Speak Agent™

Integrating Academic Language and 3-D Science Learning

Do You Agree with This NAS Report Conclusion?

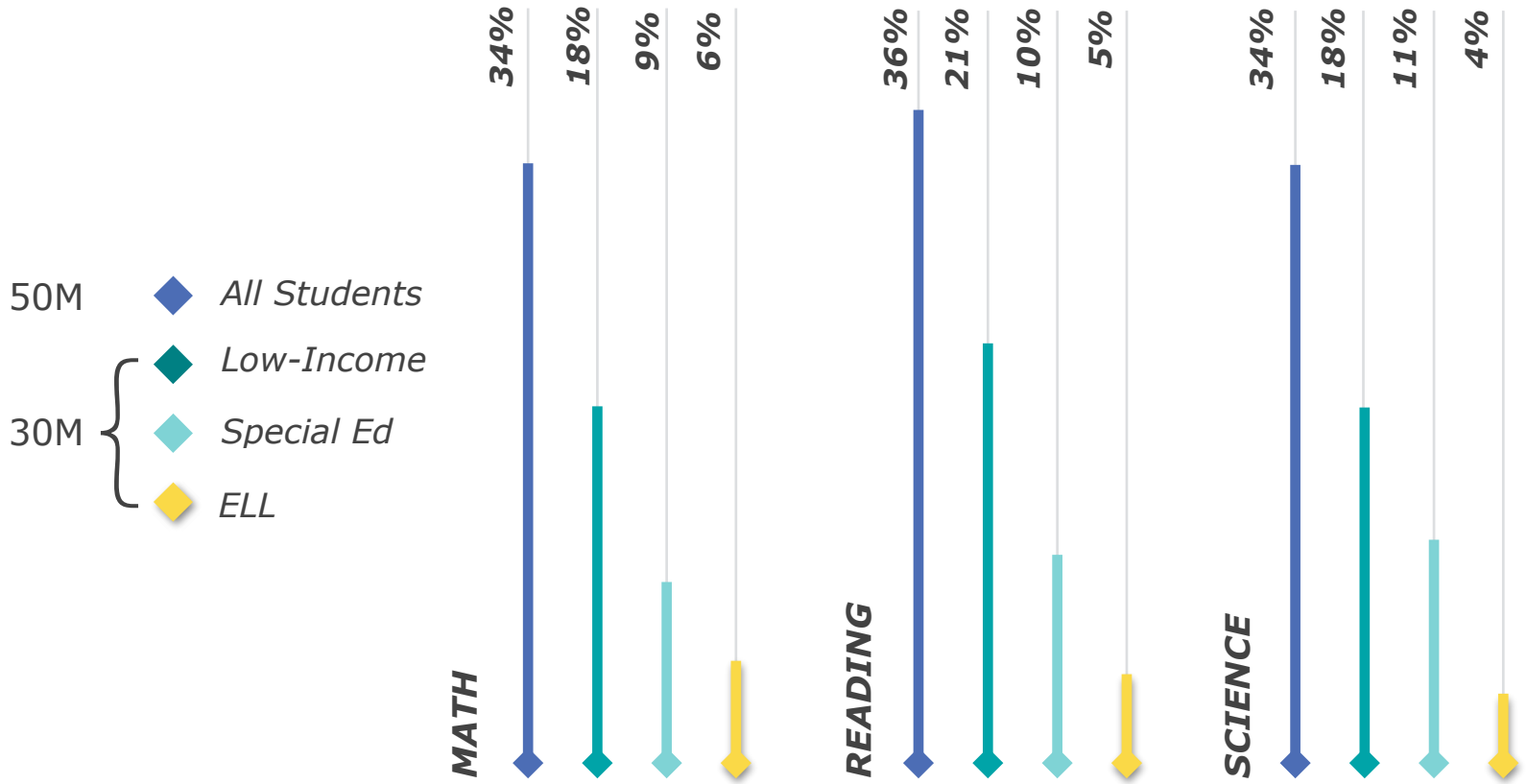
"STEM teachers are not prepared to foster simultaneous content knowledge and language development."

NATIONAL ACADEMY OF SCIENCES

SOURCE: National Academies of Sciences, Engineering, and Medicine. (2018). English Learners in STEM Subjects: Transforming Classrooms, Schools, and Lives. Washington, DC: The National Academies Press. doi: https://doi. org/10.17226/25182.

Problem: Most Students Fail to Meet National Standards

% of 8th Grade Students Achieving "Proficient" on NAEP:



Less than 21%

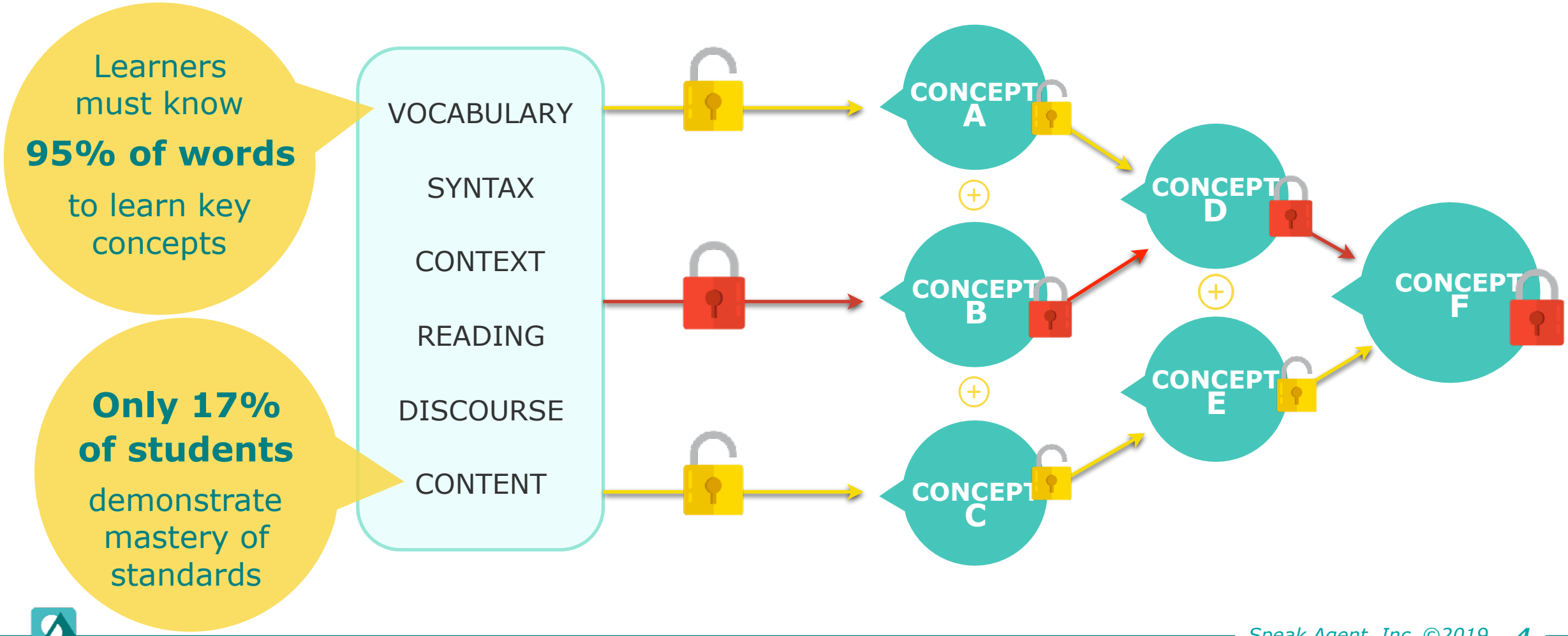
of all high school students are

ready for college-level STEM courses.

SOURCES: [1] STEM Education in the US: Where We Are and What We Can Do | 2017. Iowa City: ACT, March 2018: STEM Education Intervention, University of Pennsylvania; [2] National Assessment of Educational Progress (2017 for Math/Reading, 2015 for Science): https://www.nationsreportcard.gov. Retrieved July 4, 2018.

Academic Language Proficiency is the #1 Predictor of Success

Without academic language proficiency, students fall behind.



SOURCES: [1] Laufer, B., Ravenhorst-Kalovski, G. (2010). Lexical threshold revisited: Lexical text coverage, learners' vocabulary size and reading comprehension. Reading in a Foreign Language April 2010, Volume 22, No. 1, pp. 15–30; [2] TNTP Research: The Opportunity Myth, Sept. 2018.

Group Experiment

The Power of Multimodal Learning

天气又多云又寒冷。

Tiānqì yòu duōyún yòu hánlěng.

外太空很冷。

Wài tàikōng hěn lěng.

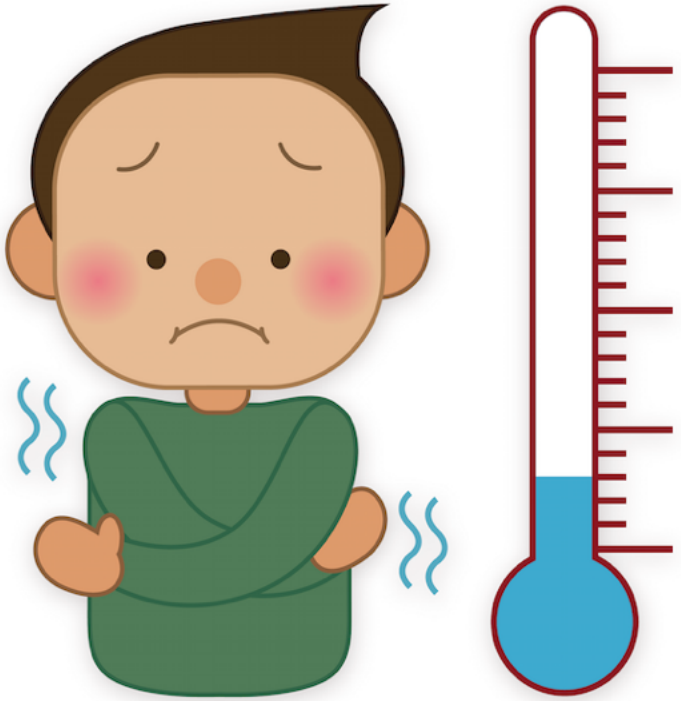
在外太空事物都漂浮。

Zài wài tàikōng shìwù dōu piāofú.

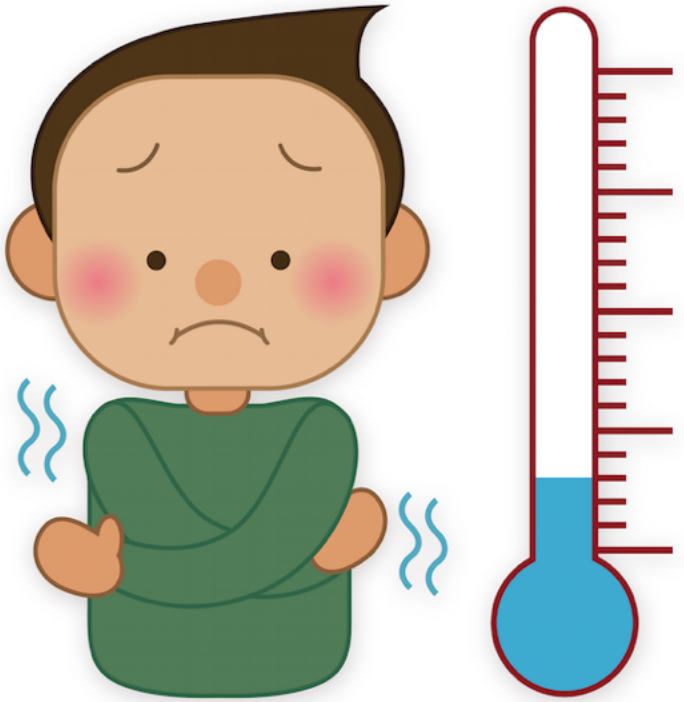
外太空中的一切都具有相同的重量。

Wài tàikōng zhōng de yīqiè dōu jùyǒu xiāngtóng de zhòngliàng.

天气又多云又寒冷。
It’s cloudy and cold.

