Using Add-ons to Make it Easier for Students to Gain and Apply Knowledge

Martin Kozloff

James D. Stocker

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 Other supplemental materials taught how to use: (1) cues and reinforcing consequences; (2) the MLTV communication format (along with lecture, demonstration, discussion, and projects); (3) work on the five phases of mastery; and (4) Socratic questioning. This document shows how to scaffold with add-ons---ways to clarify and accentuate communication. Here we go.

Adding Scaffolding (Add-ons)

 Students benefit from add-ons that enable them more easily to use the routine for constructing, applying, evaluating, and improving knowledge (chapter 1). We want students to feel, “I’m following this.” “I know what Teacher is talking about.” “I see how these examples are the same.” “I know what to do next?” Examples of add-ons are:

* Repetition. “Listen again… The definition of spiders is….”
* Reminders and knowledge checks. “What do we do first?”
* Follow-up (Socratic) questions. “How do you know?”
* Hints and partial prompts. Pointing to focus attention. Giving a partial response. “Prepos…” *preposition!*
* Consistent wording. “This letter makes the sound…. ffff.” “Remember, when we see this letter (f) we make the sound…fff”
* Using words with one main meaning. Unambiguous.
* Highlighting.
* Brisk pace, to teach more and to keep everyone engaged.
* Think time (Kameenui & Simmons, 1990).
* Graphic organizers, such as tables, diagrams, Cornell Note Taking (Pauk & Owens, 1993), Frayer Model (Frayer, Frederick, & Klausmeier (1969), timelines, causal models, and written lists of steps along with worked examples and new problems (McLaren, & Isotani, 2011).

Okay, here we go. Students’ talk is in *italics*.

Repetition

 Students might not hear or see a model, a direction, or a hint the first time. So, we repeat it to make sure. Here are examples.

1. Lilly Raphael models information.

“When I point-touch this letter, I’ll say it’s sound…. rrrrr…Listen again… rrrrr.”

2. Now Ms. Raphael and students do rhe Lead. “When I point-touch this letter, we’ll say the sound together… Get ready…”

*rrrr.*

“Again.”

*rrrr.*

“Yes, rrr.”

3. Now the class does a Test/check.

“Your turn. When I point-touch this letter, you say the sound.”

*rrrr.*

“Again…”

*rrrr.*

“Yes, rrrr…. You guys are the best!”

1. Alex Anders uses MLTV to teach a synonym.

*Model*. “Listen…. New word… turbid….”

*Test/check.* “What’s our new word?”

*Turbid.*

*Verification.* “Yup, turbid….”

*Model.* “Another word for turbid is muddy…. Turbid means…muddy.”

*Test/check.* “What’s another word for muddy?”

*Turbid!*

*Verification.* “Yup, turbid… muddy. You guys are too smart. I can’t trick you!”

5. Sacha Ulanova gives an Acquisition Test/check after she teaching *several examples* to see if students “got” them all.

“Your turn… What are the nitrogen bases in nucleotides?”

*Adenine…uhh…mmm…Thymine… uhh…Guanine…mmmmm…Cytosine?* [Students are not firm!]

“Correct. Adenine…Thymine…Guanine…Cytosine… Let’ say the four nitrogen bases again.”

*Adenine…Thymine…Guanine…Cytosine.*

“One more time. Sound off!” [Energy helps to “stamp in” the behavior!]

*Adenine…Thymine…Guanine…Cytosine*

“Yippee! You got it!”

*Your turn.*

Please think of ways to add repetition to the following.

“Believe it or not, turtles are in the class of reptiles.”

“Listen. Some mushrooms are poisonous to humans. What do you know about….?”

“Here is a list of The Seven Seas. Get ready…. Here they come…. Arctic, North Atlantic, South Atlantic, North Pacific, South Pacific, Indian, and Southern Oceans.”

Reminders and Knowledge Checks

 Skilled teachers *do not* go on to the next part of instruction (“Okay, now step 3.”), unless they are almost sure that their students “got,” and have not forgetten, earlier parts. So,

1. With a math routine.

“First, we read the problem. What do we do first?”

