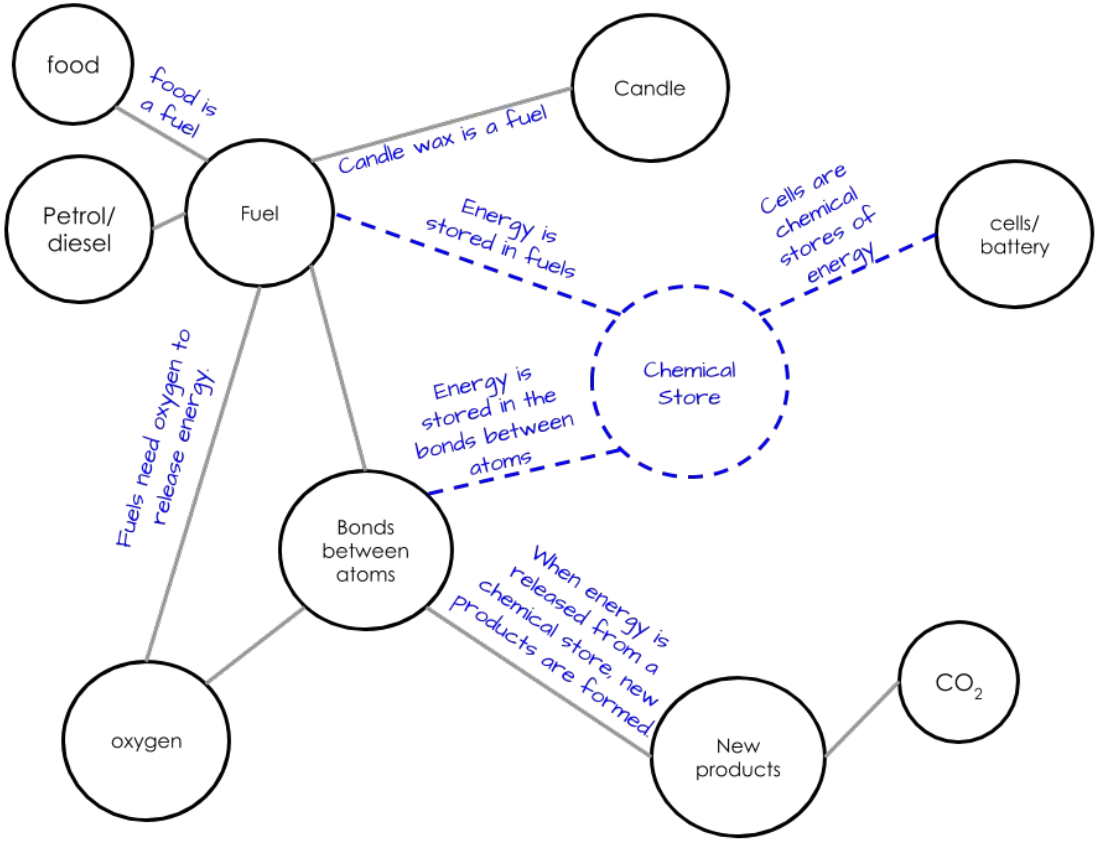
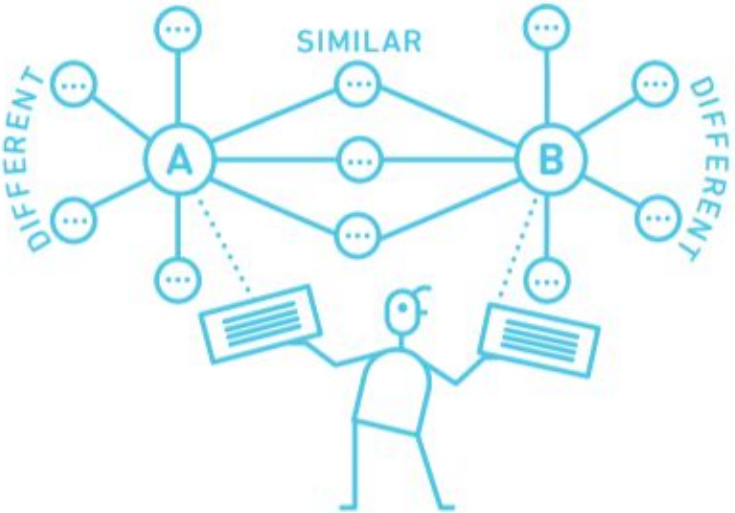