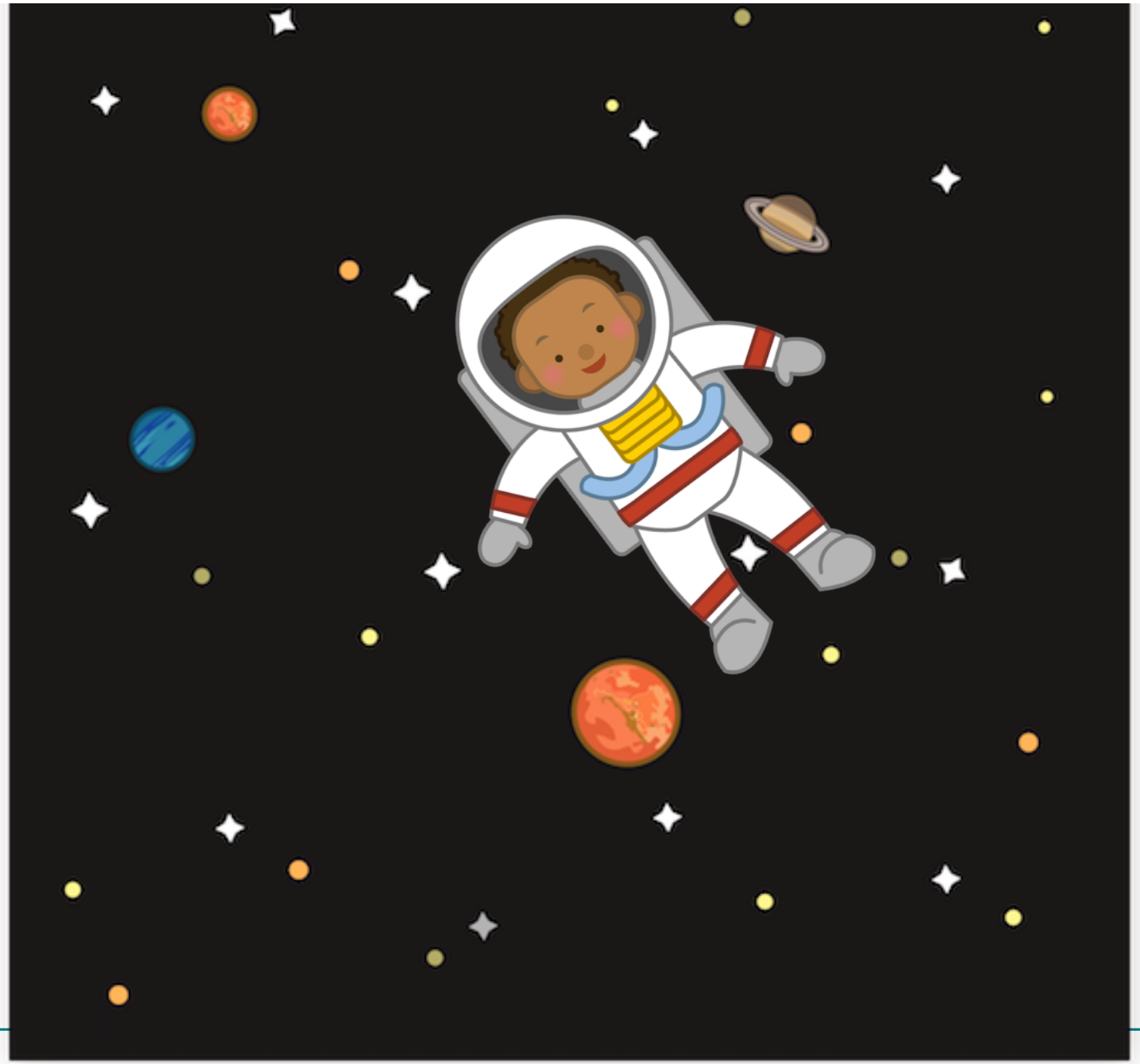


外太空很冷。
It’s cold in outer space.



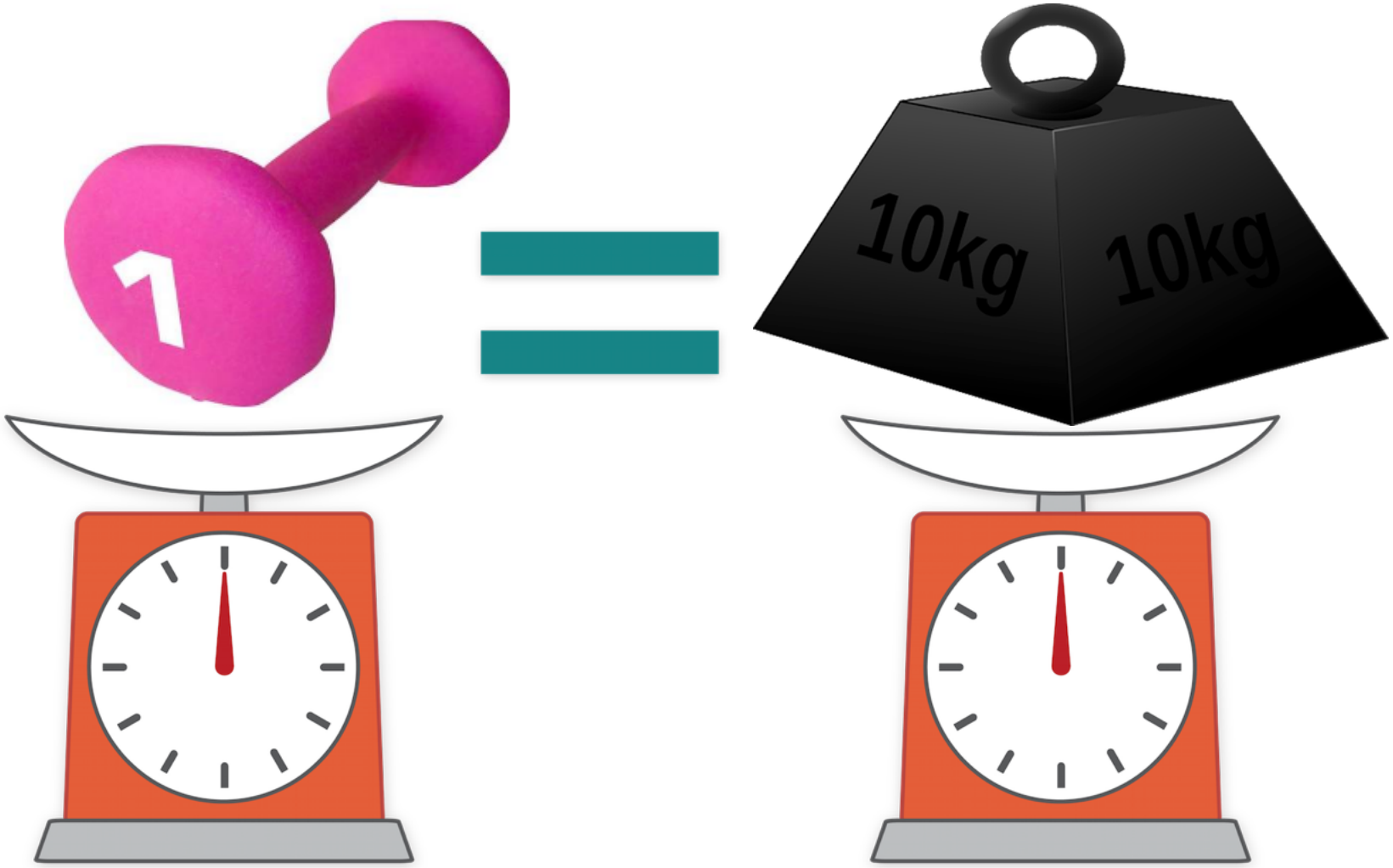
在外太空事物都漂浮。

Things float in outer space.



外太空中的一切都具有相同的重量。

Everything has the same weight in outer space.



Research Shows a Strong Connection Between Language and Performance

- Laufer & Ravenhorst-Kalovski (2010), Arya et al. (2011), and Proctor et al. (2005) showed that academic language proficiency is **the key malleable factor** influencing comprehension of academic/science texts and classroom discourse.
- Cromley (2009) showed a strong correlation (.82) between reading and science PISA scores using three years of global test data.

SOURCES:

[1] Laufer, B., Ravenhorst-Kalovski, G. (2010). Lexical threshold revisited: Lexical text coverage, learners' vocabulary size and reading comprehension. Reading in a Foreign Language, April 2010, Volume 22, No. 1, pp. 15–30.

[2] Arya, D.J., Hiebert, E.H., & Pearson, P.D. (2011). The effects of syntactic and lexical complexity on the comprehension of elementary science texts. *International Electronic Journal of Elementary Education*, Special Issue: Reading Comprehension, 4(1), 107-125.

[3] Proctor, C.P., August, D., Carlo, M., & Snow, C. (2005). Native Spanish-speaking children reading in English: Toward a model of comprehension. *Journal of Educational Psychology*, 97(2), 246- 256.

[4] Cromley, J. (2009). Reading achievement and science proficiency: International comparisons from the programme on international student assessment. Reading Psychology, 30, 89-118. DOI: 10.1080/02702710802274903

What the Experts Say:

"Language and content are not learned separately, as there is no *content-less* language nor *language-free* content."

NATIONAL ACADEMY OF SCIENCES

"Every science lesson is a language lesson."

NSTA National Science Teachers Association

Dr. David Crowther, President

SOURCES: [1] National Academies of Sciences, Engineering, and Medicine. (2018). English Learners in STEM Subjects: Transforming Classrooms, Schools, and Lives. Washington, DC: The National Academies Press. doi: https://doi. org/10.17226/25182; [2] Fathman, A. & Crowther, D. (Eds) (2006). Science for English Language Learners. Arlington, VA. NSTA Press.

What Is Academic Language?

What It Is

- The language of instruction used in school.
- Packed with meaning.
- Presented in an authoritative way.
- Highly structured.
- Tied to disciplinary content.
- Involves higher-order thinking.

What It Isn't

- Just vocabulary.
- Just definitions.
- Just a formal way of talking or writing.

SOURCES:

[1] Christie, F., and B. Derewianka. 2008. School Discourse: Learning to Write Across the Years of Schooling. London, UK: Continuum.

[2] Moje, E. B. 2010. "Comprehending in the Content Areas: The Challenges of Comprehension, Grades 7–12, and What to Do About Them." In A Comprehensive Look at Reading Comprehension, K–12, edited by K. Ganske and D. Fisher, 46–72. New York: Guilford.

[3] Quinn, H., O. Lee, and G. Valdes. 2012. "Language Demands and Opportunities in Relation to Next Generation Science Standards for English Language Learners: What Teachers Need to Know." Stanford, CA: Stanford University School of Education.

[4] Schleppegrell, M. J. 2004. The Language of Schooling: A Functional Linguistics Perspective. Mahwah, NJ: Lawrence Erlbaum Associates.

Academic Language Involves Many Types of Interactions:

Collaboration & Production

- Conversations
- Interacting via writing and media
- Commenting and persuading
- Adapting language to context
- Oral presentations
- Writing & applying precise vocabulary
- Arguing from evidence

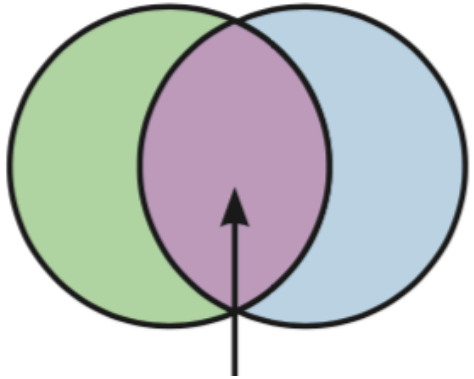
Interpretation

- Active listening
- Asking questions
- Close reading
- Explaining Ideas
- Evaluating others
- Analyzing writing

Source: CA ELD Standards, California State Board of Education, November 2012. Retrieved 4/15/2019: https://www.cde.ca.gov/sp/el/er/documents/eldstndspublication14.pdf

There Is No Achievement Without Academic Language Proficiency

Language Proficiency



STEM Achievement

Academic Language Proficiency

SOURCE: 2018 Educator Guide: Texas English Language Proficiency Assessment System (TELPAS). Texas Education Agency, October, 2017.

Current Practice

and Preliminary Efficacy Data

Current Curricula Don’t Align to NGSS

- Only one science curriculum aligns with NGSS.*

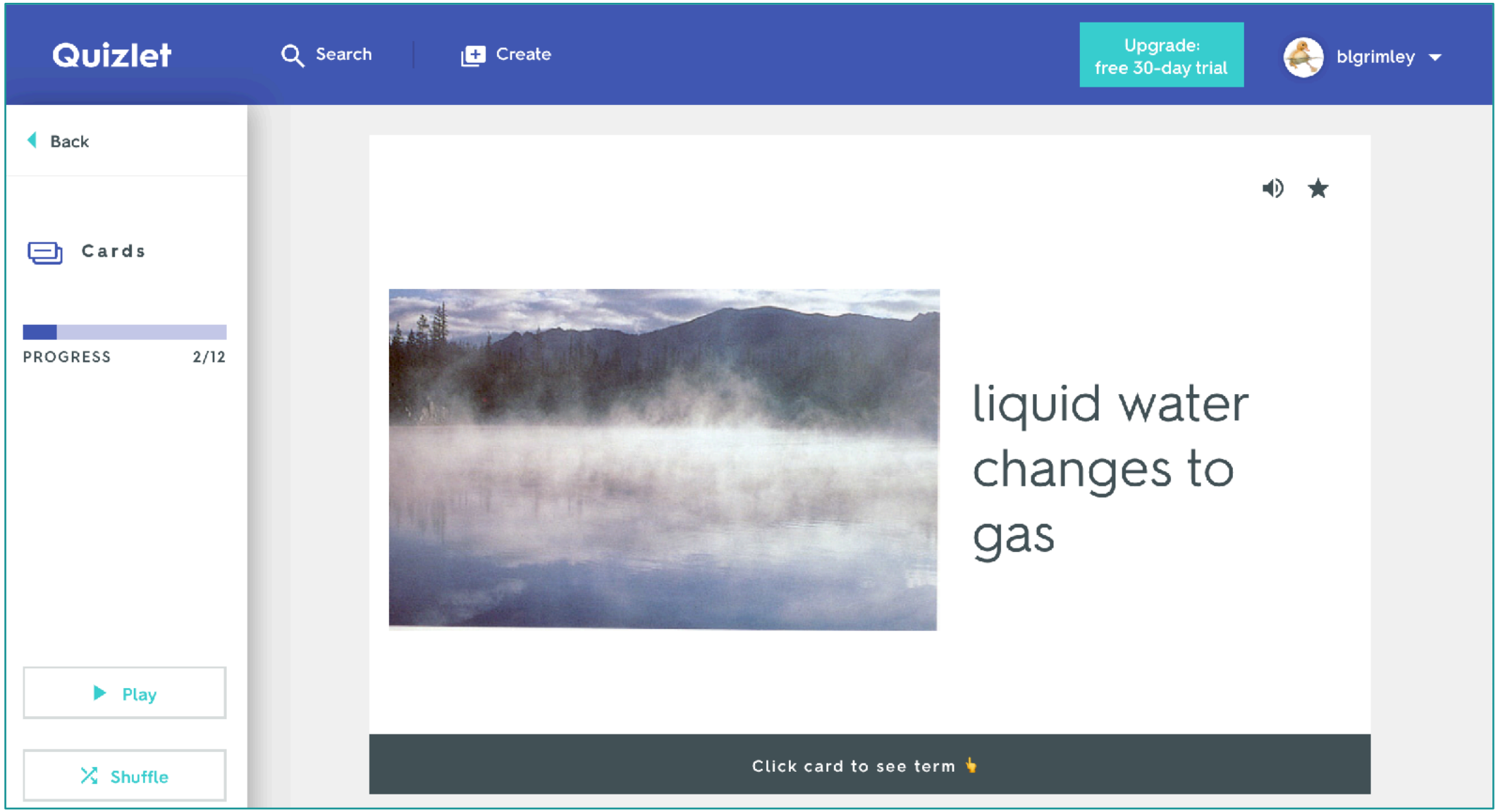
***EdReports gave all but one publisher a failing score:**

SOURCE: Sawchuk, S. (2019). “Science Curriculum Reviews Are Out, and Results Aren't Great.” Education Week, February 28, 2019. Retrieved 3/5/19: http://blogs.edweek.org/edweek/curriculum/2019/02/edreports_science_series_first_reviews.html.