*We read the problem.*

“Correct. First, we read the problem. Like this. 87 divided by 12 equals what?... Now, you read the problem.”

2. “Remember, x means multiply. What do we do when we see x?”

*Multiply.*

“Yes, when we see x, we multiply the numerals. Is there an x here….? 45 + 16 =….”

*No.*

“So, do we multiply these numerals?”

*No.*

“What do we do with these numerals that are connected by +?”
*Add*

“Correct. When we see x we multiply, and when we see + we add.”

3. Reading. The word is after. Some students read it as ‘atter’. Mr. Saint-Michael points to the letter f and says, “This letter makes the sound fffff. Don’t let it trick you. What sound?”

*ffff*

“Yes, it didn’t trick you…. Now read our word. What sound will you say when you see (points) f?”

*fff*

“Yes, ffff…. Go!”

*affffter*

“Yes, afffter. [Points to f.] I knew you’d get it!”

4. Sixth grade teacher Woody Forester takes his class through the written steps in the routine for doing an inquiry project. He says,
“First, we read the first step on the list…. What does it tell us to do?...”

*List the animals that we see, count them, and write in on our table….*

“Yes! List the animals that we see, count them, and write it on our table.”
“Second, we read the next step on the list…. What does it tell us to do?.....”

*Measure the depth of the pond at the edges and middle and write in on our table…*

“Correct… Measure the depth of the pond at the edges and middle and write in on our table.”

“Third, we read the next step on the list…. What does it tell us to do?....”

*Find out if the water is stagnant—or is moving, and write it on our table*….

“Correct. The next step is to see if the water is stagnant—or is moving--and write that fact on our table….”

This way, students learn to read and to recall the steps. And Mr. Forester learns if they’ve read and recalled correctly.

*Your turn!* Please think of several reminders.

1. Students are identifying squares and triangles…

“Remember….”

1. Students have trouble with digraphs—two letters make one sound (ch, sh, ck). They are going to read the words chopped, chicken, muck.

“Remember….”

1. Students are about to read the words re*a*d, ra*i*n, and ro*a*m.

“Remember….”

Follow-up (Socratic) Questions (chapter 6). “How do you know?”

 Socratic questions help students to recall and to evaluate what they have learned, read or heard, or believe.

Here are examples.

a. “So, what kind of geological formation is this?”

 *A plateau.*

“How do you know.” [Maggie Short makes sure that her students use a definition to identify the formation.]

*It is made of rock…. It has steep sides…. It has a flat top… That’s what plat means.*

“Correct, you used the definition to identify the formation.”

b. Students read the word stuck as *stuhk*

Teacher Bella Luna says, “Correct, stuhk. Why did you say k for ck?”

 *Because the two letters say one sound…. c and k together just say k.*

 “Yes! “C and k together are a digraph. Two letters make one sound.”

d. Students are reading *The Bells*, by Edgar Allen Poe. <https://poets.org/poem/bells>

 Ms. Drydale says, “This poem is full of onomatopoeia. Remember how the bells clang, clash, and roar. You make up an example of onomatopoeia.”

 *My cat says ‘mmeerrrmph.”…. When I run, by corduroy pants go zhwizh zhwizh.*

“How do you know those are onomatopoeia?”

 *Because the words sound like the noise…. Yeah, mmeerrrmph is what my cat says…*

“You people are too smart for your corduroys!”

In other words, skilled teachers ask follow-up questions often. This way, they find out what students know; the questions stimulate recall; and students feel smart and confident.

Hints and Partial Prompts

 Hints and partial prompts help students to be successful the first time. Here are examples.

1. Recalling a list.

“Your turn. The first phase of mitosis is…pro…..”

 *prophase!*

“Yes, prophase!”

2. In math.

“First, we multiply the numerals in the ones column. Which column of numerals is the ones column?” [Teacher points.]

*This one. 5 and 8*

“Correct. 5 and 8 are in the ones column. You point to the ones column… So, what numerals do we multiply first?”… *5 and 8*.