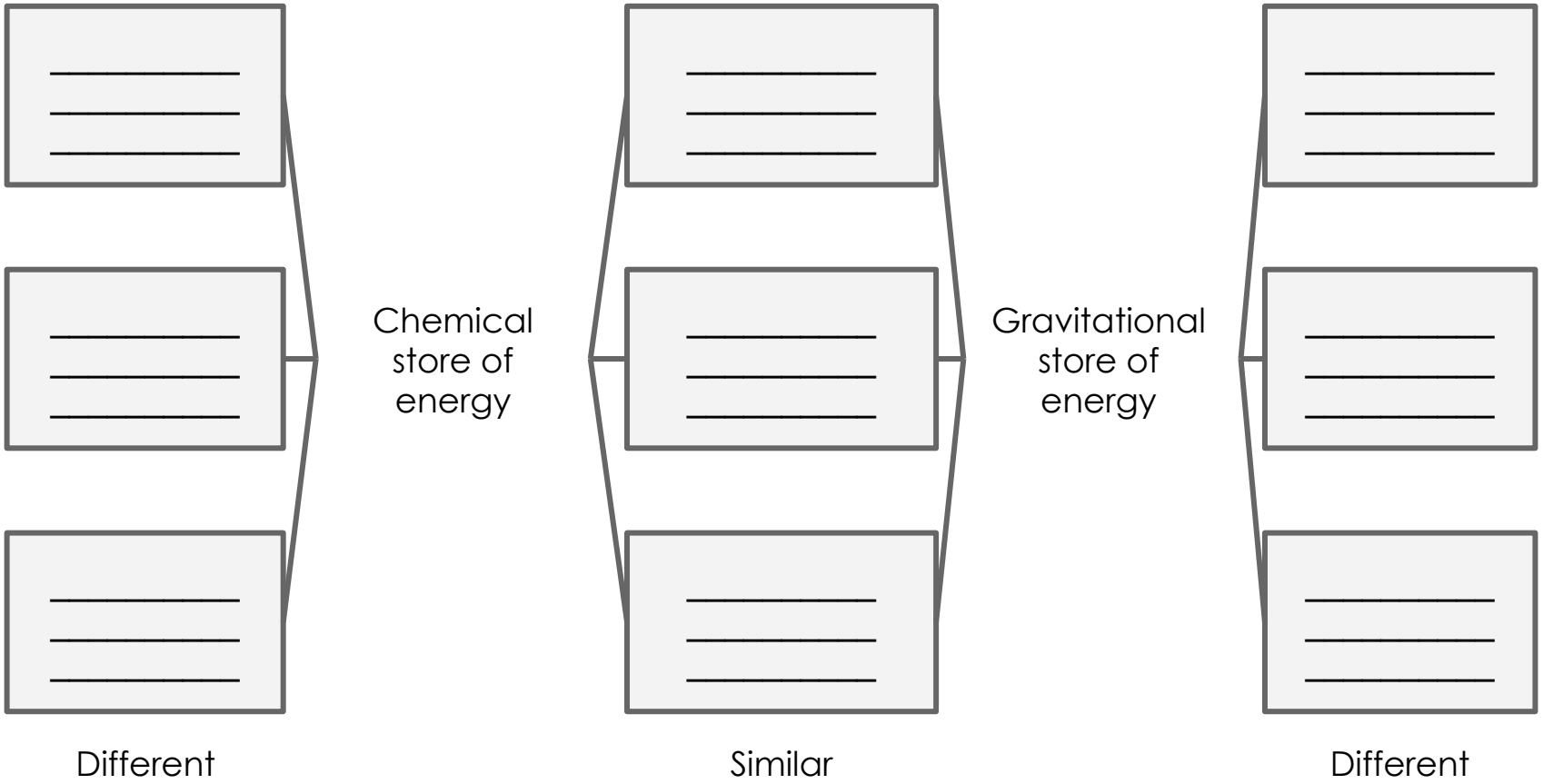
Elaboration

http://www.learningscientists.org/elaboration/

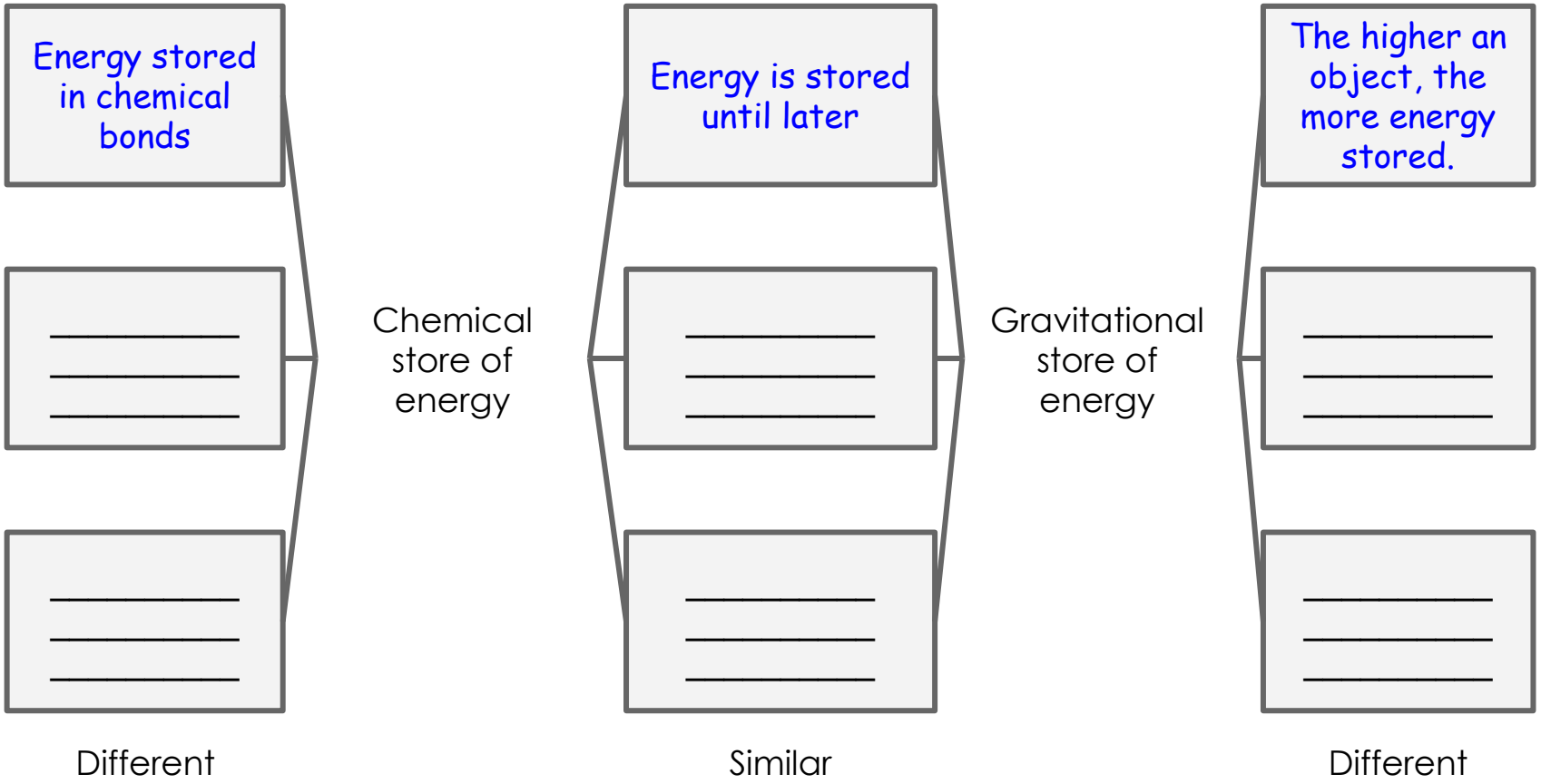
As you elaborate, make connections between different ideas to explain how they work together. Take two ideas and think of ways they are similar and different.