Current Curricula Don’t Address Language

- Only two curriculum products attempt to integrate academic language.
- None incorporate digital tools and scaffolds for language learning.
- None have shown evidence of efficacy with scientific language.
- None can tailor their content to fit other curricula—you’re locked in.

How Many of You Use Quizlet as a Supplemental Tool?



What Works?

Research-Based Strategies

Research Sources

- Bravo et al. (2007): showed language acquisition strategies apply to science just as they do to literacy.
- Multimodal learning across all four language domains is optimal for building language comprehension (Graves, 2009; Nisbet & Austin, 2013).
- Collaboration and communication among learners helps develop expressive language (Thorne & Black, 2007).
- Multimodal language learning helps students acquire fluency with science texts (Bravo et al., 2007; Graves, 2009; Nisbet & Austin, 2013; Peregoy & Boyle, 2013).

SOURCES:

[1] Bravo, M.A., Cervetti, G.N., Hiebert, E.H., Pearson, P. D. (2007). From passive to active control of science vocabulary. In D.W. Rowe et al. (Eds.), 56th Yearbook of the National Reading Conference. Oak Creek, WI: National Reading Conference.

[2] Graves, M.F. (2009). Teaching individual words. New York: Teachers College Press, IRA.

[3] Nisbet, D., & Austin, D. (2013). Enhancing ESL Vocabulary Development Through the Use of Mobile Technology. MPAEA Journal of Adult Education, 42(1), 1–7.

[4] Thorne, S. L., & Black, R. W. (2007). Language and literacy development in computer-mediated contexts and communities. Annual Review of Applied Linguistics, 27, 133-160.

[5] Peregoy, S. F., & Boyle, O. (2013). Reading, Writing, and Learning in ESL: A Resource Book for Teaching K-12 English Learners, 6th Edition (pp. 224-248). Boston, MA: Pearson.

Academic Language Learning Is Not Just Vocabulary

It requires using all language domains at all levels of meaning.

All Levels of Meaning

- Discourse
- Sentence
- Word

All Language Domains

All Four Domains Are Needed to Support Interactions:

Collaboration & Production

- Conversations
- Interacting via writing and media
- Commenting and persuading
- Adapting language to context
- Oral presentations
- Writing & applying precise vocabulary
- Arguing from evidence

Interpretation

- Active listening
- Asking questions
- Close reading
- Explaining Ideas
- Evaluating others
- Analyzing writing

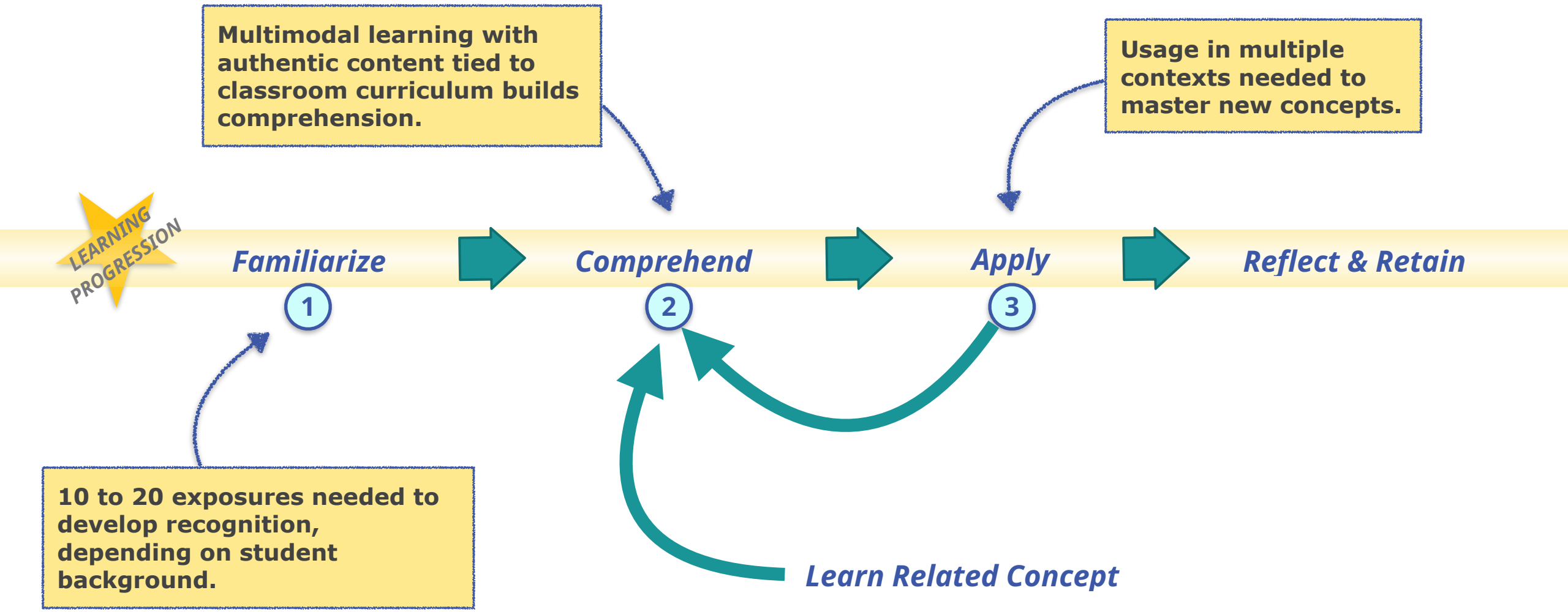
Source: CA ELD Standards, California State Board of Education, November 2012. Retrieved 4/15/2019: https://www.cde.ca.gov/sp/el/er/documents/eldstndspublication14.pdf

Scientific Language Teaching Strategies

- Include not only scientific terminology, but also sentence and discourse levels in a variety of registers.
- Use language development strategies that deliver meaningful learning and transfer to long-memory so that students progressively build their knowledge base.
- Offer repeated, multimodal supports so students acquire “active” fluency with scientific terminology and master concepts.

Progression for Science Terminology and Concepts

Academic language overall develops in a NON-LINEAR way



SOURCE: Bravo, M.A., Cervetti, G.N., Hiebert, E.H., Pearson, P. D. (2007). From passive to active control of science vocabulary. In D.W. Rowe et al. (Eds.), 56th Yearbook of the National Reading Conference. Oak Creek, WI: National Reading Conference.

Aligning Technology to the Classroom Curriculum

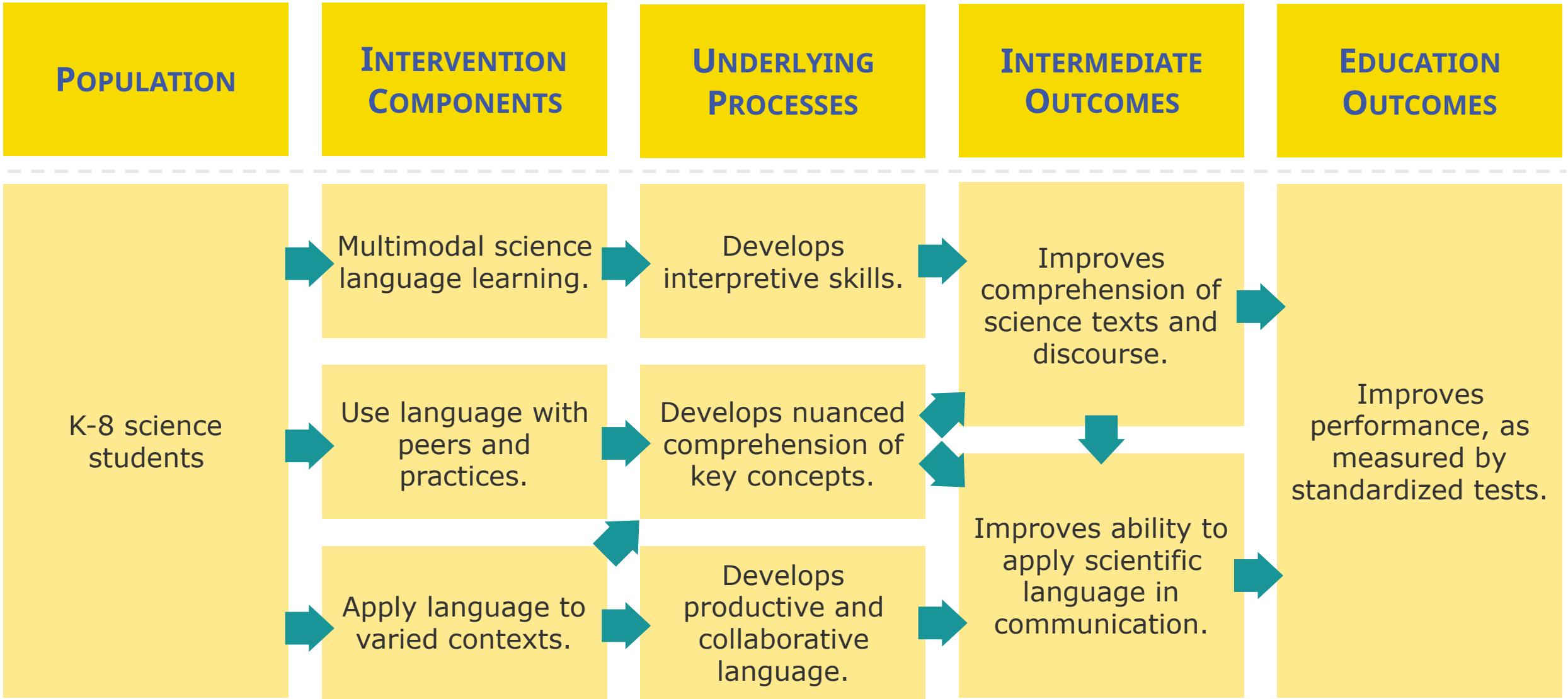
- Aligning with classroom curriculum and authentic content is **key to efficacy** (Cassady, Smith, & Thomas, 2018; Peregoy & Boyle, 2013).
  - scope
  - sequence
  - pacing

SOURCES:

[1] Cassady, J., Smith, L., & Thomas, C. (2018). Supporting Emergent Literacy for English Language Learners with Computer-Assisted Instruction. *Journal of Research in Reading*, v41 n2, p350-369, May 2018.

[2] Peregoy, S. F., & Boyle, O. (2013). Reading, Writing, and Learning in ESL: A Resource Book for Teaching K-12 English Learners, 6th Edition (pp. 224-248). Boston, MA: Pearson.

Theory of Change



Game-Based Technology Moves Theory into Practice

Easy and fun to use; tailors to precisely align with any curriculum or program.

