

# The Decisive Dozen

Research-Supported Learning Factors

ISPI 2014  
Indianapolis



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# The Decisive Dozen

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Why?

How?

Why Not?

**Learning Management**



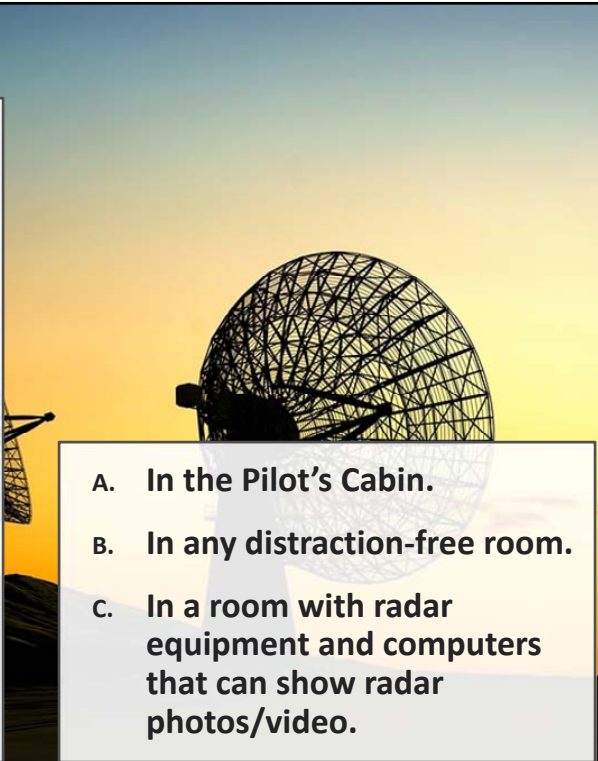
**Bridging Gap between  
Research and Practice**

**Your Radar-Damage-Assessment students have to take a paper-and-pencil certifying exam in one week.**

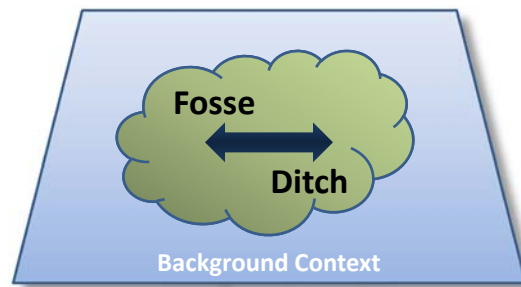
**The exam will be held in the Pilot's Cabin in the Officers Club.**

**If you want to maximize your students' scores, where should you hold your one-week course?**

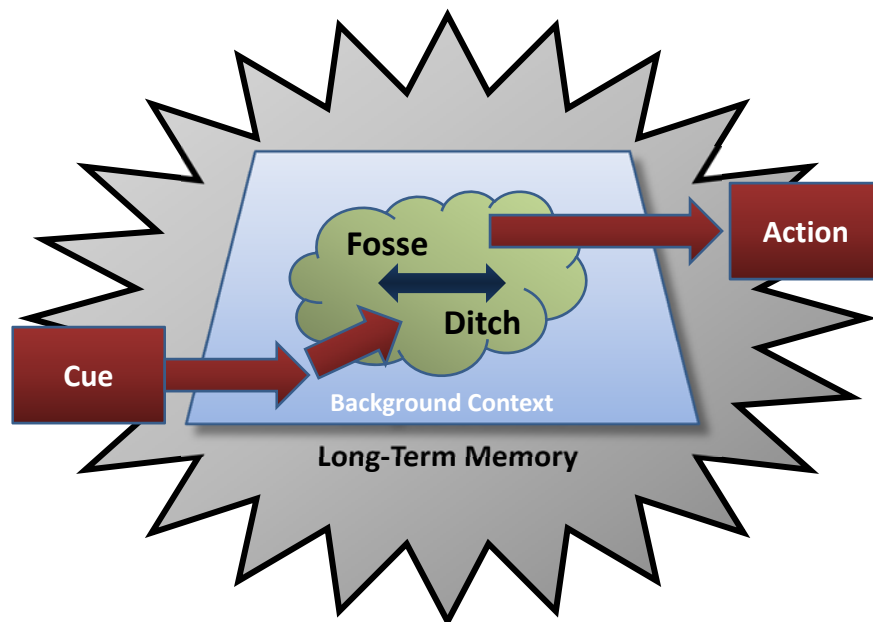
- A. In the Pilot's Cabin.**
- B. In any distraction-free room.**
- C. In a room with radar equipment and computers that can show radar photos/video.**