*Your turn.* Please think of ways to add hints or partial prompts to the following.

a. 2 x + 3 = 11 “I wonder how we get rid of the 3? It is plus 3. So,…”

b. “He bent that steel bar like it was made of rubber. Is that a simile or metaphor?.....”

c. “Sound these out… road load lead steal might right tight.”

Consistent Wording

 Use the same words and phrases so that students know what is coming. Once you are using a communication format (a series of turns) for teaching concepts, facts, rule relationships, routines, and behavior (chapters 9-14) that works (students join you and learn), stick with it. For instance,

1. “Here’s a new concept… equilibrium. Get ready to say it; read it; spell it; and define it.”

2. “Let’s review all of our (problems, words, parts of our solar system). When I (point, ask, show), you (say the sound, tell the definition, solve the problem).”

3. “Fluency time! Let’s (read these words, solve these problems, identify the bones in this skeleton) in two minutes, with no more than four errors… Be careful, but go a little faster.”

Use Words with One Main Meaning.

1. With young students, it’s better to say, “Lines make corners,” not “Lines make points,” because you’ll want “point” to mean a finger pointing at something.
2. “Watch my finger,” instead of “Pay attention to my finger” or “Look at my finger.”
3. “Read the problem first,” instead of “What does the problem say?”

Highlighting

1. *All signal; no noise at first.*

The communication below has so much noise (extra words that add nothing) that students won’t know what the teacher is trying to communicate.
“This cow (in a picture of cows in a pasture) says mmmoooo. M (ehm) for mmoooo. Mmm as in moon. Here is a moon up in the sky. Mmmooonn…. ‘Moooo,’ says the cow. ‘Mmoooo.’”

First grader Jerry McDougal says, “I’ll never learn to read this way! Cows don’t say mmmmm.” anyhow!”

In other words, *the connection between the letter m and the sound mmmm is hidden in the noise.* It would be great if the teacher simply said.
*Model*. “This letter [points] says mmmm….mmmm.”
*Lead*. “Say it with me.”… *mmm
Test/check.* “Your turn. What sound?”...

*mmm*

*Verification*. “Yup… mmm.”

 Here’s another example of *all signal, no noise*. When teaching the concept, circular, Mr. Leavitt uses pure circles at first---not circular wreaths, windows, and donuts. Once students correctly identify examples of pure circles, he helps them to find circles in Nature and in everyday objects—circular ponds, the rims of bowls.

2. *Make important features easier to see and hear.*

Here is how Roberta Dylan uses highlighting.

 a. Highlight with colors. For example, she colors the numerals in the ones column, and the divisor and the first numerals in the dividend.

 b. Covers part of a word or math problem to help students to focus on the right part.
 “Read this part.”… *start*

 “Now read this part.”.... *ing*
 “Now read the whole thing.”… *starting* c. Pauses and adds stress.

 “This is a….rhomboid!”

 d. Punctuates to highlight parts.

 For instance,

*Model.* “Listen… prepare…. I’ll say it slowly… *pre* [Ms. Dylan claps, taps, snaps her fingers, or holds up a finger for the first syllable, or she draws her hands apart.] *pare* [She claps, taps, snaps her fingers, or holds up a finger for the next syllable.].”

“Now I’ll say pre…pare fast!… prepare![She quickly claps, taps, snaps her fingers, or holds up one and then the second finger for each syllable, or she quickly brings her hands together.]

*Lead and Test/check.* Now Ms. Dylan has students punctuate words and then combine the parts as she just did.

Brisk pace

 A brisk pace means

* High energy.
* More information is communicated.
* Less time for students’ attention to wander.
* Ease of recalling previous steps. And
* The sense that instruction is moving towards a successful finish.

In addition, it is better to go quickly and, if necessary, *repeat what you just did to firm it up*, then to go slowly (thinking that it will be easier to follow), and lose students’ attention!

*She lost me half way into that sentence!*

Wait time, or Think time (Kameenui & Simmons, 1990).

Here are some ways to give students a chance to think ahead, and to build momentum.

“Get ready to read this word…….Sound it out in your head first….. Go.”
“Get ready to work this problem…..Read the problem to yourself first….. Go.”
“Here’s a cat skeleton. I’ll point to its bones, and you tell me their names and what the bones do….. First, you scan the diagram, focus on each bone, name it, and think about what it does… Ready?... Go.”