STANDARDS-ALIGNED CONTENT

CCSS | NGSS | WIDA | TEKS | eNY | CPALMS | CA ELD

Science & Engineering | Math | Technology | Civics | Life Skills | Career | Custom

GAME-BASED MULTIMODAL LEARNING

Aural | Collaborative | Experiential | Kinesthetic

Textual | Metacognitive | Verbal | Visual

EVIDENCE-BASED INSTRUCTIONAL STRATEGIES & TOOLS

Active Learning | External Memory Aids | Metacognitive Supports

Modeling & Growth Mindset | Multi-Sensory Supports | Programmatic Interventions

Repetition | Visual Learning Tools | Writing Supports

PLATFORM

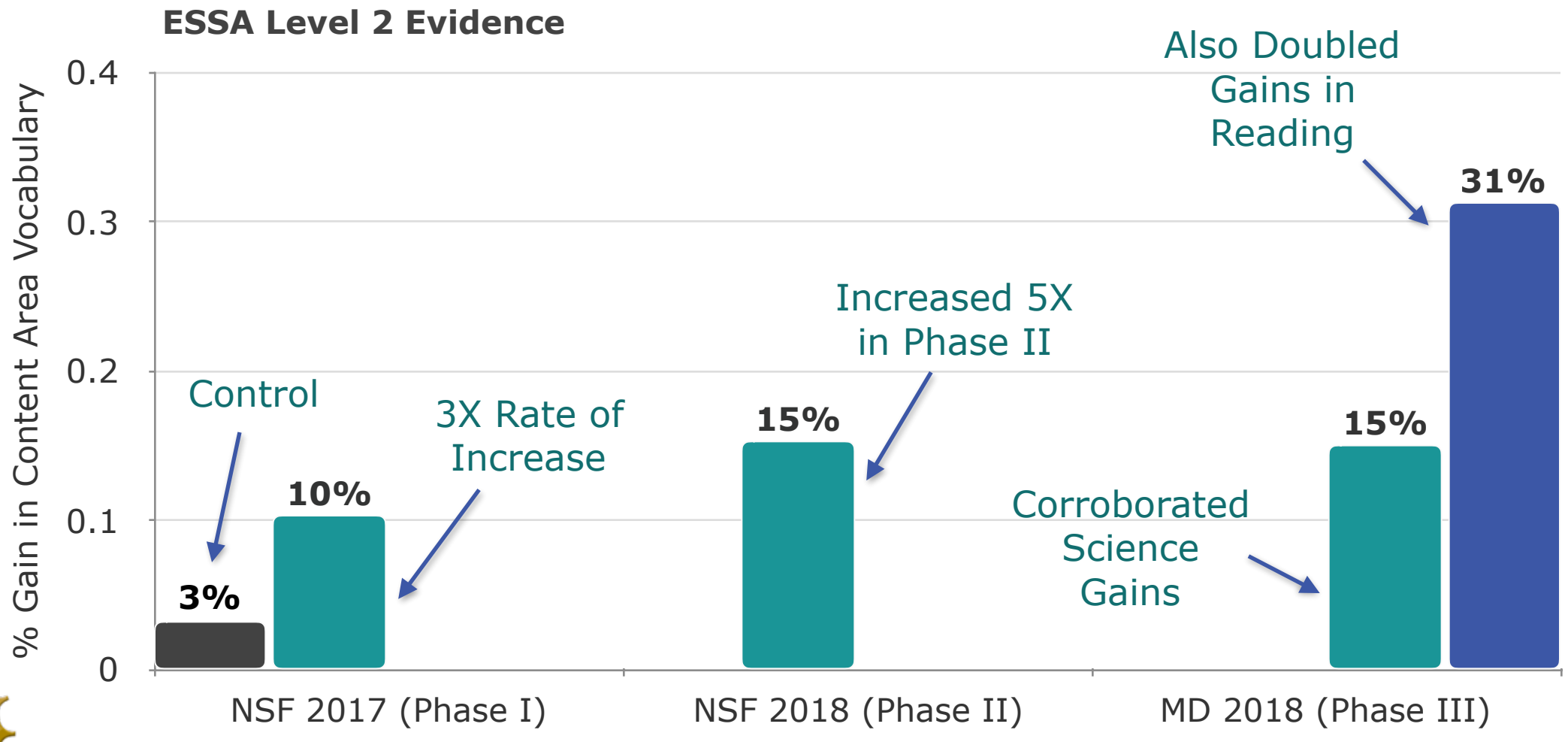
AUTHORING

PEDAGOGY

RESEARCH

Speak Agent Accelerates Concept Mastery

Gains in complex science concepts among 2nd graders after 3 hours of use, significant at p < .01



SOURCE: Li, J. (2018). Speak Agent in the Classroom Summary Report. Bloomington: Rockman et al, June 2018.

Scaffolding is a Key Reason Why It Works

Figure from Gibbons (2009) as published in the CA ELD Standards

SOURCE: Gibbons, P. 2009. English Learners, Academic Literacy, and Thinking: Learning in the Challenge Zone. Portsmouth, NH: Heinemann.

Speak Agent Engages Students in Active Co-Learning

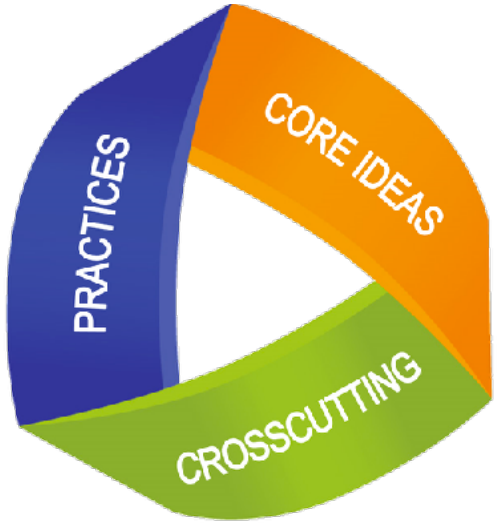
JoAnn Leleck ES, Silver Spring, MD

Drew Model School, Arlington, VA

The Shift with NGSS

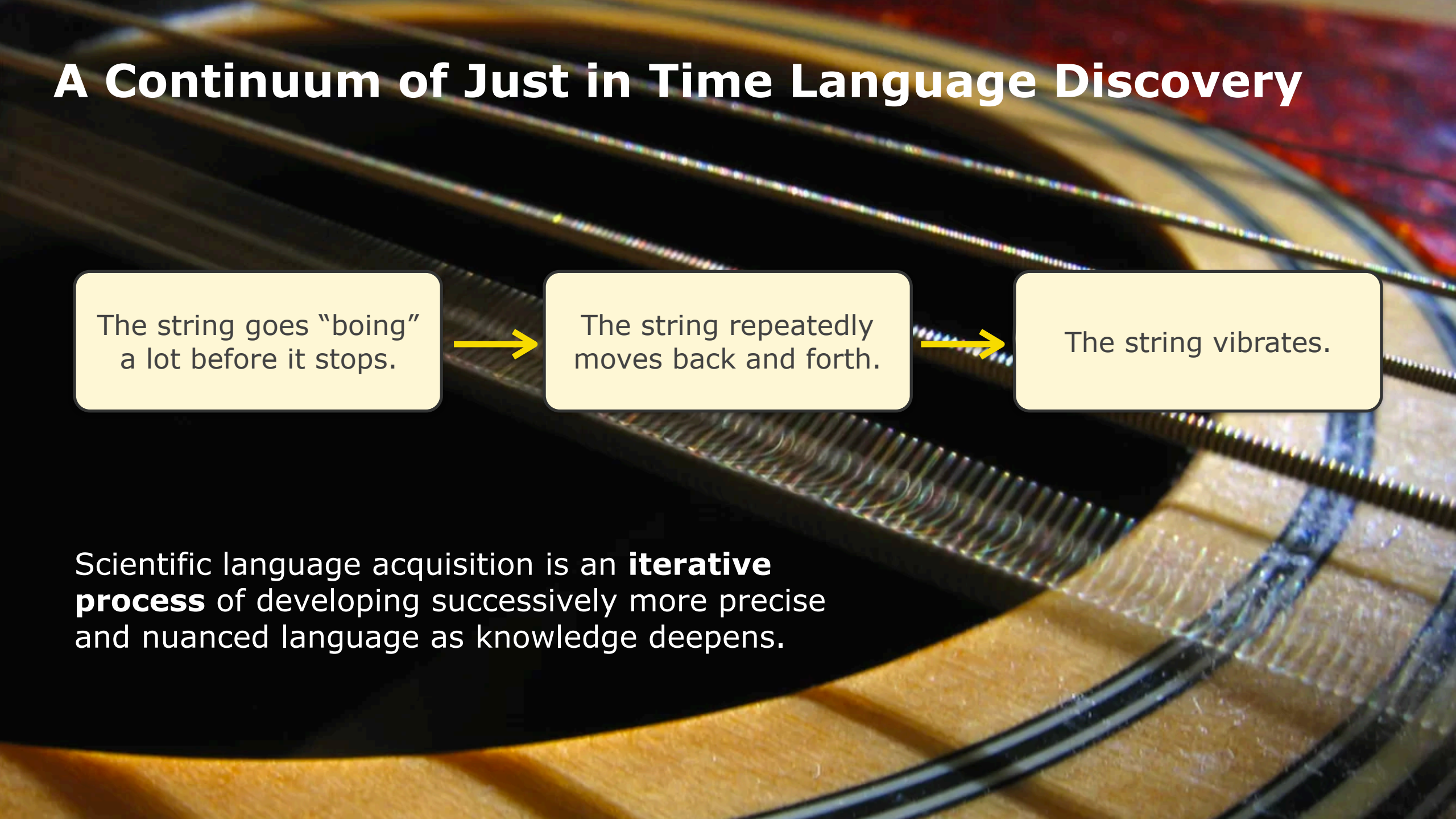
Moving to 3-D Science Learning

The Shift in STEM: 3-D Science Learning



- The NGSS Framework weaves three dimensions of science learning into a discovery-driven approach:
  - Practices
  - Core Ideas
  - Crosscutting Concepts
- The NGSS 3-D approach pushes students to ask and answer their own questions in response to their investigations of phenomena.
- Language is integrated on a **just in time** basis so as not to preempt discovery-driven learning.

A Continuum of Just in Time Language Discovery



Scientific language acquisition is an **iterative process** of developing successively more precise and nuanced language as knowledge deepens.

Key Challenges in Implementation

- Connections to background knowledge may be less obvious, particularly to multilingual and disadvantaged students.
- Curricula and resources such as texts and videos do not yet use this language approach, so it’s hard to implement.
- Relevant professional development is not yet broadly available for how to incorporate this into daily practice.

Key Recommendations from Fall 2018 NAS Report:

- Explicitly teach the language of science.
- Provide multimodal learning opportunities.
- Engage students in collaboration and discourse.
- Focus on the eight practices.

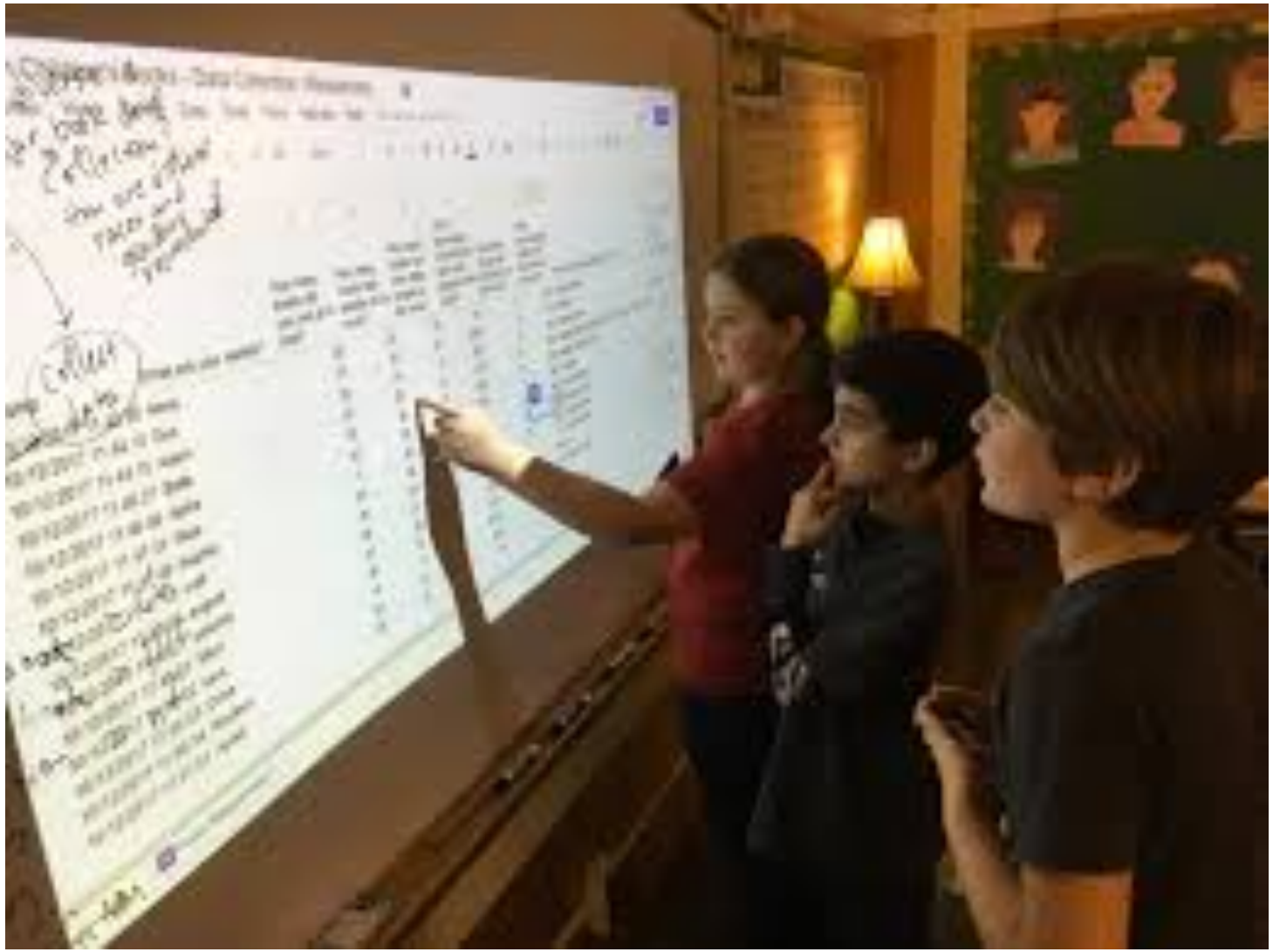
SOURCE: NASEM, National Academies of Sciences, Engineering, and Medicine. (2018). English Learners in STEM Subjects: Transforming Classrooms, Schools, and Lives. Washington, DC: The National Academies Press. doi: https://doi. org/10.17226/25182.