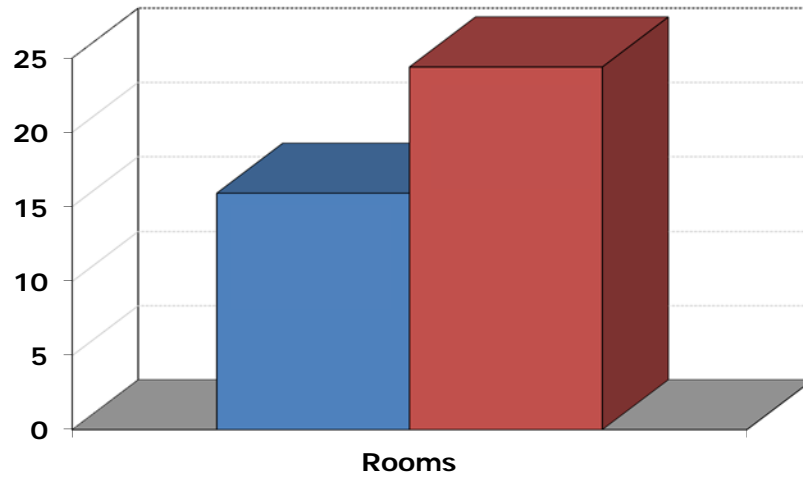


### How Learners Encode Learning Stimuli

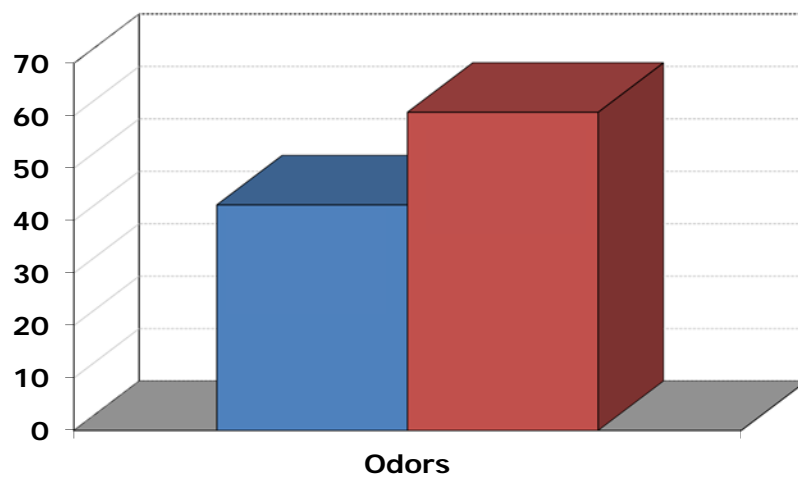


### How Background Stimuli Triggers Retrieval of Learned Information

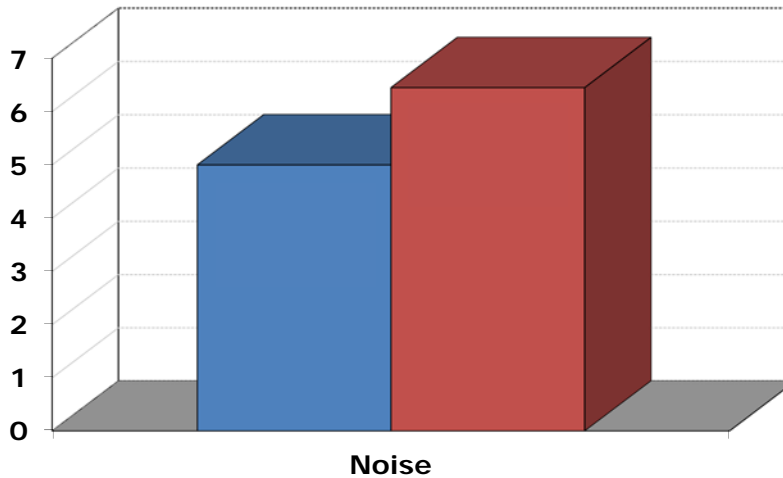




Smith, S. M., Glenberg, A., & Bjork, R. A. (1978). Environmental context and human memory. *Memory & Cognition*, 6, 342-353.