Graphic Organizers

 Graphic organizers include forms or templates; diagrams; knowledge analysis tables; Frayer Models; Cornell Note-taking; lists of steps with worked examples; time-lines; and causal models. See Tarquin & Walker, 1997.

Here are examples.

1. *Forms (boxes and columns) for multiplication, long division, and solving equations.* For example,

<Insert table 7.1 near here.>

Table 7.1. Forms as Graphic Organizers.

 1 group 2 groups 3 groups 4 groups

 of 3 of 3 of 3 of 3

 3 x 4 = 12

 1 2 3 4 5 6 7 8 9 10 1112

If we have 4 groups, and each group has 3 cookies, how many cookies do we have? 4 groups of 3 is 3, 4 times, is 3 x 4 = 12

 1 group 2 groups 3 groups 4 groups

 of 3 of 3 of 3 of 3

 1 2 3 4 5 6 7 8 9 10 11 12

 If we have 12 cookies, how many
 groups of 3 cookies can we make?

 12 can be divided by (into) groups

 of 3, 4 times. 12 divided by 3 = 4.

2. *Diagrams to label.* Solar system; maps; convection cells in the Earth, oceans, and pots on the stove; parts of plants and animals; rock cycle; cycles of political systems and civilizations; life cycles of organisms; Venn diagrams.

 Venn diagrams show relationships (rule relationships) among classes/categories of examples, which we’ll learn all about in chapter 10. Here are examples.

<Table 7.2 near here.>

Table 7.2. Venn Diagrams as Graphic Organizers.

 The class of predatory birds: The class of animals with full coats

 hawks, eagles. of hair or fur.

 The class of turtles. No turtles have

 full coats of fur or hair.

 Some cats have full coats of hair or
 fur.

 Some cats do not. They are bald.

 No cockroaches have full coats of

The class of The class hair or fur.

predators. of birds. All lions have All horses have

 full coats of full coats of

 hair or fur. hair or fur.

3. *Tables for doing knowledge analysis* (making sense) of text, and for collecting and organizing information from lectures, discussions, and inquiry projects.

Tables can be developed by the whole class with the teacher, in small groups, or by individuals, as instruction goes on, or as a summary. Note: classes/concepts/vocabulary; facts; rule relationships (class, causal, moral), and routines are taught in chapter 9 on. Here are examples. <Table 7.3 near here.>

Table 7.3. Knowledge Analysis of a Story or Play.

Can use along with Frayer Models, Cornell Notes, guided notes, time lines, causal models.

Story or Play Table: Definitions, Facts, Lessons/Rules Characters, Plot

Vocabulary words/ Who is in the Places: Actions, Memorable Lessons. concepts. story/play? Explain episodes/ lines, events. Moral rules,

Definitions and What do they significance scenes, Cause-effect.

Examples. Do? of place (raft plot. Symbolism, in *Huckleberry* rhetorical

 What are their *Finn,* whalingTragic, devices,

 characteristic ship in *Moby* comedic, voice.

 interests, skills, *Dick.*)challenge-

 feelings, actions? response-

 outcomes.

<Table 7.4 near here>

Table 7.4. Table of What We’ve Learned (Are Now Learning) About Hardy’s Pond.

Can be used along with Frayer Models, Cornell Notes, guided notes, time lines, causal models.

Concepts/classes/ Facts/lists. Rule relationships. Routines/cycles.

Vocabulary. Descriptions. How plants and animals Seasonal changes

Definitions and Parts of Hardy’s are in larger classes: in parts and in the

Examples. pond. frogs are amphibians, pond as a whole

 Changes in water snakes and turtles are system.

ecosystem and air temperature reptiles, shoots and roots Life cycles of

pond over the seasons. of cat tails are edible. Plants, fish, frogs,

biotic Changes in prevalence [Category rule relationships] and snakes.

abiotic of plants and animals

climate over the seasons. When the temperature is

salinity Water inflows and near freezing, frogs make

temperature outflows. a living space (hibernaculum:

depth underground or partly in mud),

frogs and their metabolism (energy

turtles use) slows way down. [Causal

reptiles rule relationship]

algae

predator/ Just as we want to live freely

prey and have our value and life

life cycles respected by other humans,

 so, we should leave animals

 and plants to live freely, and

 respect their lives.