Asking Questions and Defining Problems [L,S,R,W]

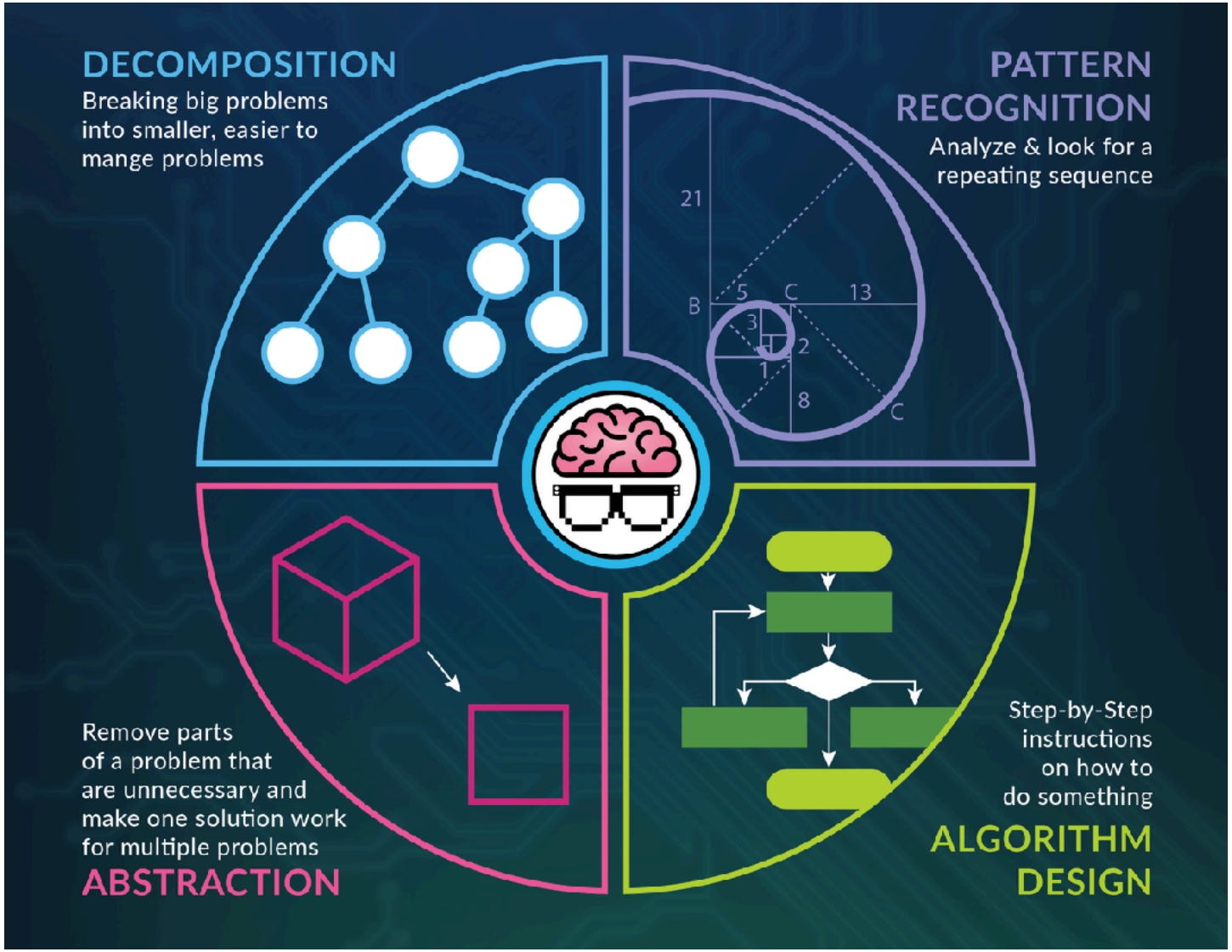
Developing and Using Models [L,S,W]

Planning and Carrying Out Investigations [L,S,R,W]

Analyzing and Interpreting Data [S,R,W]



Using Mathematical and Computational Thinking [S,R,W]



Constructing Explanations and Designing Solutions [L,R,W]

Engaging in Argument from Evidence [L,S,W]

Obtaining, Evaluating & Communicating Information [L,S,R,W]

Words of Wisdom:

"Communication is not something you add on to science; it is of the essence of science."

ALAN ALDA

Science Language 3-D

A Vision for Content and Language Integration

"Science Language 3-D" Vision and Goals

- Highly integrated with both the practices and the core ideas.
- Aligns to your classroom curriculum.
- Paced with each unit of study for just in time use.
- Works with any technology.
- Practical to implement!
- Effective in accelerating science language acquisition.
- Applies research-based strategies.
- Multimodal.
- Multilingual.
- Collaborative.
- Game-based.

How Technology and Interactivity Can Help

- Supports the practices by providing language scaffolds, higher student engagement, and effective digital tools to augment (not replace) investigations of phenomena.
- Facilitates peer review and realtime collaboration.
- Launching point for classroom discourse—should never replace or displace discourse, but augment it!
- Captures student work samples in a digital portfolio.
- Reduces teacher burden by making planning time more effective, reducing printing and copying, avoiding the hunt for supplements, and automating data capture for formative assessment.

The Hub: A Digital Investigations Notebook

- Students record observations of real-world investigations.
- Journaling with writing scaffolds such as word banks, visual supports, sentence stems, and text-to-speech.
- Integration of media.
- Class notebook for peer modeling and as an authentic purpose.
- A tool to create and revise models.
- Automated time-stamping and versioning.
- Data visualizations.
- Real-time teacher access and moderation.

Digital Investigations Notebook

Portfolio

Prototype Designs

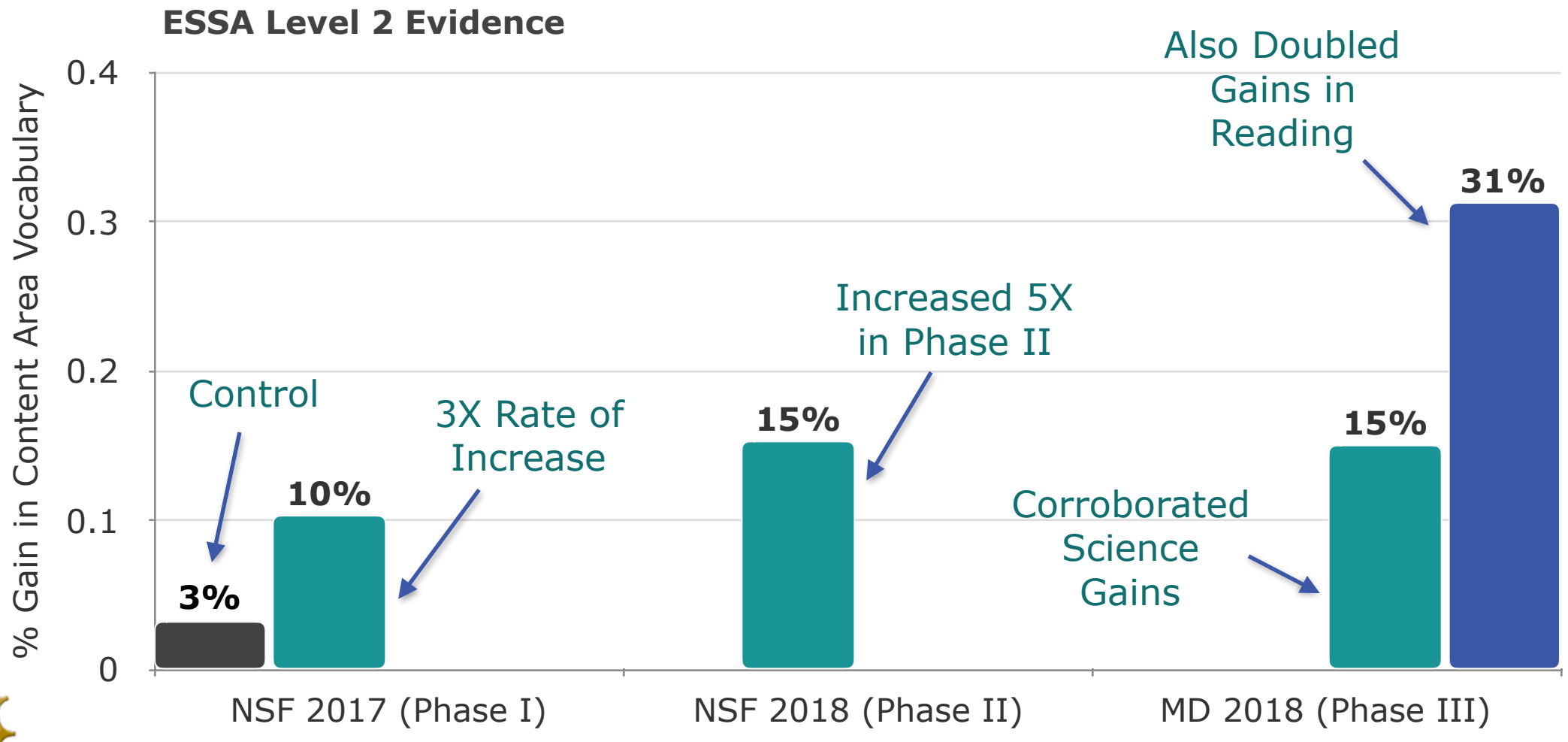
- Please note that several slides containing confidential prototype designs have been removed from this deck.
- If you would like to view the prototype designs, please contact us: ben@speakagent.com or dan@speakagent.com.

Speak Agent

Our Current Implementation Before 3-D

Researchers Found Speak Agent Accelerates Concept Mastery

Gains in complex science concepts among 2nd graders after 3 hours of use, significant at p < .01



SOURCE: Li, J. (2018). Speak Agent in the Classroom Summary Report. Bloomington: Rockman et al, June 2018.

A Speak Agent Lesson Example

A Digital Lesson in Speak Agent (K-5 Version Shown)

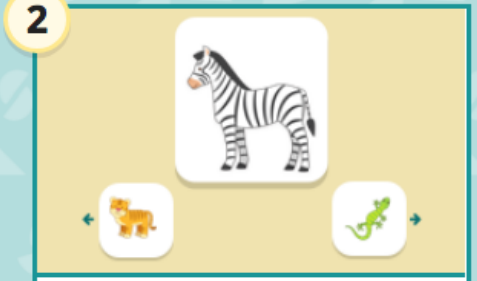
Unit 8: Exploring the Water Cycle

Play with all of the activities to finish your lesson!

1

Video
Julie's Water Cycle Experiment

2



Word Review
Unit 8: Exploring the Water Cycle

3

My Voice
Water Cycle Voice Recording

4

Matching
Unit 8: Exploring the Water Cycle

5

Picture Pairs
Unit 8: Exploring the Water Cycle

6

Scrambled Sentences
Water, Water Everywhere!

7

Vocab Lab
Exploring the Water Cycle (Science, Grade 2)

8

Tall Tales
Water, Water Everywhere! (Grade 2)

Guided Practice and Modeling

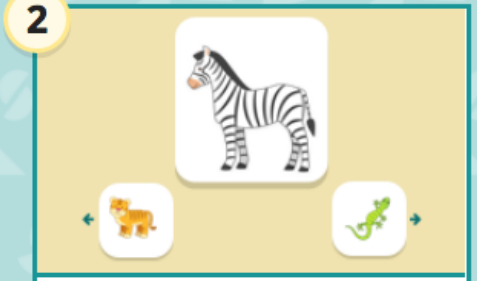
Unit 8: Exploring the Water Cycle

Play with all of the activities to finish your lesson!

Guided Practice (GP)

1

Video
Julie's Water Cycle Experiment

2

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Tall Tales
Water, Water Everywhere! (Grade 2)

Independent Practice

Unit 8: Exploring the Water Cycle

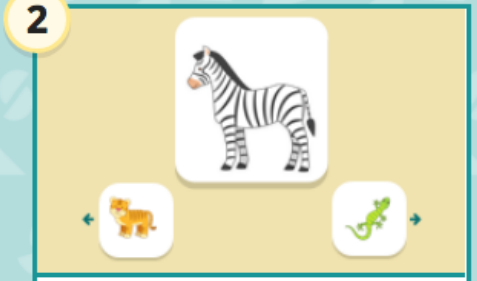
Play with all of the activities to finish your lesson!

Independent Practice (IP)

1

Video
Julie's Water Cycle Experiment

2



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Scrambled Sentences
Water, Water Everywhere!