Herz, R. S. (1997). The effects of cue distinctiveness on odor-based context-dependent memory. *Memory & Cognition*, 25(3), 375-380.



Grant, Bredahl, Clay, Ferrie, Groves, McDorman, & Dark (1998). Context-dependent memory for meaningful material: Information for students. *Applied Cognitive Psychology*, 12, 617-623.

### Some Research on Context Alignment

differential encoding hypothesis. *Journal of Verbal Learning and Verbal Behavior*, 11, 801-808.

Godden, D. R., and Baddeley, A. D. (1975). Context dependency in two natural environments: on land and underwater. *British Journal of Psychology*, 91, 99-104.

Godden, D., & Baddeley, A. (1980). When does context influence recognition memory? *British Journal of Psychology*, 71, 99-104.

Grant, H. M., Bredahl, L. C., Clay, J., Ferrie, J., Groves, J. E., McDorman, T. A., & Dark, V. J. (1998). Context-dependent memory for meaningful material: Information for students. *Applied Cognitive Psychology*, 12, 617-623.

Herz, R. S. (1997). The effects of cue distinctiveness on odor-based context-dependent memory. *Memory & Cognition*, 25(3), 375-380.

Jacoby, L. L. (1983). Remembering the data: Analyzing interactive processes in reading. *Journal of Verbal Learning and Verbal Behavior*, 22, 485-508.

Johnson, A. J., Miles, C. (2008). Chewing gum and context-dependent memory: The independent roles of chewing gum and mint flavour. *British Journal of Psychology*, 99(2), 293-306.

Marian, V., & Fausey, C. M. (2006). Language-Dependent Memory in Bilingual Learning. *Applied Cognitive Psychology*, 20, 1025-1047.

Marian, V., & Kaushanskaya, M. (2007). Language context guides memory content. *Psychonomic Bulletin & Review*, 14(5), 925-933.

Marian, V., & Neisser, E. (2000). Language-dependent recall of autobiographical memories. *Journal of Experimental Psychology: General*, 129, 361-368.

Mead, K. M. L., & Ball, L. J. (2007). Music tonality and context-dependent recall: The influence of key change and mood mediation. *European Journal of Cognitive Psychology*, 19(1), 59-79.

Pan, S. (1926). The influence of context upon learning and recall. *Journal of Experimental Psychology*, 9, 468-491.

Parker, A., & Gellatly, A. (1997). Moveable cues: A practical method for reducing context-dependent forgetting. *Applied Cognitive Psychology*, 11, 163-173.

Prestera, G. E., Clariana, R., & Peck, A. (2005) Memory-Context Effects of Screen Color in Multiple-Choice and Fill-in Tests. *Journal of Educational Multimedia and Hypermedia*, 14(4), 2005, 415-436.

Riccio, D. C., Richardson, R., & Ebner, D. L. (1984). Memory retrieval deficits based upon altered contextual cues: A paradox. *Psychological Bulletin*, 96, 152-165.

Roediger, H. L., III, & Gynnn, M. J. (1996). Retrieval processes. In E. L. Bjork & R. A. Bjork (eds.), *Memory* (pp. 197-236). San Diego, CA: Academic Press.

Russo, R., Ward, G., Geurts, H., & Scheres, A. (1999). When unfamiliarity matters: Changing environmental context for unfamiliar stimuli. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 25(3), 750-759.

Shab, F. R. (1997). Context-dependent memory for odors. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 23(3), 685-689.



Schroers, M. (1997). Context-dependent memory for odors. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 23(3), 685-689.

Smith, S. M. (1979). Remembering in and out of context. *Journal of Experimental Psychology: Human Learning and Memory*, 5(3), 315-325.

Encoding Specificity

Transfer Appropriate Processing

Context-Dependent Memory


$$\text{Retrieval} = \text{Learning} - \text{Forgetting}$$
$$+ \text{Spontaneous Remembering}$$


## Utilizing the Aligning-Contexts Notion

By aligning contexts we can create:

**spontaneous remembering**

1	Change learning context to make it similar to performance context
2	Change performance context
3	Provide multiple learning contexts
4	Add transportable cues to learning context and performance context

## What level of expertise do you have about Human Learning?



I know the topic so well I could teach it.



I know the topic well, but I'm eager to learn more.



I know a modest amount.



I know a little.

I don't need to know it.

