



Teach Effective Learning Strategies to Your Students: A Best-of-the-Conference Webinar



Learning Strategies: Implications for Student and Faculty Development

(Session L14B)

Cecil Robinson, PhD; University of Alabama

Alison Dobbie, MD; Eastern Virginia Medical School

James Tysinger, PhD; UT Health San Antonio

Disclosure Statement

None of the authors have anything to disclose.

Learning Strategies: Implications for Student and Faculty Development

Objectives:

1. Define learning strategies;
2. Cite examples of learning strategies that promote expanding medical knowledge and application of material;
3. Describe the implications of teaching learning strategies to students on student and faculty development.

Scenario 1

Immediately following your clerkship orientation a student asks you for help. The student failed the Surgery Shelf Exam; barely passed the Pediatrics and Psychiatry Shelf Exams; and reports scoring 198 on the USMLE Step 1. The student is worried about failing the Family Medicine Modular Shelf Exam and pleads, “Please help me better prepare for your exam.”

What would you suggest?

Or, are you not sure what to say?

Another big thanks to all who completed the pre-webinar survey!!

Scenario 1

(Audience Responses)

Response	N	%
Assess / Develop Learning Strategies*	8 / 21	38%
Not sure	5 / 21	24%
Med, Neuro, Psych, Behavioral, Learning Disability Eval	4 / 21	19%
Practice more questions	2 / 21	10%
Assess Learning Styles	2 / 21	10%

** Two responses identifying specific strategies*

Background

Concepts are taken from the *science of learning*

Institute of Educational Science, National Research Council, American Psychological Association

High yield practices that results in significantly improved learning

Used to improve the *learning and high-stakes test performance* of biology, psychology, pre-med students, rural program prematriculation students, medical students, and family medicine residents.

Reflection: Part 1

Think for a moment.

What the best predictor of human performance?



Deliberate Time on Task

Best predictor of performance.

Read More?

Deliberate

Not all studying is created equal →
Work Smart and Effectively



Learning strategies

Individuals approach to a task; **Executive process** of choosing, coordinating, and applying skills in effort to accomplish a task

Not skills!



Effective learning strategies support learner's **metacognition** (thinking about thinking):

Executive process of planning, monitoring comprehension, evaluating progress, and adapting thinking and action to accomplish a learning task.

Audience Participation: Part 1

Directions:

1. Take 30 seconds.
2. Read the list of learning strategies.
3. Type the strategy or strategies that you think have the **lowest** effectiveness into the chat box.

Learning Strategies

Highlighting
Keyword mnemonic
Imagery use
Summarization
Rereading
Interleaved Practice
Elaboration / Explanation
Spaced Practice
Practice Testing

Audience Participation: Part 2

Directions:

1. Take 30 seconds.
2. Read the list of learning strategies.
3. Type the strategy or strategies that you think have the **highest** effectiveness into the chat box.

Learning Strategies

Highlighting
Keyword mnemonic
Imagery use
Summarization
Rereading
Interleaved Practice
Elaboration / Explanation
Spaced Practice
Practice Testing

Audience Participation: Part 3

Directions:

1. Take 30 seconds.
2. Read the list of learning strategies.
3. Type the strategy or strategies that you **have never heard of, or do not understand**, into the chat box.

Learning Strategies

Highlighting
Keyword mnemonic
Imagery use
Summarization
Rereading
Interleaved Practice
Elaboration / Explanation
Spaced Practice
Practice Testing

Science of Learning

Not all Learning Strategies are Created Equal

Strategy	Effectiveness	Memorization	Application
Highlighting	Low	Variable	Not Effective
Keyword mnemonic	Low	Variable	Variable
Imagery use	Low	Variable	Variable
Summarization	Low	Positive Effect	Variable
Rereading	Low	Positive Effect	Variable
Interleaved Practice	Moderate	Variable	Positive Effect
Elaboration / Explanation	Moderate	Positive Effect	Positive Effect
Spaced Practice	High	Positive Effect	Positive Effect
Practice Testing	High	Positive Effect	Positive Effect