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Vocab Lab
Exploring the Water Cycle (Science, Grade 2)

8

Tall Tales
Water, Water Everywhere! (Grade 2)

Peer Collaboration

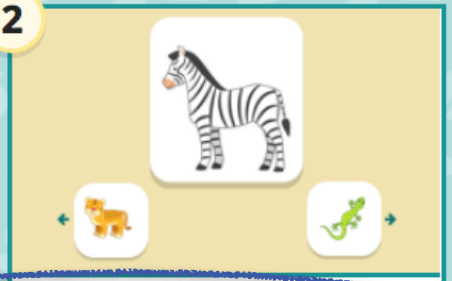
Unit 8: Exploring the Water Cycle

Play with all of the activities to finish your lesson!

Co-Learning Roles

1

Video
Julie's Water Cycle Experiment

2

Word Review
Unit 8: Exploring the Water Cycle

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Water Cycle Voice Recording

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Unit 8: Exploring the Water Cycle

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Picture Pairs
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6


Scrambled Sentences
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Vocab Lab
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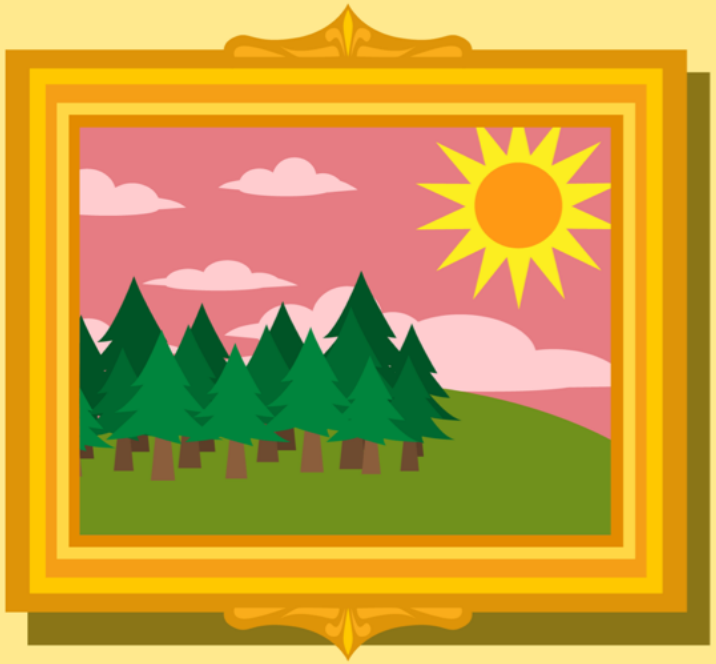
Tall Tales
Water, Water Everywhere! (Grade 2)

Word Gallery



Strategy: Daily Review

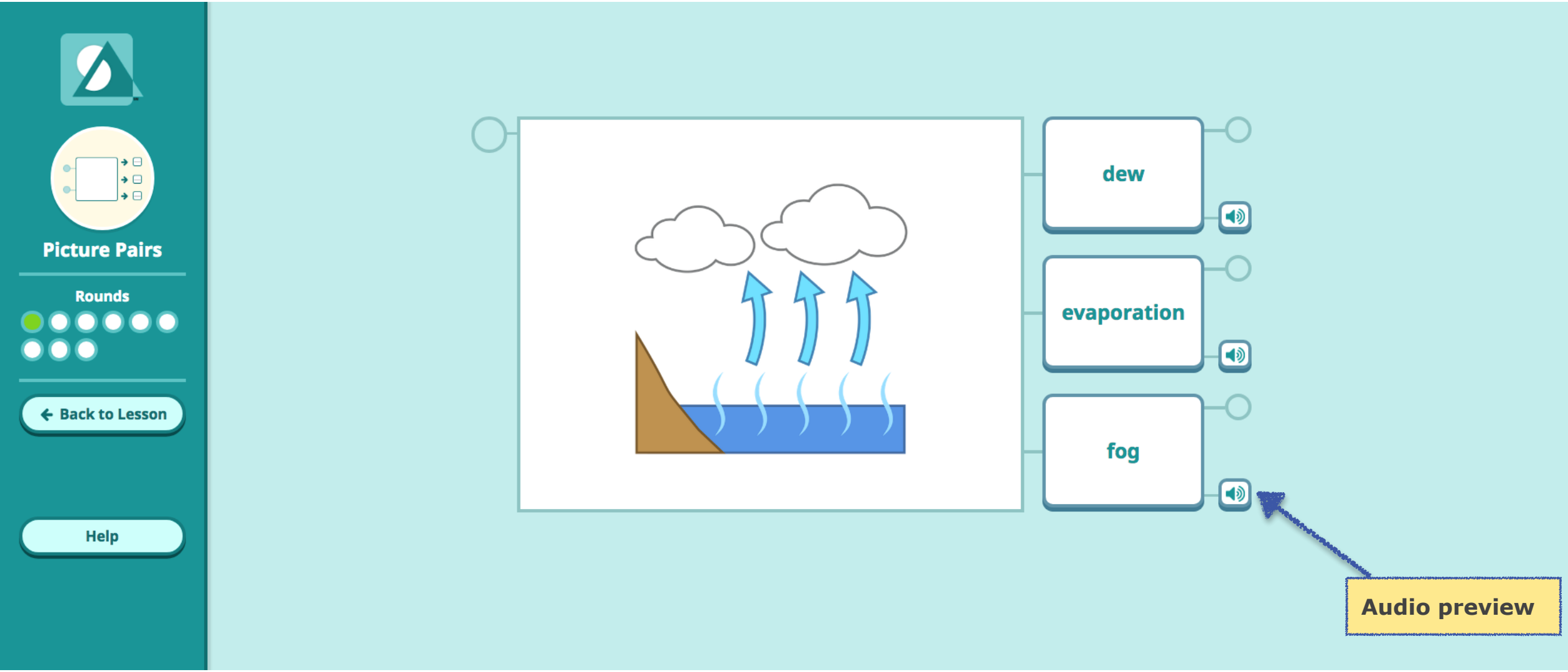
Picture Pairs

apple

water

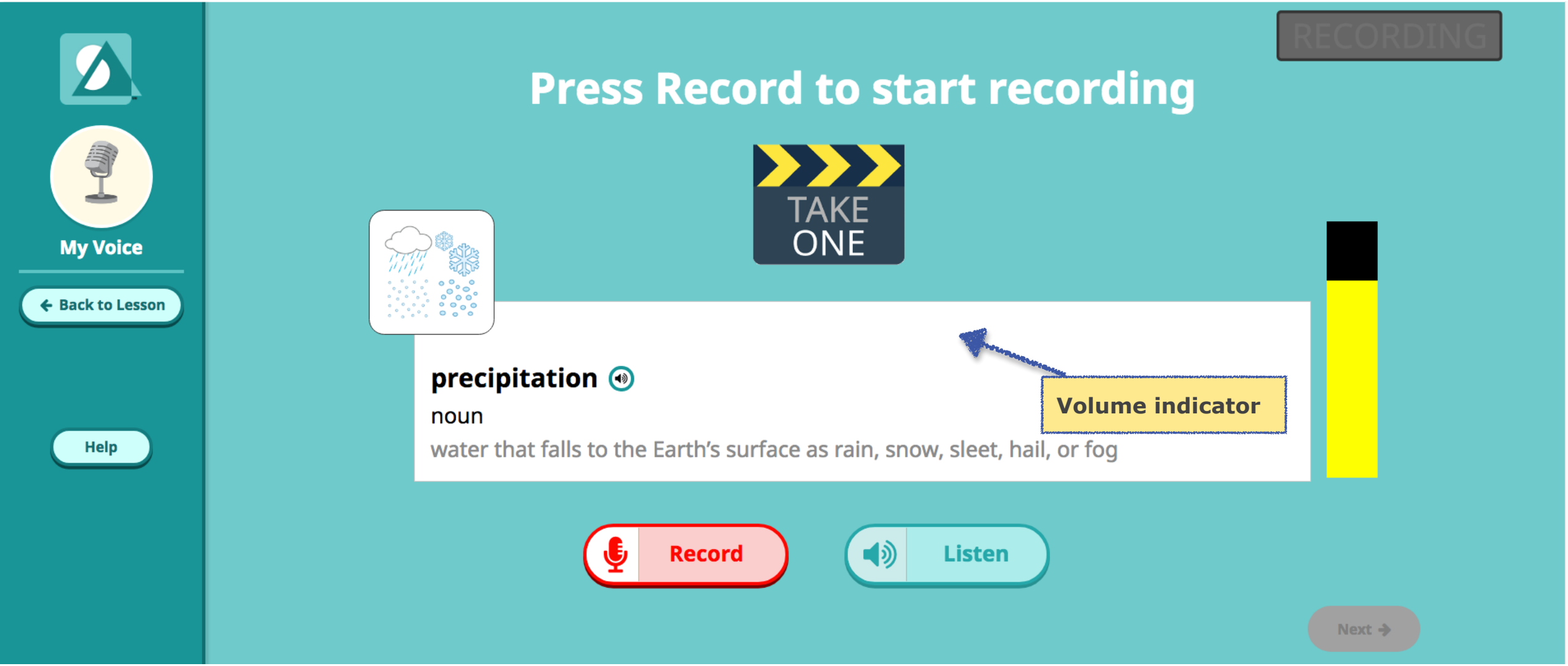
science

Strategy: Multimodal Exposure




My
Voice

Strategy: Verbal Repetition



Strategy: Partner Read-Alouds

My Voice

Back to Lesson

Help

Choose your best take!

precipitation

noun

water that falls to the Earth's surface as rain, snow, sleet, hail, or fog

Take 1: Listen

Take 2: Listen

Take 3: Listen

Have a language buddy review and critique. Their favorite take is shared with you!

Do Over

Done


Tall
Tales

Strategy: Word Games & Puzzles

Tall Tales

← Lesson

Help

The Egg That Grew

Listen Check My Work

There once was a tiny  (EGG) that grew on a big leaf. One day, it hatched and a _____ (NOUN) came out. The little butterfly larva _____ (VERB) lots and lots of _____ (NOUN). Soon it formed a _____ (NOUN) around its body. Inside it changed into a _____ (NOUN). Four hours later it could _____ (VERB)! That's the last stage of the butterfly _____ (NOUN). The _____ (ADJECTIVE) butterfly could now lay its own eggs! Its _____ (NOUN) from egg to butterfly was complete.

Strategy: Multisensory Supports

Tall Tales

Lesson

Help

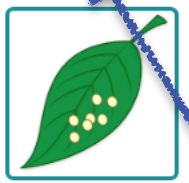
Choose a noun.

A noun is a person, place, thing, or idea.

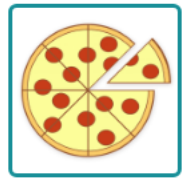
CLOSE


caterpillar


baby


egg


monkey


pizza


ate


hippopotamus


milkweed

Audiovisual support is everywhere!

There once was a tiny _____ ...tched and a _____ (NOUN) came out. The little butterfly larva _____ (VERB) lots and lots of _____ (NOUN). Soon it formed a _____ (NOUN) around its body. Inside it changed into a _____ (NOUN). Four hours later it could _____ (VERB)! That's the last stage of the butterfly _____ (NOUN). The _____ (ADJECTIVE) butterfly could now lay its own eggs! Its _____ (NOUN) from egg to butterfly was complete.

Strategy: Visual Aids

Tall Tales

← Lesson

Help

The Egg That Grew

Listen Check My Work

Gives corrective feedback *when the student is ready*.

There once was a tiny  EGG that grew on a big leaf. One day, it hatched and a  BABY came out. The little butterfly larva  ATE lots and lots of  GUACAMOLE. Soon it formed a  CHRYSALIS around its body. Inside it changed into a  BUTTERFLY. Four hours later it could  FLY! That's the last stage of the butterfly  LIFE CYCLE. The  MATURE butterfly could now lay its own eggs! Its  DANGER from egg to butterfly was complete.

Builds a rebus-style story.

Vocab Lab

Strategy: Dialogic Reading

Vocab Lab

← Lesson

Read the story for clues to solve the secret formula for the word in black letters.

brood

Listen

A bee brood is the eggs and young bees that are still growing. The brood lives inside the bee hive. They cannot fly yet. It takes about three weeks for the brood to become adult bees.