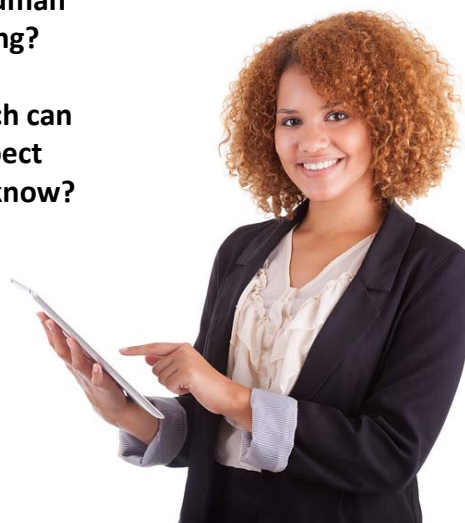
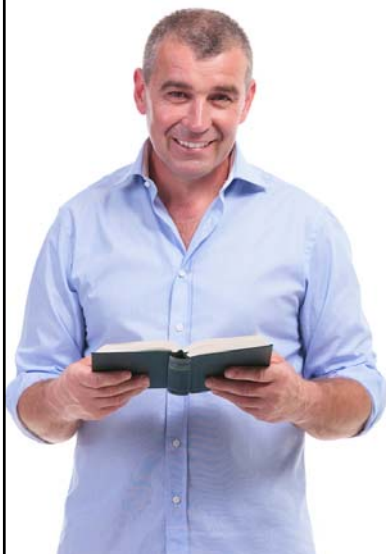
I can look it up on Wikipedia



How much do instructional designers need to know about Human Learning?

Trainers, eLearning Developers, Teachers... Learning Professionals.

How much can we expect them to know?





# The Decisive Dozen

for Learning Design and Learning Measurement

1. <b>Content</b>	Baseline
2. <b>Exposure</b>	
3. <b>Guiding Attention</b>	Engagement & Understanding
4. <b>Creating Correct Conceptions</b>	
5. <b>Repetition</b>	
6. <b>Feedback</b>	Remembering
7. <b>Variation</b>	
8. <b>Retrieval Practice</b>	
9. <b>Context Alignment</b>	Application
10. <b>Spacing</b>	
11. <b>Persuasion</b>	
12. <b>Perseverance</b>	

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<http://is.gd/ddResearch>

# The Decisive Dozen

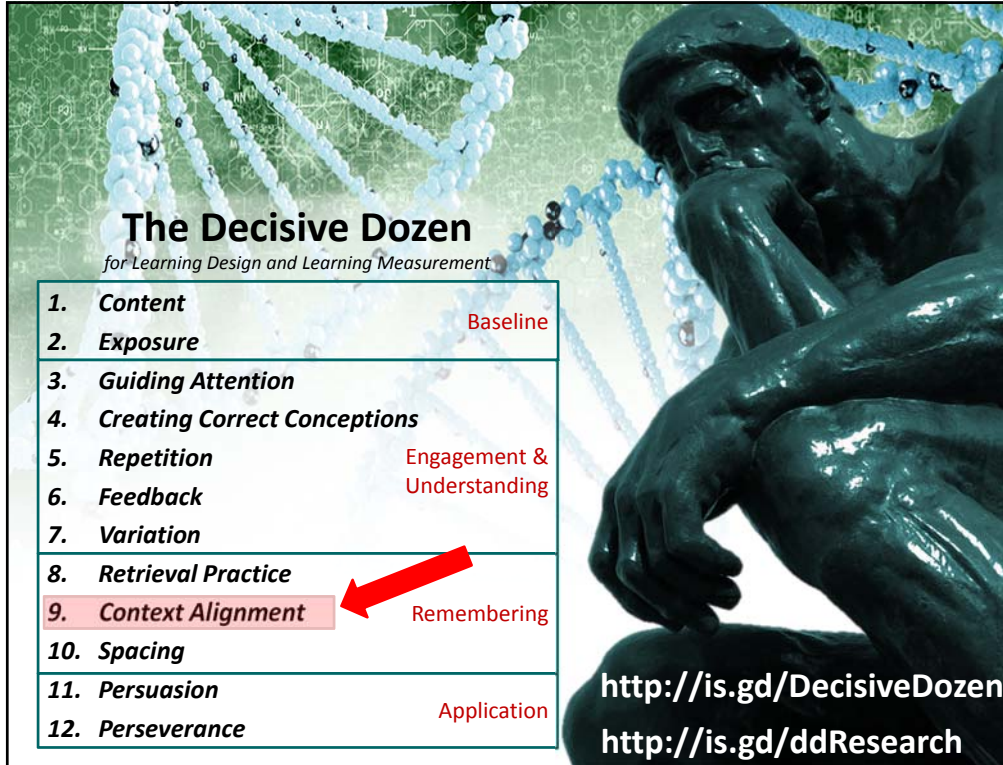
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**The Decisive Dozen**  
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**Who will perform better  
by remembering more on June 4th?**