Elaboration



Elaboration



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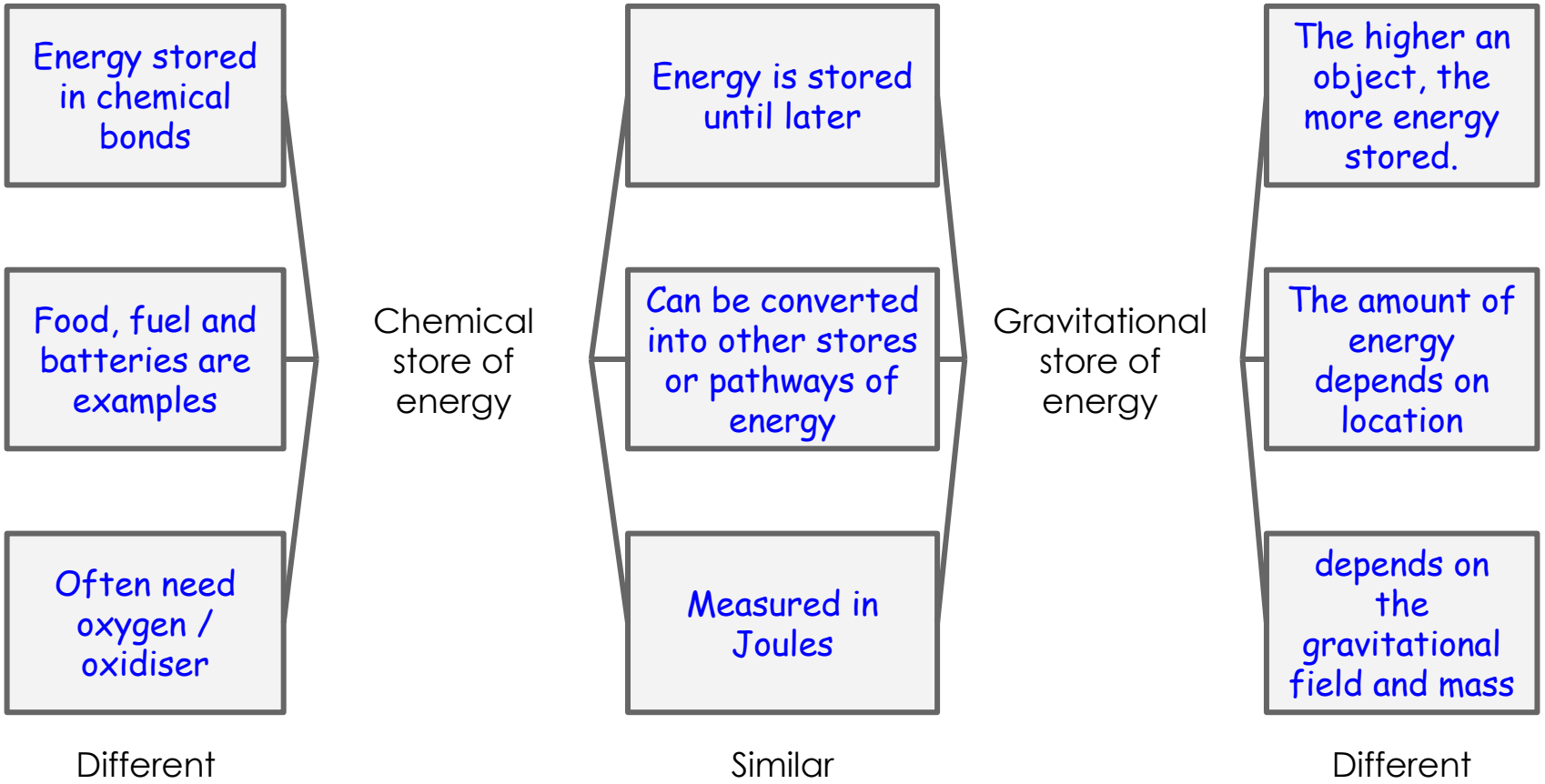

Reading in the Science Classroom

Knowledge and Reading

As the desert sun climbs overhead, the kangaroo rat burrows deep in the sand and rests until evening.

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Reading in the Science Classroom

Knowledge and Reading

As the desert sun climbs overhead, the kangaroo rat burrows deep in the sand and rests until evening.