Adapted from: John Dunlosky; Katherine A. Rawson; Elizabeth J. Marsh; Mitchell J. Nathan; Daniel T. Willingham; *Psychol Sci Public Interest* 14, 4-58.DOI: 10.1177/1529100612453266; Copyright © 2013 Association for Psychological Science

Science of Learning

Not all Learning Strategies are Created Equal

Strategy	Effectiveness	Memorization	Application
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Elaboration / Explanation	Moderate	Positive Effect	Positive Effect
Spaced Practice	High	Positive Effect	Positive Effect
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Roadmap

Elaboration / Self-Explanation

Practice Testing

Spaced Practice

Interleaved Practice

Developing a Plan



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Elaboration / Explanation



Elaboration / Self-Explanation

Ask questions while studying about how things work and why

Compare / contrast how ideas are similar and different

Make connections between different ideas to explain how they work together.

e.g., developing case presentations utilizing multiple preclinical topics (e.g., Sickle Cell Anemia connected to genetics, biochemistry, histology, and anatomy and physiology)

Use elaboration as a form of Practice Testing

e.g., describe and explain processes and applications while looking at class materials.



Roadmap for this Session

Elaboration / Self-Explanation

Practice Testing

Spaced Practice

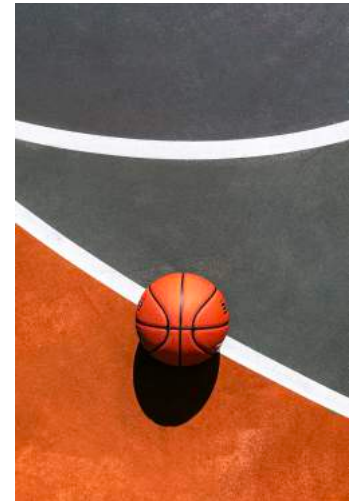
Interleaved Practice

Developing a Plan

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Reflection: Part 2

How do you know when you make a shot in basketball?



How do you know when you hit the right note while singing?



Reflection: Part 3

Why do you monitor vital signs of a patient?



Reflection: Part 4



How do you know that you have learned something?

How do you know when a student has mastered a concept?

Practice Feedback: Making the Invisible, Visible

Results are directly visible in basketball and singing.

Technology makes vital signs visible for patients.

Visible Vital signs (data) direct our plan of action.

How do we make learning in the classroom or clinic visible?



Feedback (Data) is Crucial for Learning



Practice → Feedback (made visible) → Monitor progress towards a goal → Adjust action as appropriate

Practice to make the invisible, visible

- Record basketball shot to analyze mechanics
- Metronome in music to monitor tempo
- Vital signs to measure improvement / decline

What feedback do learners have in class, in clinic, and when studying, to make the invisible, visible?

Practice Feedback in Class & Clinic

Practice in / for Class

Discussion and Activities

Clickers

Quizzes

Midterms

Assignments

Practice in Clinic

Case Presentations

Entrustable Professional
Activities

Longitudinal Integrated
Clerkships



Practice → Feedback (learning made visible) →

Monitor progress towards a goal →

Adjust action as appropriate

Practice Feedback When Studying

Turn all studying into a form of practice or quiz

Free Recall of Material

Closed Book Notes and Flash Cards

Study group quizzes

Study group reciprocal teaching

Self-quizzing (flashcards)

Q-Banks

**... But do not stop there! Practice
is only the first step.**



BIG IDEA

Questions are like lab results

Analyze results to identify strengths to review and concepts to learn.

Feedback to Guide Study

Work Smarter, Not Harder

1. Quiz first → Generate feedback to assess understanding → Use results to guide what to read / study.

Record the feedback to track progress. Create a study log.

2. Repeat.
3. Practice / Adjust until mastery or goal achieved.

Additional benefit: Anxiety reduction during high-stakes tests!

If you have already done it before, then less likely to get anxious.