Next →

Strategy: Word Games & Puzzles

Vocab Lab

Lesson

Choose an ingredient for this word to put in the flask!

brood

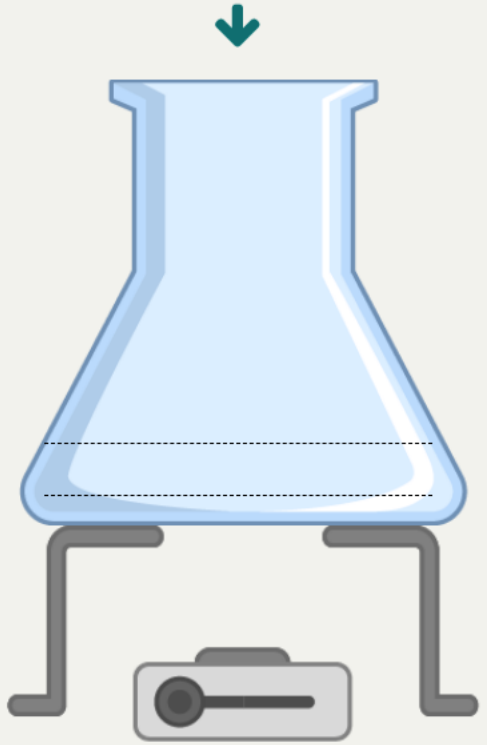
Ingredients

- old
- books
- bee keeper
- bees
- young

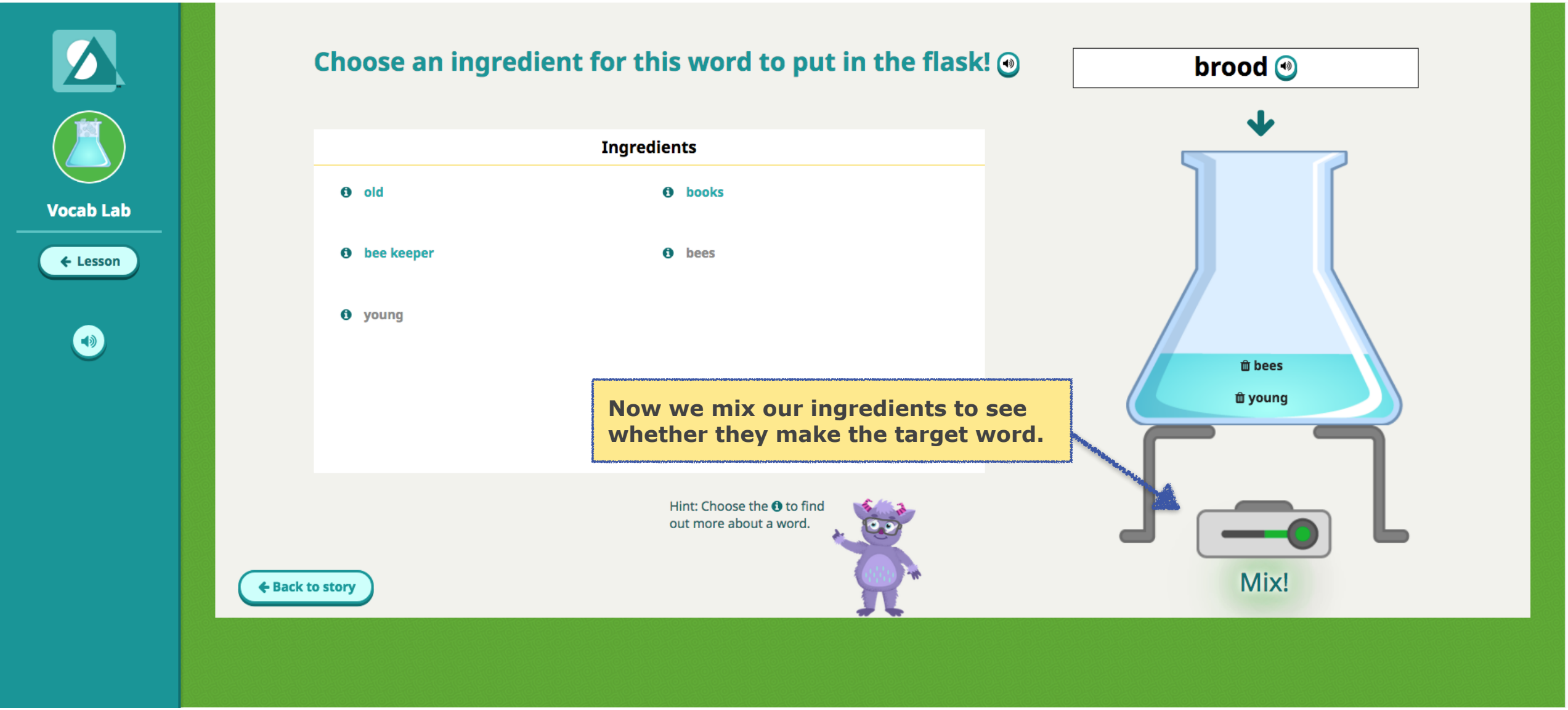
Students select "ingredients," which are words related to the concept.

Hint: Choose the ℹ to find out more about a word.

Back to story

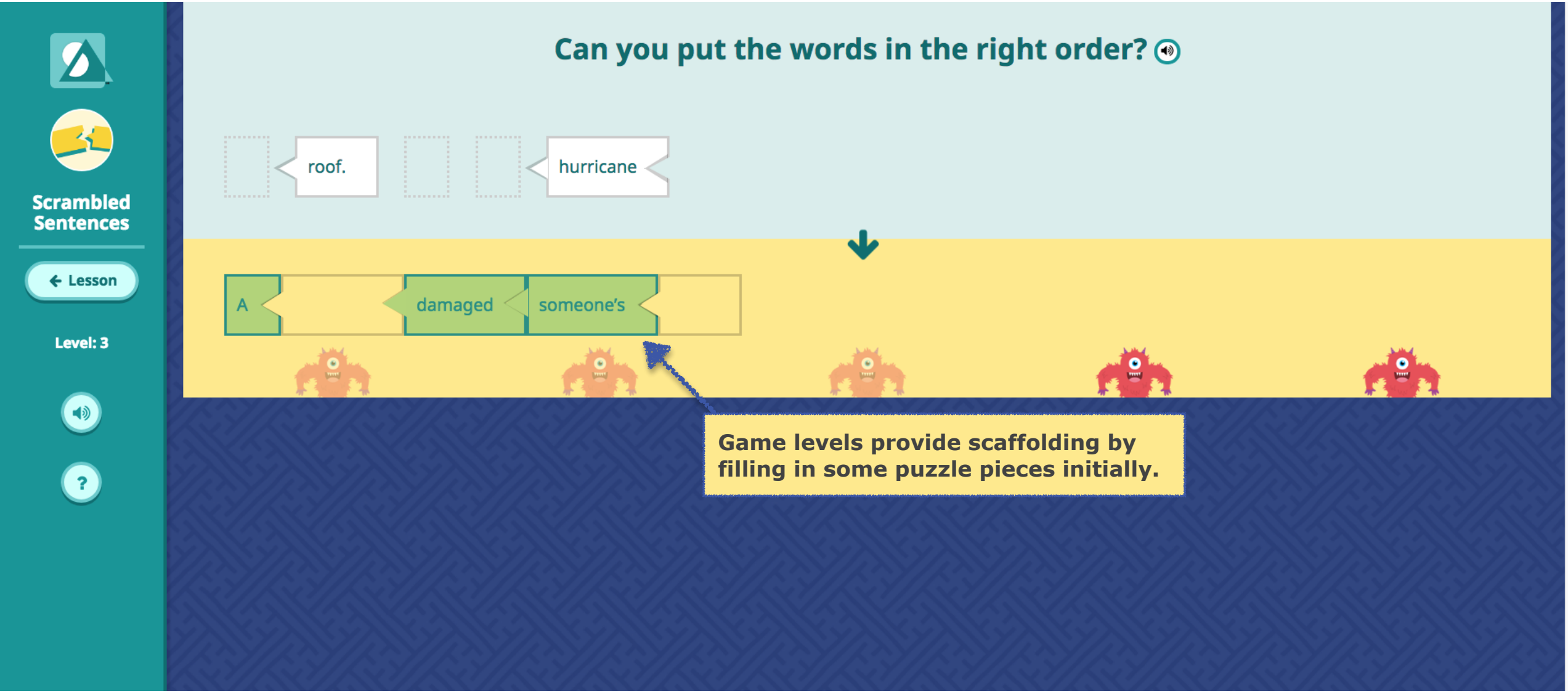


Strategy: Word Games & Puzzles

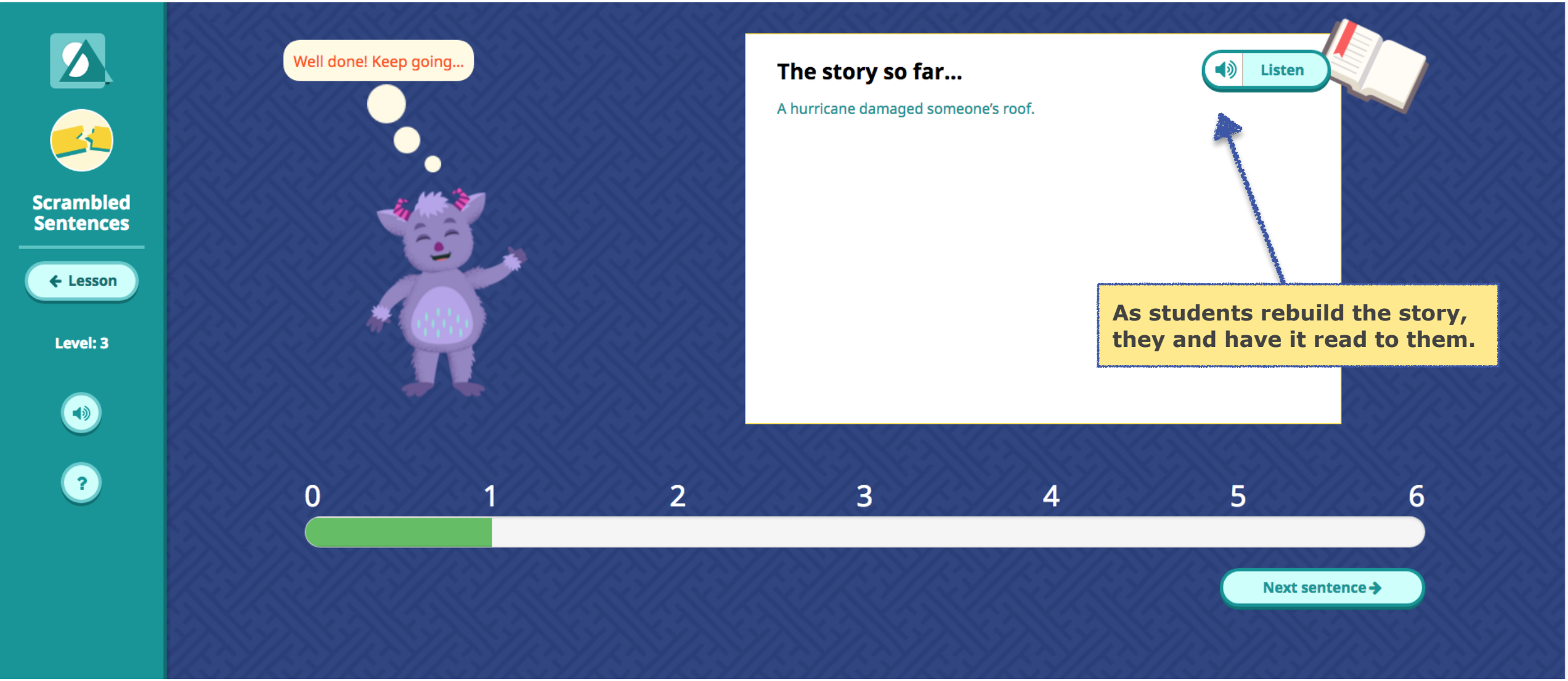



Scrambled
Sentences

Strategy: Virtual Manipulatives & Scaffolding



Strategy: Progress Markers & Audiobooks




Read
Along

Strategy: Dialogic Reading

Audiobook

Back to Lesson

Beehive on tree

Some bees live together in a hive located in the wild. Wild bee hives are often nestled inside hollow trees and on branches.

Prompts ask students to answer questions about the text or to write down their reflections.

Where do bees live?

They live in trees i think

Save

Listen

1

Next

Strategy: Opportunities for Self-Reflection

Audiobook

Back to Lesson

A box beehive

Other bees live in hives made by beekeepers. They are usually made of wood and look like a bit like bird houses or big wooden shoe boxes.

Students can write anything and save it to their digital portfolio.

Listen

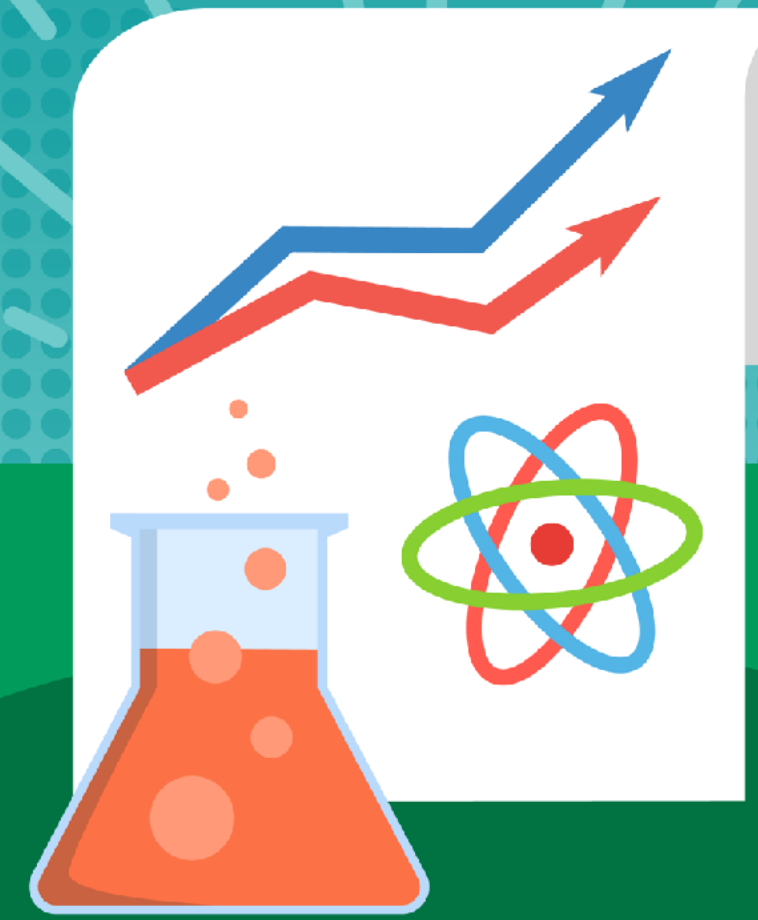
2

Save

Back

Next

Explain Your Work



Explain Your Work

Lesson

Help

Fill the blanks to complete the story about sound.