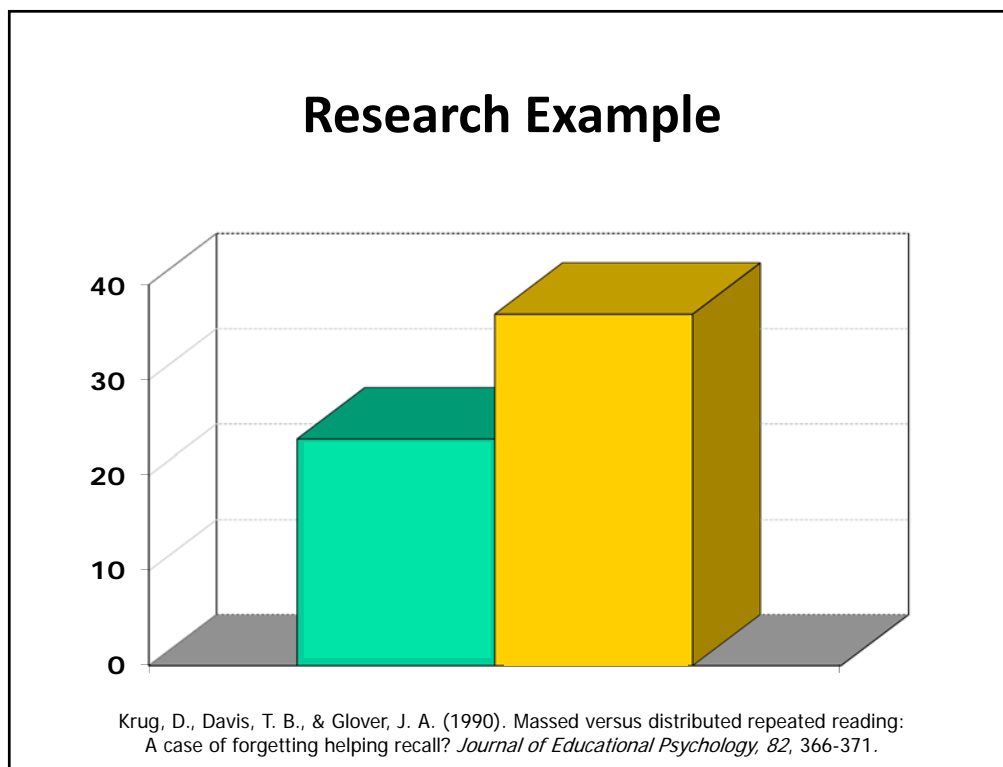
- A. *Wide Spacing***  
Person who spends 12 hours (3/day) learning and **relearning** relevant material on Feb 4, Mar 4, April 4, May 4?
- B. *Narrow Spacing***  
Person who spends 12 hours (3/day) learning and **relearning** relevant material on May 1, 2, 3, and 4?
- C. *Both will perform about the same.***  
Because both get the same learning events, both will remember similar amounts.



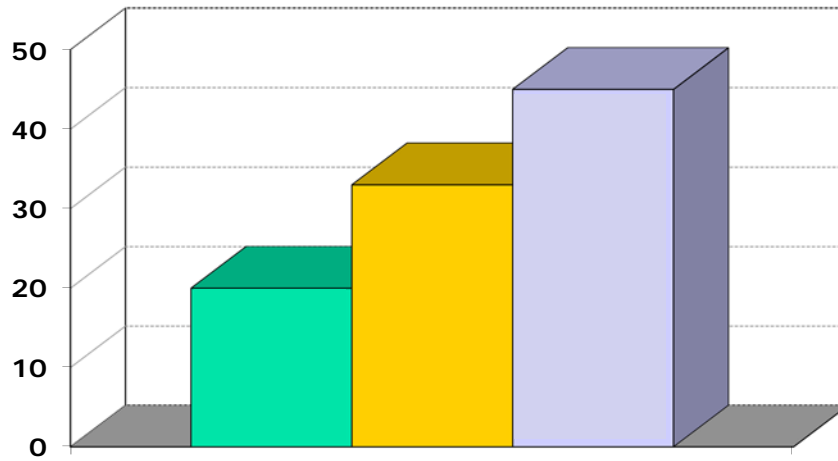
*“The spacing effect is one of the oldest and best documented phenomena in the history of learning and memory research.”*