A Scenario

A student who is worried about failing their Family Medicine Shelf Exam is doing practice questions leading up to the exam. During a break in clinic, the student shares that they answered 60% of questions correctly on a recent practice test and would like to know if you have any tips about how to help them continue to improve.

What would you suggest to this student?

Scenario 2

(Audience Responses)

Response	N	%
Target areas of struggle / incorrect responses	10 / 21	48%
Not sure	5 / 21	24%
Examine study materials / skills / learning styles	4 / 21	19%
Practice more	1 / 21	5%
Assess how learners' reason	1 / 21	5%

Application: Using Practice Tests as Data

REMEMBER: Questions are like lab results. Analyze results to identify strengths to review and concepts to learn.

Need more information about the 60% quiz performance.

Ask student study to further describe performance by identifying following questions types (and enter this data into study log) :

Mastery Understanding

Narrowed – Guessed Correctly

Narrowed – Guessed Incorrectly

Did not know – Completely Guessed

Thought I knew – But Was Wrong

Application: Using Practice Tests as Data

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Revisiting the Scenario

A student who is worried about failing their Family Medicine Shelf Exam is doing practice questions leading up to the exam. During a break in clinic, the student shares that they answered 60% of questions correctly on a recent practice test and would like to know if you have any tips about how to help them continue to improve.

BIG IDEA: NEED MORE DATA

All learners are different.

60% can mean different study approaches for different learners.

Four Learners each scoring 60%

Learner A (Typical)

Mastery Understanding (40%)

Narrowed – Correctly (20%)

Narrowed – Incorrectly (20%)

Did not know – Gessed (8%)

Thought I knew – But Was Wrong (2%)

Learner C (Unknowing Typical)

Mastery Understanding (20%)

Narrowed – Correctly (40%)

Narrowed – Incorrectly (40%)

Did not know – Gessed (8%)

Thought I knew – But Was Wrong (2%)

Learner B (Unknowing Lucky)

Mastery Understanding (10%)

Narrowed – Correctly (50%)

Narrowed – Incorrectly (10%)

Did not know – Gessed (25%)

Thought I knew – But Was Wrong (5%)

Learner D (Knowing Unlucky / Overthinker)

Mastery Understanding (50%)

Narrowed – Correctly (10%)

Narrowed – Incorrectly (40%)

Did not know – Completely Gessed

Thought I knew – But Was Wrong

Big Ideas for Practice Testing

Learners Practice Test to Guide Study

Practice → Feedback (made visible) → Monitor progress towards a goal → Adjust action as appropriate

Questions are like lab results. Analyze results to identify strengths to review and concepts to learn.

Roadmap

Elaboration / Self-Explanation

Practice Testing

Spaced Practice

Interleaved Practice

Developing a Plan



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Reflection: Part 5

Has anyone ever crammed for an exam and by lunch forgotten everything you studied?

Pitfalls of Cram and Forget

More work! Need to relearn for final, or step, or shelf, or board exam.

Safe and Effective Doctors Do Not Forget

Study to become a doctor → grades and degrees happen along the way





Spaced Practice

Massed instruction occurs in one block

Cram 7 hours before Friday exam

Spaced instruction occurs over time

Study 45-60 minutes each day a week before the exam

Spaced instruction is more effective!!!

How to Space Practice

1. Plan early, setting aside a little time every day.
2. Review information from each class, but not immediate after class.
3. After reviewing a recent class, go back and study older classes to keep it fresh.

**When reviewing, use effective strategies
(practice testing, elaboration)**



WARNING

Spaced Practice feels funky and will seem difficult
Learners may not feel they learned everything
Learners may forget some information from previous studying

Both are good things
Avoids **Illusion of Knowing** or the **Problem of Familiarity**
Forces retrieval from memory

Learners will feel / report it is not effective...

... they are wrong, trust the process!!!

Roadmap

Elaboration / Self-Explanation

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Developing a Plan

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How did you learn to write your ABCs?