Listen | Check My Work

We _____ a pattern when we made sounds with drums, guitars, and tuning forks. We could feel them vibrating. We saw the same _____ when we dropped rocks on a table. So we _____ this pattern to all things that make sound. Next, we measured how much an object _____. We made a graph that showed how much it vibrated over time.

VERB

NOUN

VERB

VERB

Word Bank

- increases
- observed
- wave
- pattern
- generalized
- amplitude
- frequency
- vibrated

Story Spin

Play Now!

Strategy: Collaborative Writing (with Visual Aids)

Story Spin

Story Spin

← Lesson

Today's story is about Unit 2: Investigating Properties of Matter

LU
Luis R

Skip student

You're it! Write a sentence that goes with the story.

Things in space has mass

, . ? !

magnetic | attract | Celsius | float

gas | liquid | magnet | magnetism

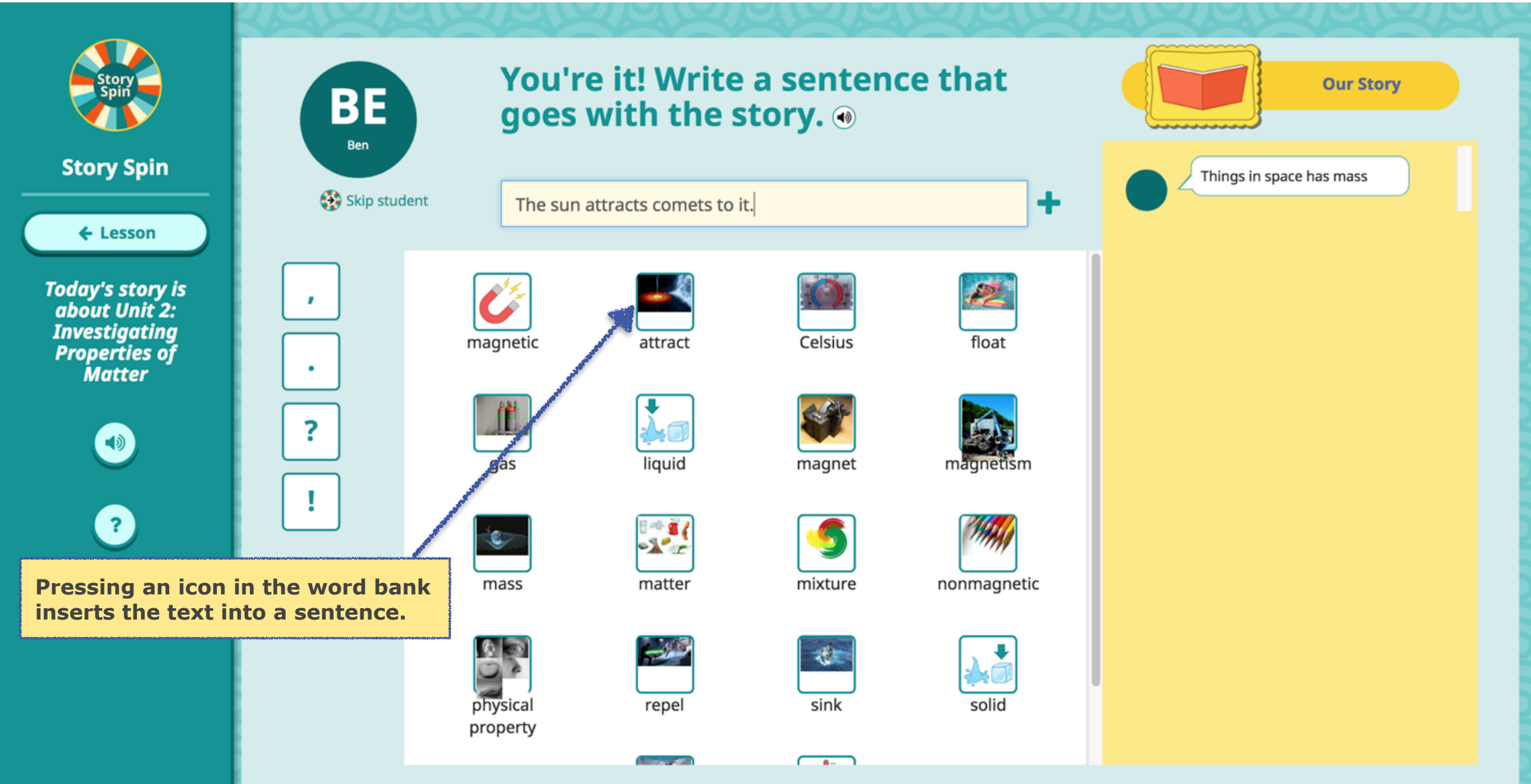
mass | matter | mixture | nonmagnetic

physical property | repel | sink | solid

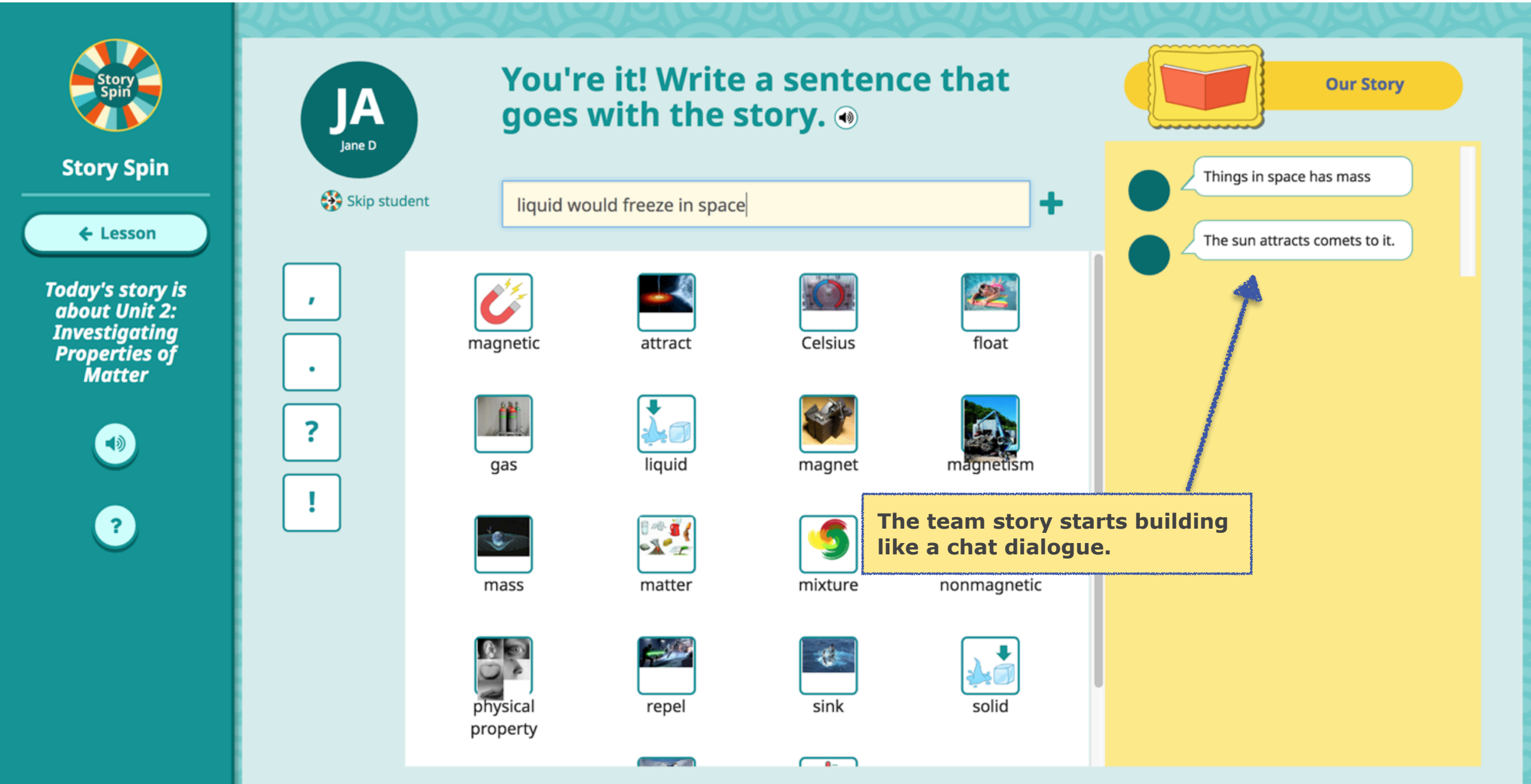
Our Story

Type or use the word shortcuts to make a story about this topic: Unit 2: Investigating Properties of Matter

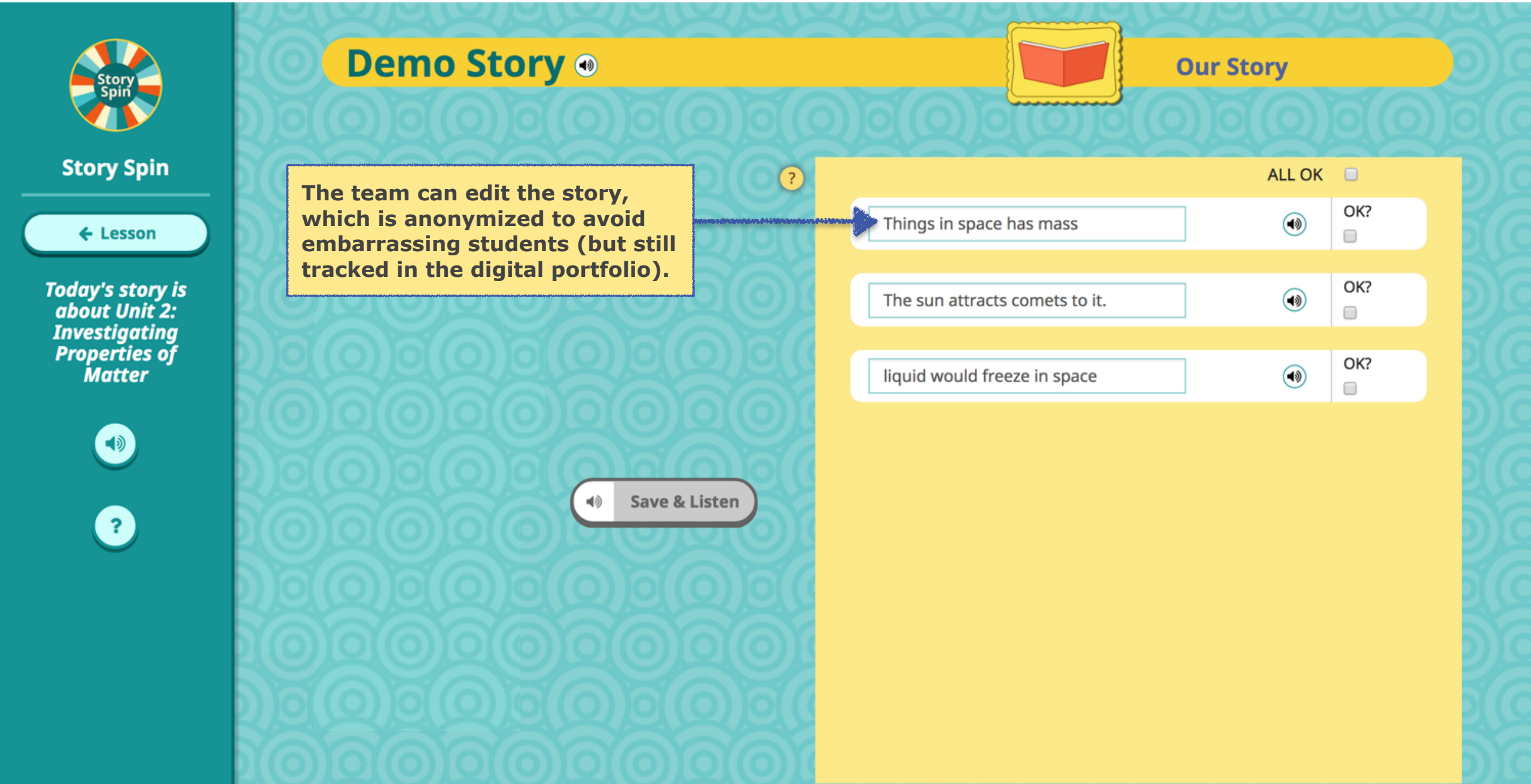
Strategy: Word Manipulatives



Strategy: Whole Language



Strategy: Collaborative Editing & Feedback



"It encouraged students to think more critically."

"Once they start playing they get really engaged and don't want to stop!"

"It inspired greater interest in science and helped them do much better on assessments."

"My kids *love* it!"

Speak Agent℠

STUDENT PRIVACY PLEDGE SIGNATORY

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