

From Neuroscience to Can-Do Philosophy: *Learning Science for ML Scaffolds*

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Participant Workbook

THE GOAL:

To design multilingual learner scaffolds using science of learning principles that increase access while building self-efficacy. Effective scaffolds reduce barriers without removing the thinking.

THE DESIGN PROCESS:

Learning Goal → Barrier → Learning Principle → Scaffold Design → Self-Efficacy → Independence

Ask before adding a scaffold ask:

- What is the learning goal?
 - What barrier am I reducing?
 - What thinking must remain with the student?
 - Which Science of Learning principle informs the scaffold?
 - How will the scaffold build self-efficacy?
 - How will responsibility move toward the student?
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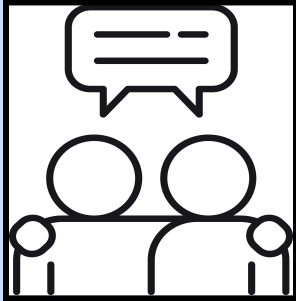
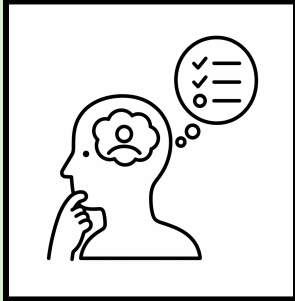
A SHIFT IN THINKING:

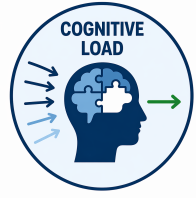
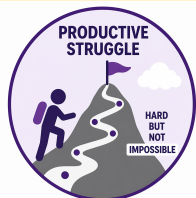
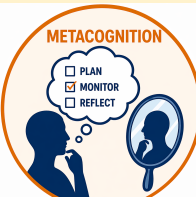
Many of these scaffolds are familiar.

What is **new** is using the Science of Learning to understand WHY they work—and to intentionally design new scaffolds that preserve rigor, increase access, and build student independence.

Self-Efficacy: A student's belief in their capacity to successfully engage in challenging learning, make progress through effort and support, and identify as a capable learner.

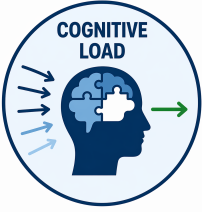
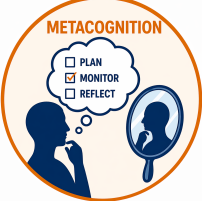


			
Science of Learning principles	Linguistic Scaffolds: <u>Examples:</u> • Sentence Expansion Routine • Academic Word Wall • PWIM.	Collaborative Scaffolds: <u>Examples:</u> • Teach the Talk • Intentional Pairings • Collaborative Writing • Teach the Teamwork	Metacognitive Scaffolds: <u>Examples:</u> • Self Assessments • Language Lookback • Self Scaffolding

	Language structures that support language expression without simplifying thinking.	Clear collaboration routines help students focus on ideas, rather than figuring out how to participate.	Reflection prompts help students organize and monitor thinking and understanding.
	Students generate language rather than selecting examples.	Students retrieve and explain ideas during partner discussions and collaborative tasks.	Students recall and evaluate strategies they used during learning.
	Linguistic supports guide students without giving the answer, allowing them to construct meaning and language.	Peer discussion encourages students to explain and refine ideas through dialogue.	Students reflect on challenges and identify strategies for improvement.
	Language structures help students participate in academic conversations.	Structured collaboration (Teach the Talk, Teach the Teamwork, intentional pairings) enables learning through interaction.	Reflection often occurs through peer feedback or shared evaluation of thinking.
	Students become aware of how language works (metalinguistic awareness).	Students reflect on how effectively they communicated and collaborated.	Self-assessment, goal setting, and self-scaffolding help students monitor learning and build independence.

Science of Learning (SOL) Tracking Mat

Which of the SOL principles do you see in the strategies modeled? Several? All of them?

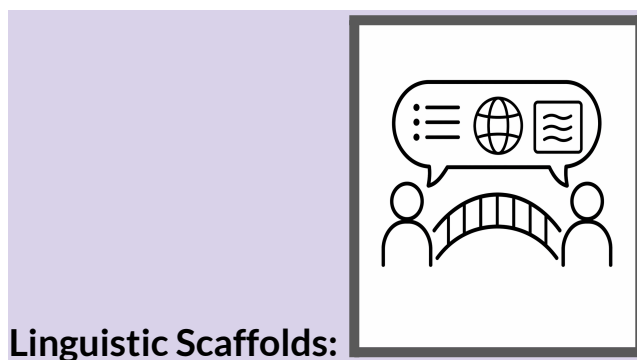
 Self Efficacy check		
		

ORIGINAL TASK ANALYSIS

Original Task: *Write one sentence describing Ulysses S. Grant and then two or three sentences comparing and contrasting General Grant with General Lee.*

What thinking must students do?