-----AAAAAAAaaaa-----
-----BBBBBBBbbbb-----
-----CCCCCCCcccc-----
-----DDDDDDDdddd-----

My Name is Cecil Robinson.

I am seven years old.

I am in the first grade.

I live in Tuscaloosa, Alabama.

**To teach writing, practice writing words, not
repeating the same string of letters**

Interleaved Practice

Switch between ideas during a study session. Don't study one idea for too long.

90 min of Biochem Daily	6 hrs of Biochem on Mon
90 min of Genetics Daily	6 hrs of Genetics on Tues
90 min of Histology Daily	6 hrs of Histology on Wed
90 min of Physiology Daily	6 hrs of Physiology on Thurs

Go over ideas again in a different order to strengthen understanding.

Mon: Biochem, Genetics, Histology, Physiology

Tues: Genetics, Physiology, Biochem, Histology

Wed: Histology, Biochem, Physiology, Genetics

Thurs: Physiology, Histology, Genetics, Biochem

Interleaved Practice

When studying for Molecular and Cellular Biology unit exam, vary topics within study session in the week leading up to the exam.

40 min of Water Molecules Daily	2 hrs of Water Molecules on Monday
40 min of Acid and Bases Daily	2 hrs of Acid and Bases on Tues
40 min of Marcomolecules Daily	2 hrs of Macromolecules on Wednesday

When studying for Molecular and Cellular Biology unit exam, vary topics within study session in the week leading up to the exam.

Mon: Water Molecules, Acid/Base, Macromolecules

Tues: Macromolecules, Water Molecules, Acid/Base

Wed: Acid/Base, Macromolecules, Water Molecules

WARNINGS



Do not continue to study a mastered topic at the expense of a topic where more learning is needed.

Use practice testing to guide study (monitor progress)

Interleaved Practice will feel harder (like spaced practice)

Learners may not feel they learned everything

Learners may forget some information from previous studying

Both are good things

Avoids **Illusion of Knowing** or the **Problem of Familiarity**

Forces retrieval from memory AND movement among different representations

Review of Effective Learning Strategies

Practice Testing: Quiz to monitor progress and direct attention to areas of needed study.

Spaced Practice: Study less per session over a longer period (planning) vs. more per session over shorter length of time (cramming)

Elaboration / Self-Explanation: Ask questions, compare / contrast, make connections

Interleaved Practice: Switch between ideas during a study session.

Roadmap

Elaboration / Self-Explanation

Practice Testing

Spaced Practice

Interleaved Practice

Developing a Plan

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Big Idea: Develop a Plan

Strugglers are those with NO PLAN, or not realistic plans.

Without a plan, learners develop **inappropriate adaptive inferences**
(Andrews et al., 2018)

Developing a Learning Plan

Need **realistic** and **healthy** plan for each day, each week, and each clerkship.

SMART Goals

(Specific, Measurable, Achievable, Realistic, Time-boung)

Savor Success

Learning Plan – Example I

Tuesday, December 3

1. Go to clinic in the morning
2. Study during lunch
3. Go to clinic in the afternoon
4. Eat Dinner
5. Get in workout
6. Study and do practice questions

STFM Conference on Medical Student Education

Learning Plan – Example II

Tuesday	December 3
6:00 - 7:00	Get up, Shower, Breakfast
7:00 - 7:30	Drive to clinic; Enjoy cup of coffee (SAVOR)
7:45 - 8:00	Huddle to identify 2-3 patients
8:00 - 8:30	Read about 1-2 patient conditions
8:30 - 12:00	See pts; Present to preceptor/attending; Read about each pt after present to attending
	Feedback during read: Free recall of signs / symptoms & relation to patho; recommend treatment / management / prevention
12 - 1:00	Lunch and Study using Uworld / AAFP Test Questions, Analysis, & Review (Goal of 75%)
1:00 - 5:00	Repeat AM Learning and Practice Schedule
5:30 - 6:15	Drive Home / Dinner with Friends (SAVOR)
6:15 - 7:15	Quick Workout
7:15 - 8:15	Uworld / AAFP Test Questions, Analysis, & Review (Goal of 75%)
8:15 - 8:30	Break (Facetime with Family SAVOR)
8:30 - 9:30	Study articles for didactic (Closed Book Notes / Chart of Common Condition)
9:30 - 10:00	Veg in front of TV
10:00	Lights Out
	5-6 hours of study
	5-6 hours of clinic
	5 hours of drive/food/workout/free/savor time
	8 hours of sleep