What time of day does the animal enter its burrow?	How big do you think a kangaroo rat is?	Why does it burrow deep in the sand?
A: morning	A: small, like a mouse	A: to sleep
B: afternoon	B: medium, like a dog	B: to avoid predators
C: evening	C: large, like a	C: to stay cool

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Reading in the Science Classroom

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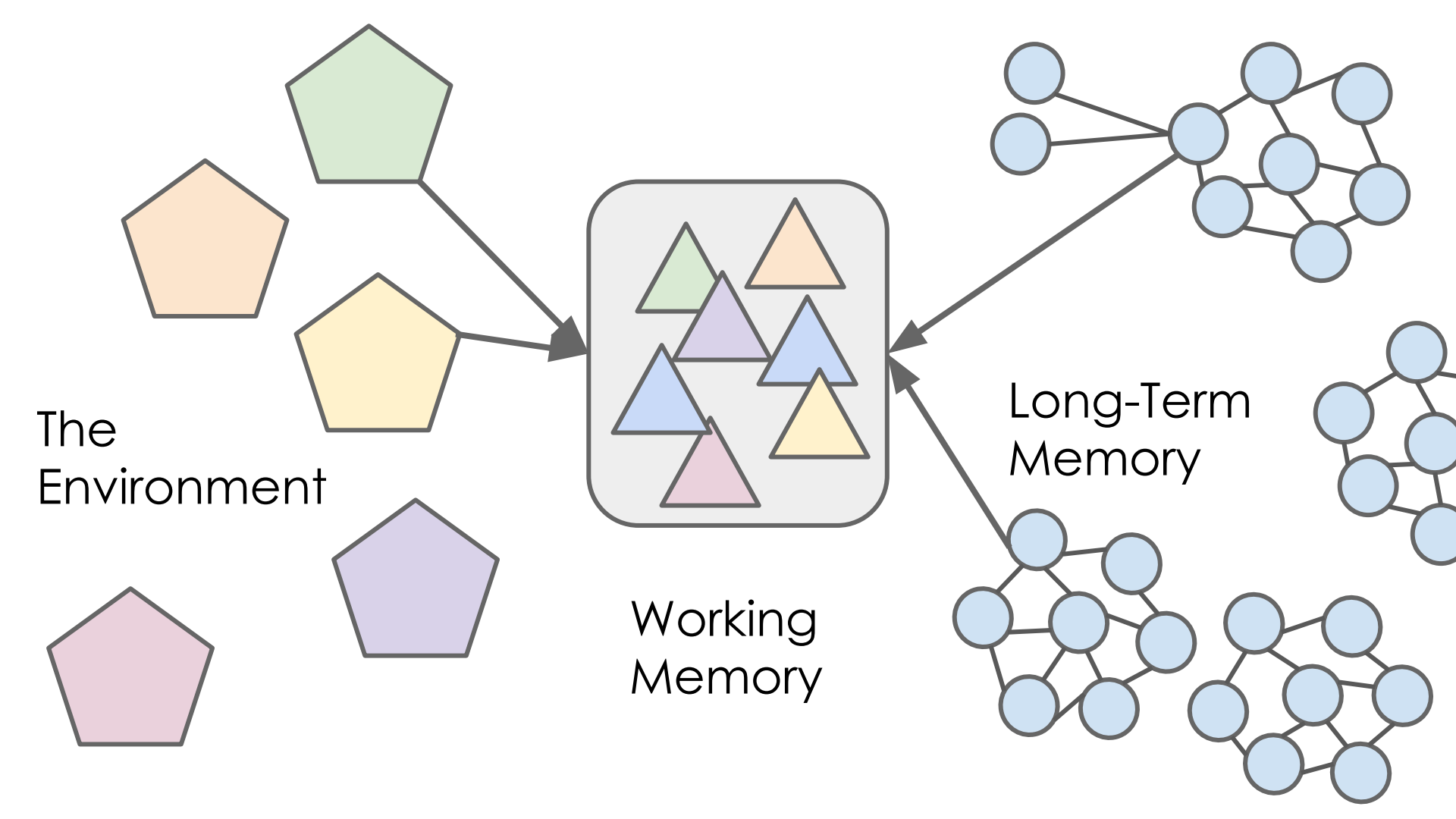
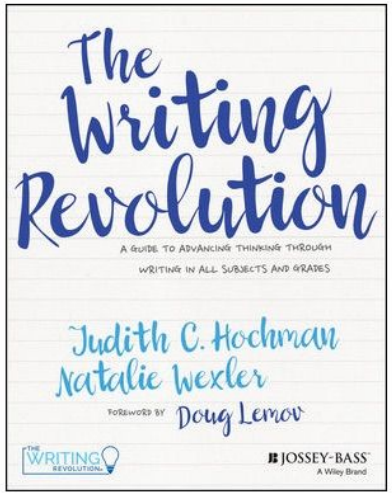

The
Environment
Working
Memory
Long-Term
Memory

Writing in Science

"Writing is the hardest thing that we ask children to do."

Hochman and Wexler, 2017, The Writing Revolution



Paradigm Trust

Writing in Science

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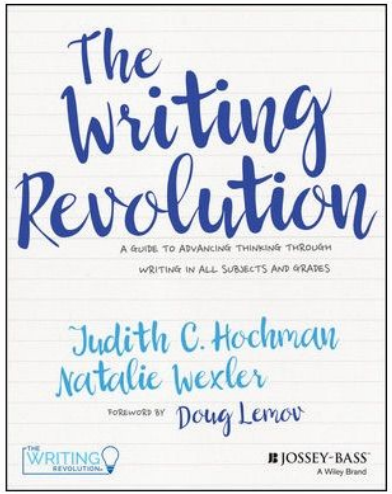

but, because, so...