What barriers might prevent multilingual learners from accessing the task or expressing their thinking?



Linguistic Scaffolds:

Linguistic Scaffold #1: Sentence Expansion Routine

SOL connections: Retrieval and Cognitive Load reduction

NOTES:

Template for: Sentence Expansion Routine

Purpose: Move students from simple responses to precise academic language.

Use When:

- responses are too short
- ideas are underdeveloped
- students need support combining ideas
- writing lacks academic vocabulary

Step 1: Start with a Kernel Sentence

Step 2: Expand the Sentence

Add Meaning Through...	Student Adds
Who?	_____
What?	_____
Where?	_____
When?	_____
Why?	_____
How?	_____

Step 3: Final Expanded Sentence

Science of Learning Links

- ☐ Retrieval (recalling vocabulary/content)
- ☐ Cognitive Load (structured production)
- ☐ Productive Struggle (challenging but supported)

Fade Toward Independence

- ☐ Teacher models
 - ☐ Students expand with prompts
 - ☐ Students independently elaborate writing
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Linguistic Scaffold #2: Collaborative Word Wall w/writing

SOL connections: Retrieval and Productive Struggle

Students use a shared word wall during speaking and writing tasks to retrieve and apply academic vocabulary in meaningful contexts.

Linguistic Scaffold #3: PWIM Picture Word Induction Model w/student writing

SOL connections: Social Learning and Productive Struggle

NOTES:

TASK REDESIGN: LINGUISTIC SCAFFOLD

BARRIER: *What language-related barrier are you addressing?*

SCIENCE OF LEARNING CONNECTION: *Which principle or principles inform your design?*

- ☐ Cognitive Load
- ☐ Retrieval
- ☐ Productive Struggle

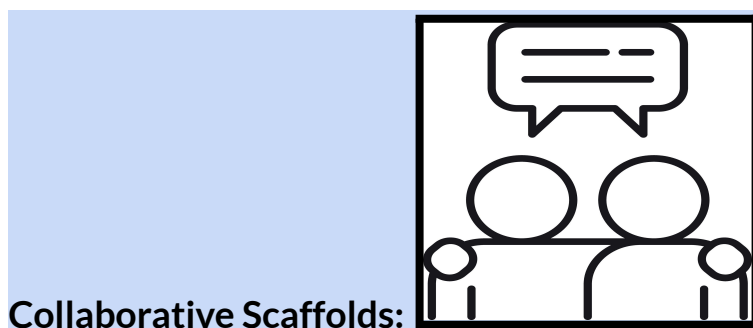
☐ Social Learning

☐ Metacognition

SCAFFOLD DESIGN: *What linguistic scaffold will you add?*

THINKING PRESERVED: *What must students still do for themselves?*

SELF-EFFICACY AND INDEPENDENCE: *How will this scaffold help students experience successful effort or become more independent?*



Collaborative Scaffolds:

Collaborative Scaffold #1 and #2: Teach the Talk and Intentional Student Pairings

SOL connections: Social Learning and Productive Struggle

NOTES:

Template for: Teach the Talk-Structured Partner Talk Routine

Purpose: Increase language production, reasoning, and confidence before whole-group sharing or writing.

Use When:

- students need oral rehearsal
- few students participate
- students need time to process ideas
- writing quality improves after discussion

Prompt / Question

Partner A

I think _____ because _____.

Partner B

I agree / disagree because _____.

Both Partners Must:

- ☐ use academic vocabulary
- ☐ cite evidence
- ☐ ask one follow-up question
- ☐ build on partner's idea

Reporting Out

One idea we developed together was:

Science of Learning Connections

- ☐ Social Learning
- ☐ Retrieval
- ☐ Productive Struggle

Fade Toward Independence

- ☐ Sentence stems provided
 - ☐ stems optional
 - ☐ independent academic discussion
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Collaborative Scaffold #3: Collaborative Writing

SOL connections: Social Learning and Metacognition

NOTES:

Collaborative Scaffold #4: Teach the Teamwork

SOL principles: Cognitive load and productive struggle

NOTES: *Students are explicitly taught the collaboration skills needed for productive group work, reducing cognitive load and increasing participation.*