 Human beings, plants, animals,

 and ecosystems are parts of the

 Whole---The Earth. We depend

 on each other. [Moral rule

 relationships.]

4. Frayer Model for Organizing Knowledge of Concepts/classes/vocabulary.

The Frayer Model was developed by Frayer, Frederick, & Klausmeier (1969) as a way to learn vocabulary—classes/concepts/names—in any subject. Frayer Models help students to collect, store, review, and firm vocabulary; and to organize discussions. See Estacioa & Martinez (2017); Alashry, Qoura, & Gohar (2019); Wati & Alimin (2022), Kustati & Prisillia (2018), Sacapaño & de Castro (2022).

 After collecting definitions on Frayer Models, students can work as pairs in peer-assisted learning, with Teacher pals asking Student pals questions to firm up knowledge and to build automaticity. “I got this down, solid.” For example,

Teacher pal Becky says, “What’s your definition of lizards, Lenny?... How may legs do they have?... What about their skin? … How are lizards different from worms?... Check your Frayer Models for a hint.”

Student pals also use Frayer Models for reminders during review, discussions, and projects.

 Here is an example. <Table 7.5 near here.>

Table 7.5. Frayer Model Defining Lizards.

 **Definition in your own words** **Defining Features** **Not Defining**

Lizards are small reptiles; four legs,Features shared by all Features by

 long tail. examples. which examples

 Reptiles, small, four vary, and so,

 legs, tail, sharp teeth, logically, cannot

 usually leathery skin, be defining

 usually lay eggs, ecto- features.

 thermic, diet mostly Color, habitat.

 **Concept**, of insects.

 **Class,**

 **Examples Name** **Nonexamples**

Clearly show defining features.May have some features of examples but

 are missing some defining features.

 Snakes: no legs. Worms. No legs, no teeth.

5. Cornell Note-Taking system

The Cornell Note Taking System (Pauk & Owens, 1993) was developed by Walter Pauk at Cornell University in the 1950’s, and has been used ever since in math, literature, history, law, medicine, English, and other subjects from elementary grades through college. It’s an easy and engaging way to assist students to prepare to hear or to read important information; take notes; and to recall and review (firm up) what they learned. See Anjarsit & Adnan (2017), Bakri, Ismail, Saiful, & Syam (2022), Maulidia, Ys, & Silviyanti (2021), Pauk & Owens (1993), Susanti (2020), Yuniarti & Trisnawati (2018).

 Students can use Cornell notes individually, in pairs (peer-assisted learning), and in small groups, to compare (“I also learned….”), review (“What facts did we find?”), identify weak spots (“I didn’t get the whole list of steps.”), and to generate questions for future instruction and inquiry. “Do you think the causal model of climate change fits the facts?” Therefore, it is useful in all learning phases: acquisition of knowledge, generalization to new topics, fluency, integration, and maintenance.

 Cornell notes look like this. <Table 7.6 near here.>

Table 7.6. Section of Cornell Notes on the Civil War.

Can be used along with Frayer Models (for definitions of classes/concepts/names),

Guided Notes, time lines, and causal models. Or the Cornell Note format can be can be embedded in Guided Notes.

 Cues Notes on

 Learn defin- Definitions. Union, Confederacy,

 itions. Industrial, agricultural, slavery…

 Find out Time lines. Events leading to

 how many War, battles.

 died.

 Facts. Battles, leaders, casualties.

 Draw causal

 model that Rule relationships. When infra-

 helps to structure (land, homes, food)

 explain origin, is destroyed (Sherman’s March),

 process, and it breaks the spirit of the Enemy.

 outcomes.

 Causal models. How wars begin,

 proceed, and end.

 Summary

 Questions

On a sheet of note paper, students write the following.

* In the left column---about two inches wide—they write a list of *cues* to guide reading and listening.
* They take notes in the wider, right-hand column.