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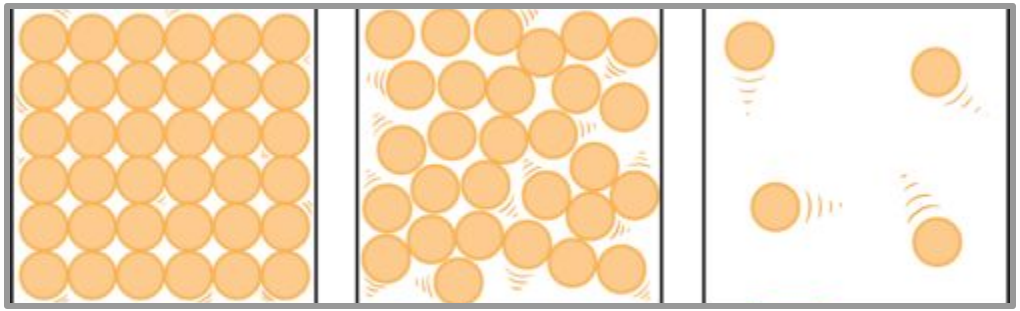
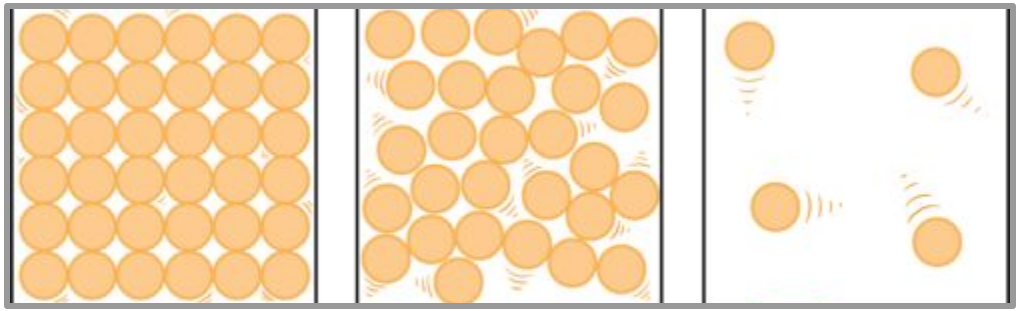


In a gas, the particles move about the container.



Complete the three sentences below:

- In a gas, the particles move about the container, but _____

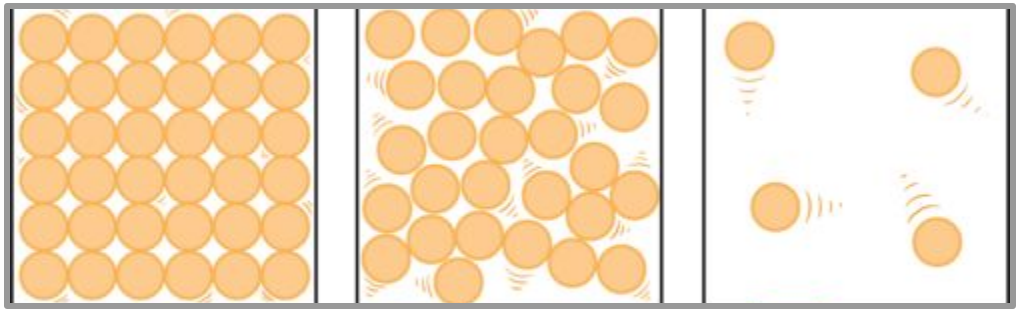
  _____

- In a gas, the particles move about the container, because _____

  _____

- In a gas, the particles move about the container, so_____

  _____



Complete the three sentences below:

- In a gas, the particles move about the container, but in a solid, they can only vibrate.
- In a gas, the particles move about the container, because they are not attracted to each other.
- In a gas, the particles move about the container, so they collide with the walls and exert pressure.

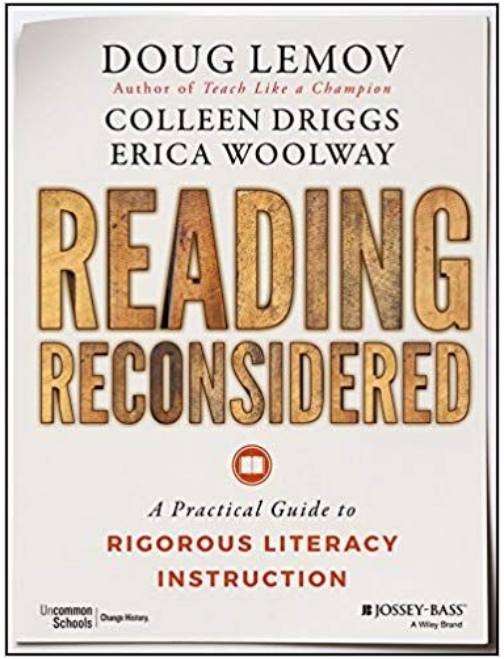
In the geocentric model, the Earth is at the centre, but actually the sun is in the ~~centre~~ centre.

In the geocentric model, the Earth is at the centre, because the ancient ~~ge~~ Greeks thought Earth was the most important.

In the geocentric model, the Earth is at the centre, so everything orbits the Earth.

Write/Discuss/Rewrite

The power of revision



Writing

Write/Discuss/Rewrite

(Teach Like a Champion)

Write: Describe the Geocentric model in your own words.

A ~~geo~~ Geocentric model is a giant sphere which lets light ~~from~~ heaven shine through. The Earth is in the middle and the other planets are around the edge.

Discuss:

planets & the sun orbits Earth at different distances the orbits the planets are perfectly ~~spherical~~ round.

Rewrite:

A Geocentric model is where all the planets and the sun orbit the Earth in ~~perfect circles~~ ~~that~~ within a sphere which lets light from heaven shine through as stars. The planets are perfect spheres

Write: Describe the Heliocentric model in your own words.

The Heliocentric Model showed the sun in the centre and the planets orbiting it.