TASK REDESIGN: COLLABORATIVE SCAFFOLD

BARRIER: *What participation or interaction barrier are you addressing?*

SCIENCE OF LEARNING CONNECTION: *Which principle or principles inform your design?*

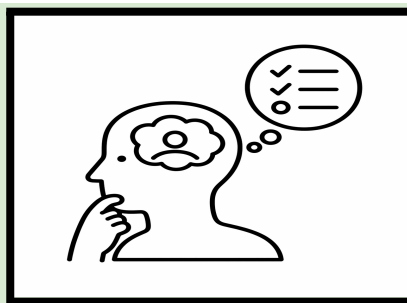
- ☐ Cognitive Load
- ☐ Retrieval
- ☐ Productive Struggle
- ☐ Social Learning
- ☐ Metacognition

SCAFFOLD DESIGN: *What collaborative scaffold will you add?*

THINKING PRESERVED: *What must students still do for themselves?*

SELF-EFFICACY AND INDEPENDENCE: *How will this scaffold help students contribute, experience success, or harness the power of social learning?*

Metacognitive Scaffolds:



metacognitive Scaffold #1: Student Self Assessments

SOL connections: Metacognition and Cognitive Load reduction

NOTES: *Students evaluate their understanding, language use, and progress toward goals, strengthening metacognition and learner independence.*

Metacognitive Scaffold #2: Language Lookback

SOL connections: Metacognition and productive struggle.

NOTES:

Template: Language Lookback

Purpose: Help students reflect on the language they used to think, talk, read, or write during an academic task.

Use When:

- students have just discussed, written, explained, argued, compared, or presented
- you want students to notice how language helped them do academic work
- students need to become more intentional language users

Academic Task

Today I used language to:

- ☐ explain
- ☐ describe
- ☐ compare
- ☐ justify
- ☐ ask questions
- ☐ agree / disagree
- ☐ add on to someone's idea

☐ use evidence

☐ other: _____

Language I Used

Important Words I Used

The academic language I used: _____

I used it when I said/wrote: _____

Sentence or Phrase I Used

A sentence frame, phrase, or language move I used was: _____

It helped me:

☐ explain my idea

☐ connect ideas

☐ sound more precise

☐ participate in discussion

☐ use evidence

☐ ask for clarification

☐ other: _____

Language I Noticed

One word or phrase I heard/read from a classmate was: _____

I want to try using it because: _____

Language I Want to Strengthen

Next time, I want to work on:

- ☐ using more precise words
- ☐ explaining with more detail
- ☐ connecting ideas
- ☐ asking stronger questions
- ☐ using evidence
- ☐ agreeing/disagreeing respectfully
- ☐ using complete sentences
- ☐ using academic phrases

My goal:

Science of Learning Connection

This helps students build:

- ☐ Metacognition

Fade Toward Independence

- ☐ Guided reflection choices
- ☐ short written reflection
- ☐ independent goal setting

Metacognitive Scaffold #3: Self-scaffolding

SOL connections: Metacognition and Productive Struggle

NOTES:

TASK REDESIGN: METACOGNITIVE SCAFFOLD

BARRIER: *What reflection, self-monitoring, or independence barrier are you addressing?*

SCIENCE OF LEARNING CONNECTION

Which principle or principles inform your design?

- ☐ Cognitive Load
- ☐ Retrieval
- ☐ Productive Struggle
- ☐ Social Learning
- ☐ Metacognition

SCAFFOLD DESIGN: *What metacognitive scaffold will you add?*

THINKING PRESERVED: *What must students still monitor, evaluate, or decide for themselves?*

SELF-EFFICACY AND INDEPENDENCE: *How will this scaffold help students recognize their progress or manage their own learning?*

FINAL Task Redesign SYNTHESIS:**Original Task**

Write one sentence describing Ulysses S. Grant and then two or three sentences comparing and contrasting General Grant with General Lee.

Final Redesigned Task

Rewrite the original task to include your linguistic, collaborative, and metacognitive scaffolds.

FINAL DESIGN CHECK

What barriers does your redesigned task address?

Which Science of Learning principles informed your decisions?

What important thinking still belongs to the students?

How will students experience successful effort?

How will the scaffolds move students toward greater independence?

Next Step: Use the Planning Tool

After today's session, use the Planning Tool to redesign one real lesson you teach next week. Start with the learning goal, identify the barrier, choose one learning science principle, and plan linguistic, collaborative, and metacognitive scaffolds that preserve rigor and build self-efficacy.

[Planning Tool: Designing ML Scaffolds Through the Science of Learning](#)