Review of Effective Learning Strategies

Practice Testing: Quiz to monitor progress and direct attention to areas of needed study.

Spaced Practice: Study less per session over a longer period (planning) vs. more per session over shorter length of time (cramming)

Elaboration / Self-Explanation: Ask questions, compare / contrast, make connections

Interleaved Practice: Switch between ideas during a study session.

Develop a Plan: Turn Clinic into learning opportunities. Be specific. Savor success.

A Scenario (Revisited)

Immediately following your clerkship orientation a student asks you for help. The student failed the Surgery Shelf Exam; barely passed the Pediatrics and Psychiatry Shelf Exams; and reports scoring 198 on the USMLE Step 1. The student is worried about failing the Family Medicine Modular Shelf Exam and pleads, “Please help me better prepare for your exam.”

What would you tell the student?

Practical Application 1

1. Take 30 seconds.
2. Name one learning strategy discussed today that you will share with a learner this week.

Practical Application 2

1. Take 30 Seconds.
2. Name one learning strategy discussed today that you will integrate into your teaching this week.

Additional Questions

Type any additional questions that you may have into the text box.

OR

Email the presenters:

Cecil Robinson (crobinso@ua.edu)

Jim Tysinger (tysinger@uthscsa.edu)

Alison Dobbie (dobbieae@evms.edu)



Resources

Andrews, M. A., Kelly, W. F., & DeZee, K. J. (2018). Why does this learner perform poorly on tests? Using self-regulated learning theory to diagnose the problem and implement solutions. *Academic Medicine*, 93(4), 612–615.

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Pashler, H., Bain, P. M., Bottge, B. A., Graesser, A. C., Koedinger, K. R., McDaniel, M. A., & Metcalfe, J. (2007). Organizing Instruction and Study to Improve Student Learning. IES Practice Guide. NCER 2007-2004. *National Center for Education Research*.

Sawyer, K. (2014). *The Cambridge Handbook of the Learning Sciences* (2nd Ed). New York: Cambridge University Press.

<http://www.learningscientists.org/>

Popular Strategies: More Effective

Though effective, students may not feel comfortable changing from the familiar

What we can do to make common strategies “more effective”?

Rereading

Highlighting

Taking Notes / Outlining

Flash Cards

Rereading

Common Pitfalls	Tips for Optimal implementation	Effectiveness for Test Types	
		Factual	Application
“Illusion of knowing” Mistake familiarity or fluency with a text as mastery of the material.	Space out readings. Test yourself before / after readings.	Yes	No

Highlighting

Common Pitfalls	Tips for Optimal implementation	Effectiveness for Test Types	
		Factual	Application
Marking too little	Read text once before marking.	Yes	No
Marking noncritical information	Pay attention to text structure to identify important information to mark.		
Mindless marking (too frequent)			

Taking Notes / Outlining

Common Pitfalls	Tips for Optimal implementation	Effectiveness for Test Types	
		Factual	Application
Copying lecture notes verbatim.	Generate your own notes as form of practice testing.	Yes	Yes
Outline from scratch without paying attention to the text structure.	Identify main points after reading the section.		
Not reviewing notes.	Pay attention to text structure.		
	Use skeletal outline as a guide.		
	Review notes before an exam.		

Flash Cards

Common Pitfalls	Tips for Optimal implementation	Effectiveness for Test Types	
		Factual	Application
Dropping flash cards from study after one successful retrieval.	Retrieve an item correctly at least three times before dropping it from study.	Yes	No