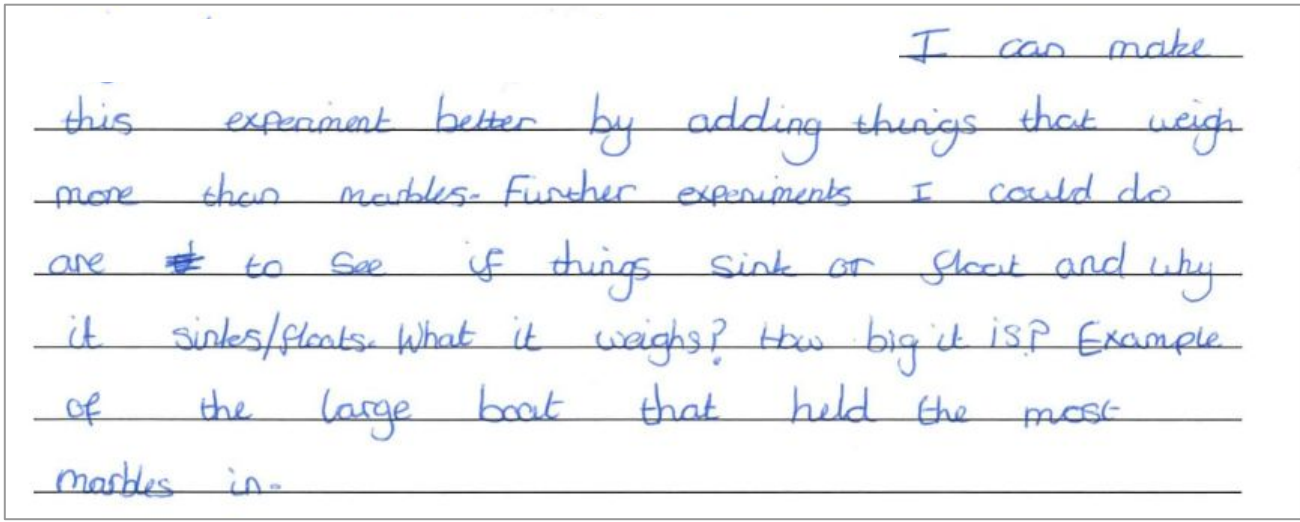
Discuss:

~~he~~ Copernicus thought the sky was ~~were~~ perfect - he thought the orbits ~~where~~ circular

Rewrite:

The Heliocentric Model shows a ~~perfect~~ ~~model of~~ the planets orbiting the Sun. the orbits were perfect circls.

Using Exemplars to Make Feedback Specific

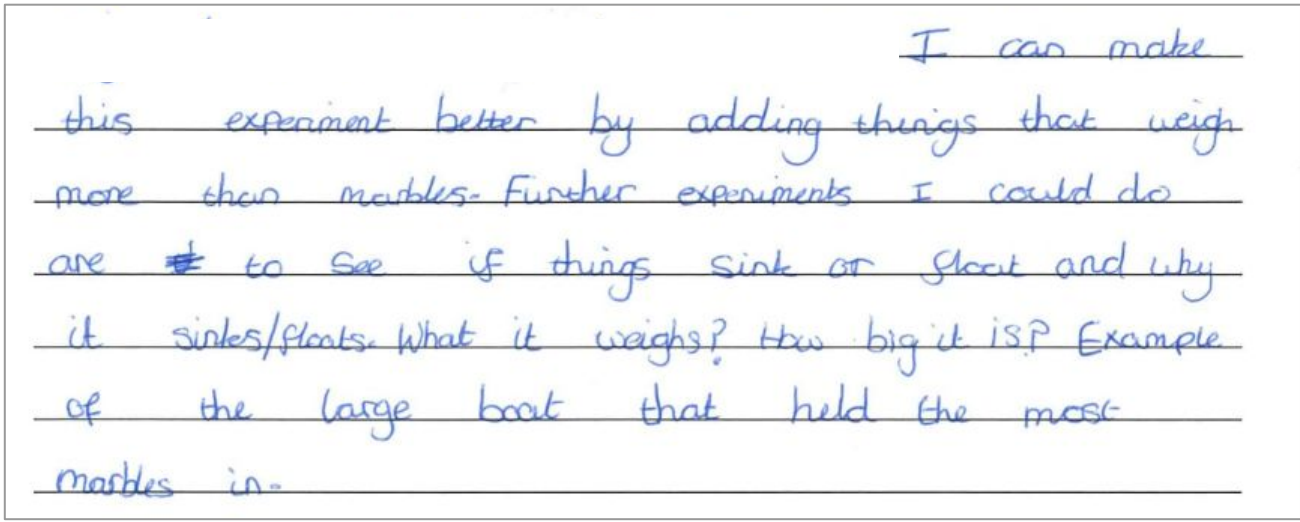

I can make this experiment better by adding things that weigh more than marbles. Further experiments I could do are to see if things sink or float and why it sinks/floats. What it weighs? How big it is? Example of the large boat that held the most marbles in.

Exemplar:

To improve the experiment, I could repeat each boat three times and take an average. I could also make sure that each boat was the same shape, so that I can be sure that tI am only investigate the size of the boat and not the shape.

Using Exemplars to Make Feedback Specific

Specific feedback:
explain why the boats should all be the same shape.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Judging, not Marking

Using comparative judgement to assess scientific writing.

Comparative judgement is a technique used to assess writing by ranking the quality of the work.

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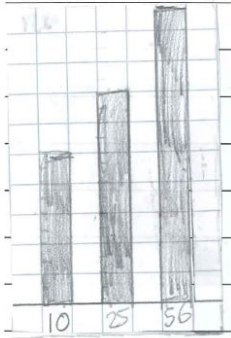
Measuring the Quality of Writing with Comparative Judgement

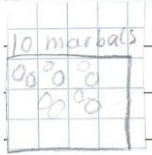
Left	51.4s	Which demonstrates a better scientific understanding?	28	Right

Page 1



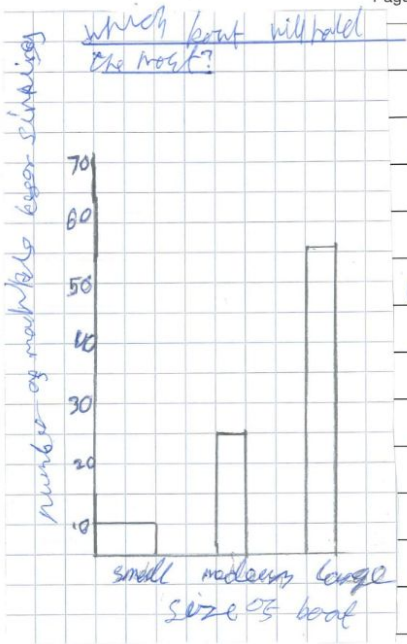
This is a chart to show how many marbals were in each boat.