“Planets are held in their orbits by a balance of centrifugal force (pushing the planet out and away from the Sun) and gravity (pulling the planet in, towards the Sun).”

* They summarize notes at the bottom of the page.

“I learned that……..”

* Also at the bottom, students ask questions for clarification or further investigation. “Do these laws of physics (causal rule relationships) apply everywhere and always? How could you find out?”

See more at https://lsc.cornell.edu/how-to-study/taking-notes/cornell-note-taking-system/

6. Guided Notes.

Guided Notes are like the Cornell Note-Taking System, but give students *more guidance*. The teacher either *prepares* Guided Notes with the list of topics filled in, or *students list the topics* on a blank Guided Note form as the teacher reads the list. See Austin, Lee, & Carr (2004), Biggers & Luo (2020), Haydon, Mancil, Kroeger, McLeskey, & Lin (2011), Konrad, Joseph, & Eveleigh (2009), Konrad, Joseph, & Itoi (2011), Larwin, Dawson, Erickson, & Larwin (2012), Lazarus (1993), Sweeney, Ehrhardt, Gardner, Jones, Greenfield, & Fribley (1999).

 Table 7.7 shows an example of Guided Notes combined with the Cornell Note-Taking Method.

<Insert table 7.7 near here.>

Table 7.7. Guided Notes Organized with the Cornell Note-Taking Method.

Can be used along with Frayer Models (definitions), time lines, and causal models, or

Can be embedded in the Notes.

 Cues. Students write questions to self, suggested by the teacher and/or materials.

 Note-taking area. Teacher lists topics. Students take notes in space provided.

 Summary. Students summarize the notes.

 Questions. For further study.

 Cues Note Taking

 Take good 1. Concept. What kind of plant is corn? monoecious.

 notes on Examples of varieties.

 definitions. 2. Life cycle (a routine). Show time line.

 a. Concepts to be used in a. and b. Taught by verbal

 Compare definitions, examples, and nonexamples (chapter 11).

 with other pollen grain

 crops. pollen shed

 anthers

 tassel

 silk

 vegetative

 fertilization

 b. Vegetative stage. Routine (steps). Show time line.

 c. Fertilization stage. Routine (steps). Show time line.

 d. Factors that affect growth and stages (Rule relationships.

 X 🡪 Y)

 3. Diseases: blight, rot, smut, rust.

 4. The role of corn in different cultures.

 5. Modern farming. (A large routine)

 6. Inquiry projects: grow corn; make corn fritters.

 Summary

 Questions

7. Giving Written Instructions and Worked Examples for Routines

Research on routines (chapter 14) shows the effectiveness of *written steps* and *worked examples* (Models) along with *solving problems* (Barbieri, Miller-Cotto, Clerjuste, & Chawla, 2023; McLaren & Isotani, 2011; Van Gog, Kester, & Paas, 2011; Atkinson, Derry, Renkl, & Wortham, 2000; Carroll, 1994; Kalyuga, Chandler, Tuovinen, & Sweller, 2001; Renkl, 2017). With practice, students no longer need the list or the scaffolding of worked examples (as much), and they do routines more on their own, using the written lists and examples as back-up.

 Here is an example, using a list of steps and worked examples.

 Veteran 4th grade teacher, Jiimmy Eagle, is teaching math routines. He

1. Writes an example of a long division problem on the board. 72 divided by 6.
2. Lists the steps in the routine for solving it.
3. Gives students a copy of the list and reads it with them, using MLTV.
4. Uses MLTV (on a worked example) to teach students to use the list; he anticipates errors or hard steps and uses more add-ons to pre-correct (hints, reminders); and he corrects any errors by modeling the correct behavior and then having student repeat the step (chapter 8.)
5. Repeats solving the routine a few times with the same example.
6. Repeats MLTV with more problems in the acquisition set.
7. Then teaches students to use the list to work a generalization set of problems.

Next.