Small



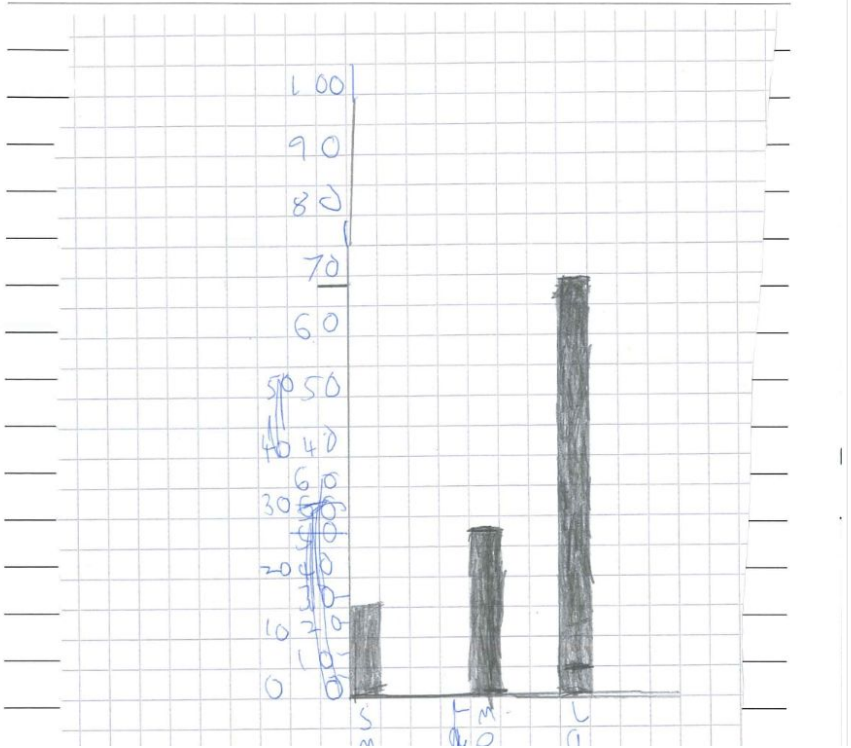
This is showing the smallest boat so far, and as you can see there are 10 (ten) marbals in the smallest boat.

Page 1

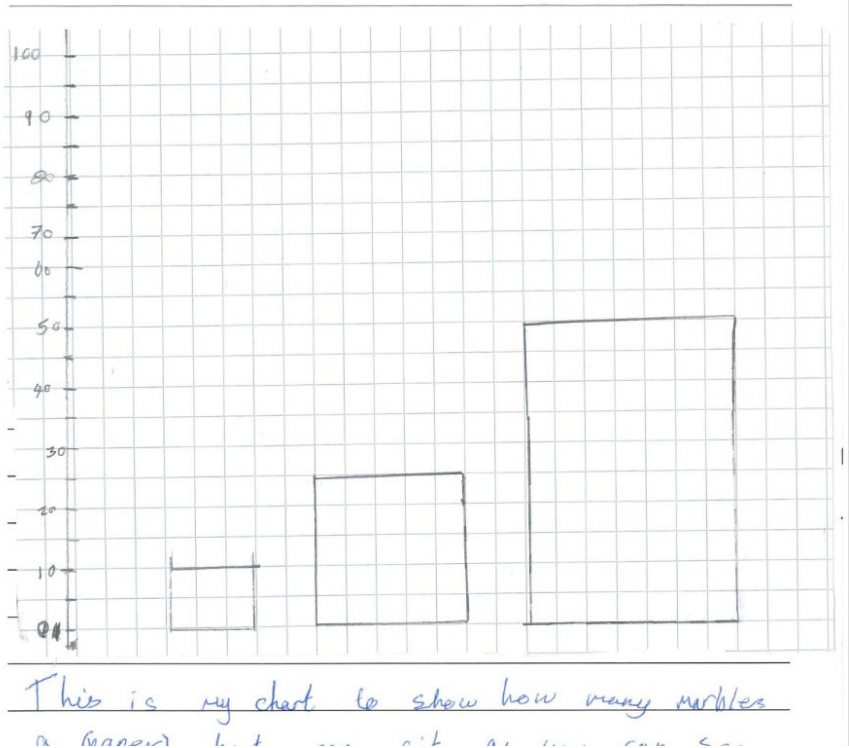


My results show that the small boat can't hold much because it has more forces together. On the other hand, the medium one has more room so it can hold more and takes longer to sink it. But the large one has no more space so it can hold more until it sinks in the most amount water and it take

Page 1



Page 1


100
90
80
70
60
50
40
30
20
10
0
This is my chart to show how many marbles

Conclusion:

1. Words and Knowledge
    a. Examples and non-examples
    b. Frayer Model
    c. Relationships between words
    d. Similar/Different
2. Writing:
    a. But, Because, So
    b. Write/Discuss/Rewrite
3. Judge Don't Mark

Where to find these slides:

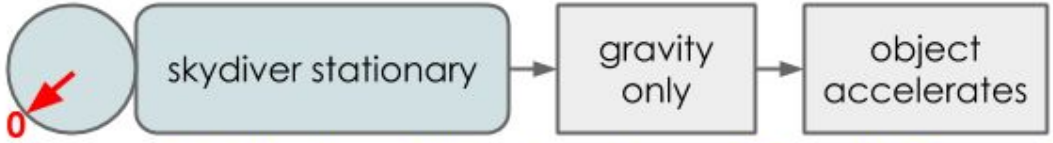
http://ipswichacademy.paradigmtrust.org/news/

Further reading:

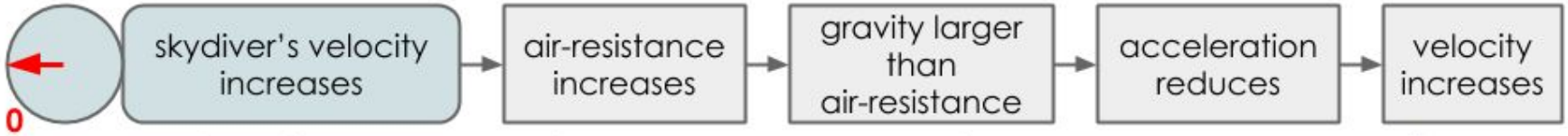
- https://readingforlearning.org/2018/10/10/characteristics-of-science-vocabulary-and-some-classroom-tools/
- https://bunsenblue.wordpress.com/2018/10/03/writing-in-science-a-symposium/
- https://rosalindwalker.wordpress.com/2018/10/17/sentences-and-the-web-of-knowledge/
- http://www.teach-well.com/writing-revolution-activities-in-primary-science/
- http://thescienceteacher.co.uk/writing-in-science/

Questions/Discussion

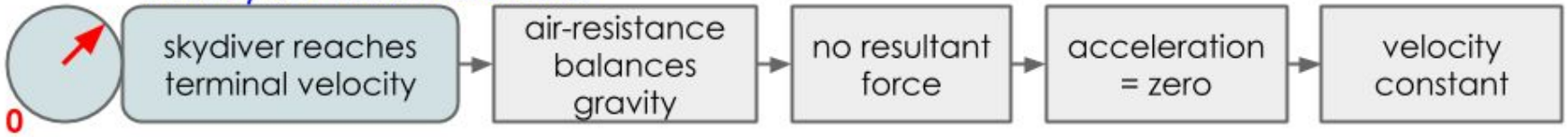
Terminal Velocity #1 model response.



Initially, the skydiver is stationary. The only force acting on her is gravity, so she accelerates downwards.

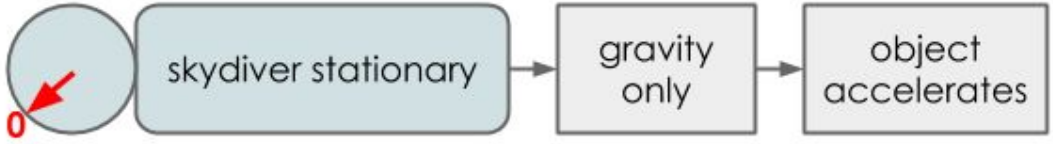


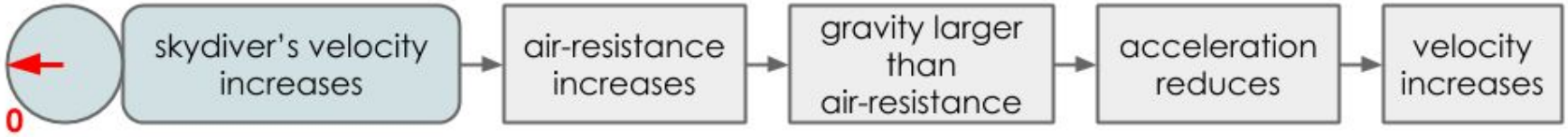
As her velocity increases, the air-resistance acting on her increases. As gravity is still greater than air-resistance, she continues to accelerate, though at a reduced rate. Her velocity continues to increase.

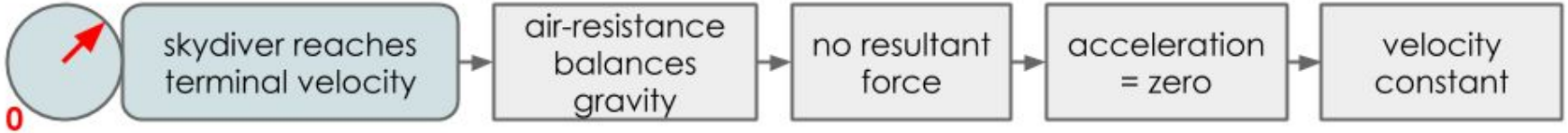


When she reaches terminal velocity, the air-resistance on the skydiver will balance the gravity acting on her. There will be no resultant force and her acceleration will be zero. She will fall at a constant velocity.

Terminal Velocity #1







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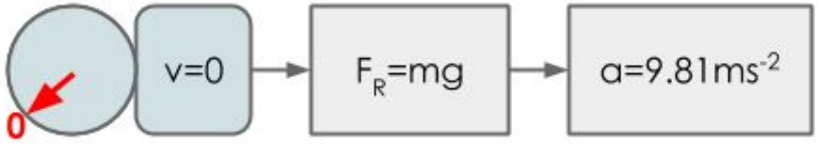
Terminal Velocity #3



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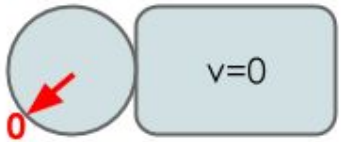
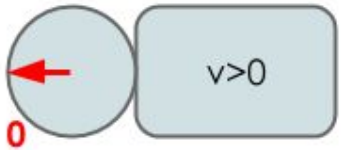
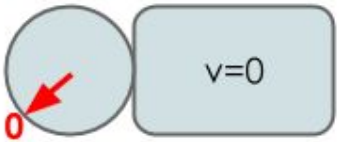
Terminal Velocity #4

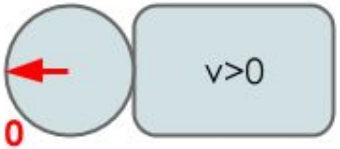




Paradigm

Terminal Velocity #5 - problem solving





A mouse can fall very large distances without harm.

Use the idea of terminal velocity to explain why the mouse is unhurt.

Paradigm