8. Time-lines.

Deborah Judge uses time-lines two ways.

a. She shows a time-line as an *advance organizer*. “This time-line tells what happened in a sequence. As we (read the text, listen to my presentation), you will know what’s happening, what came earlier that led to it, and what will come after.”

b. She also helps the class to *construct time lines.* She says, “As we (read the text, listen to my presentation), we’ll make a time line that shows what’s happening, what came earlier that led to it, and what came after.”

 Here is her class’s time-line of the Civil War.

<Table 7.8 near here.>

Table 7.8. American Civil War (1862-1865) Between the Union (Northern) States and 11 Southern States That Succeeded from the Union and Formed the Confederate States of America.

Events Leading April 12, 1861. Lincoln prepares Differences First battles, 1861-end 1865

up to War. Rebels fire on for war. in Leader- Virginia Bull run Lee surren-

Friction between Fort Sumpter Calls up militias. ship (Davis then ders at

North and South and capture it. vs. Lincoln); Lexington Appomattox.

over slavery. Naval blockade of fighting then

 More Southern Southern ports. experience; Fort Henry

When Lincoln states join the Southern then

(anti-slavery) was Confederacy Suspends writ of advantages. Shiloh

elected President, *habeas corpus*  then

Southern states Chancellorsville

began to succeed. Calls up then

 400,000 soldiers. Vicksburg

then

 Atlanta

 then

 Nashville

 then

 Wilmington

Using the time-line, students elaborate on events by listing facts, new concepts, and rule relationships.

9. Causal Models

Causal models are diagrams showing how factors (variables, classes) are connected. For instance,

The more A (the amount of exercise) increases, the more C (metabolism) increases; and the more C (metabolism) increases, the more D (weight) decreases.

Each of these is a causal rule relationship, as described in chapter 13.

 Helena Troy uses causal models two ways.

a. As an *advance organizer* (she displays and explains the whole model first) to prepare and guide students through presentations, readings, and inquiries. As students listen, read, observe and take notes, they *map* what they see, hear, and note *onto* the causal model in front of them.

Perhaps they take notes using Guided Notes/Cornell notes!

Perhaps they define concepts/names using Frayer Models!

<Figure 7.1 near here.>

Figure 7.1. Simplified Causal Model of Immune Response to Bacterial Infection.

If the skin is unbroken, it is a barrier that hinders the entrance of pathogens (such as bacteria).

When bacteria enter the eyes or mouth, they are likely to be killed by saliva, mucous, or tears.

But when a pathogen enters the body,

Blood flows to the area of infection, and Chemicals are released that raise

 body temperature.

As blood flows to the area of infection,

blood vessels expand.

 As body temperature increases,

As blood vessels expand, phagocytes it slows or even stops pathogen cells

(white cells) leak from the blood vessels. from growing.

When white cells contact a pathogen cell,

they produce proteins (antibodies)

that attach to the pathogen cell.

When antibody proteins attach to pathogen cells,

they kill them.

Concepts/names to be pre-taught and reviewed. Pathogen, bacteria, blood vessel, body temperature, infection, phagocytes, white cells, immune system, protein, antibody.

 Following is what students’ Cornell Notes/Guided Notes might look like.

<Insert table 7.9 near here.>

 Table 7.9. Cornell Notes/Guided Notes on the Immune System Response to Bacterial Infection.

 Cues Notes

 Take good 1. Definitions of concepts/names:

 notes! system

 immune system

 Ask questions. infection

 pathogens: kinds

 bacteria

 temperature

 antigens

 proteins

 antibody

 phagocytes/white cells

 2. Causal model

 Skin is a barrier to pathogens.

 Breaks in skin let them in.

 This starts the immune response,

 which starts with inflammation.

 Next, …….

 Summary …..

 Questions

 What is the immune response for

 viruses and cancer?

 How can the immune system be

 strengthened?

 This chapter presented ways to add scaffolding to teacher-student communication. Chapter 8 finishes our work on scaffolding. It tells how to prevent or to correct errors. You’ll see all of the scaffolding we’ve learned about in chapters 4-7 (cues and reinforcement, the MLTV format, add-ons, handling errors), when we teach Learning Readiness, classes/categories, concepts/names, facts, rule relationships, routines, and then 5-Part Lessons.

References

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