Harry Bahrick & Lynda Hall  
*Journal of Memory and Language*

**So, why don't we use it more?**

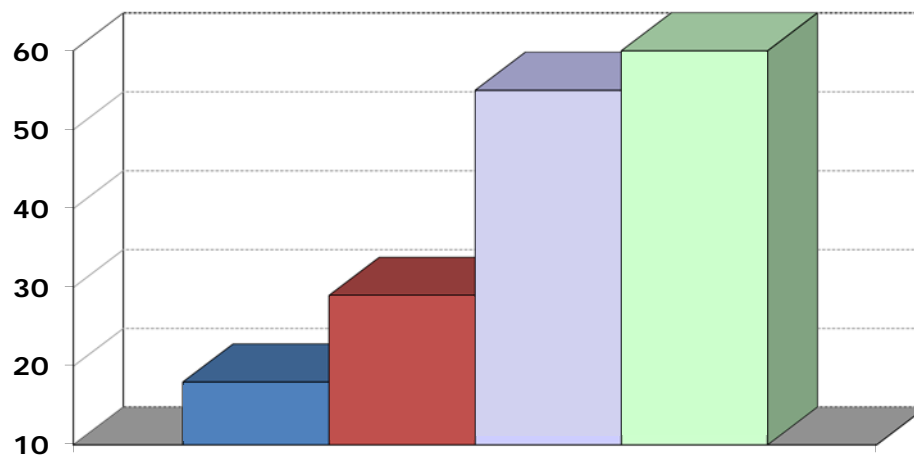


## Research Example

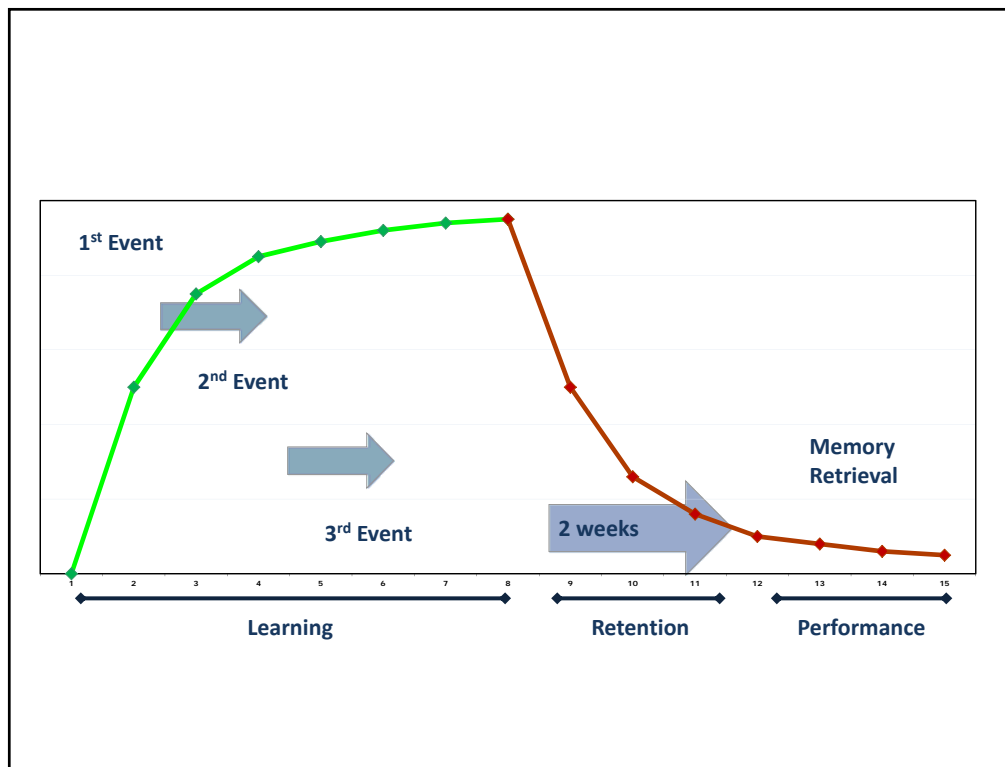
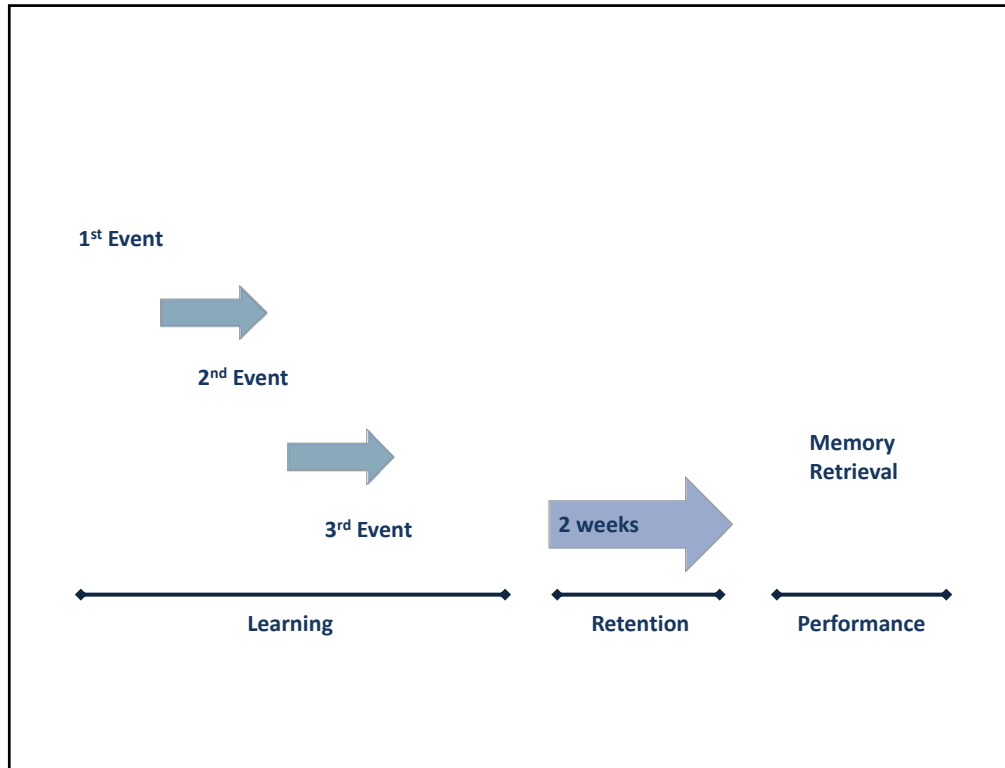


Karpicke, J.D. & Roediger, H.L. (2007). Expanding retrieval practice promotes short-term retention, but equally spaced retrieval enhances long-term retention. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 33, 704-719.

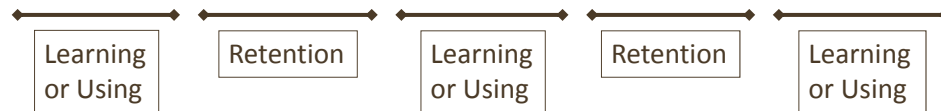
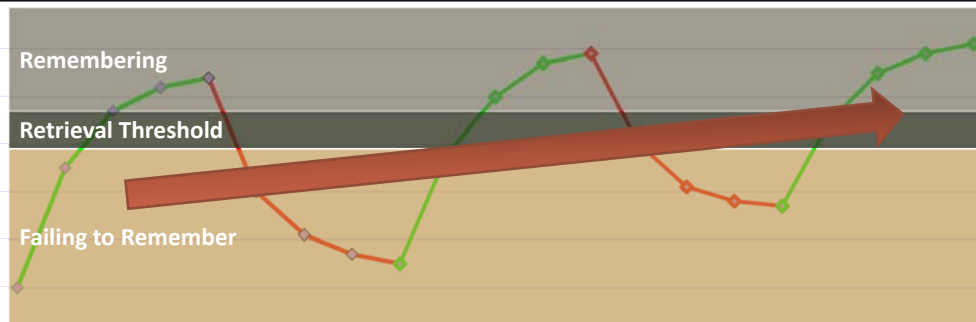
## Research Example



Dellarosa, D., & Bourne, L. E. (1985). Surface form and the spacing effect. *Memory & Cognition*, 13, 529-537. From Experiment 1.

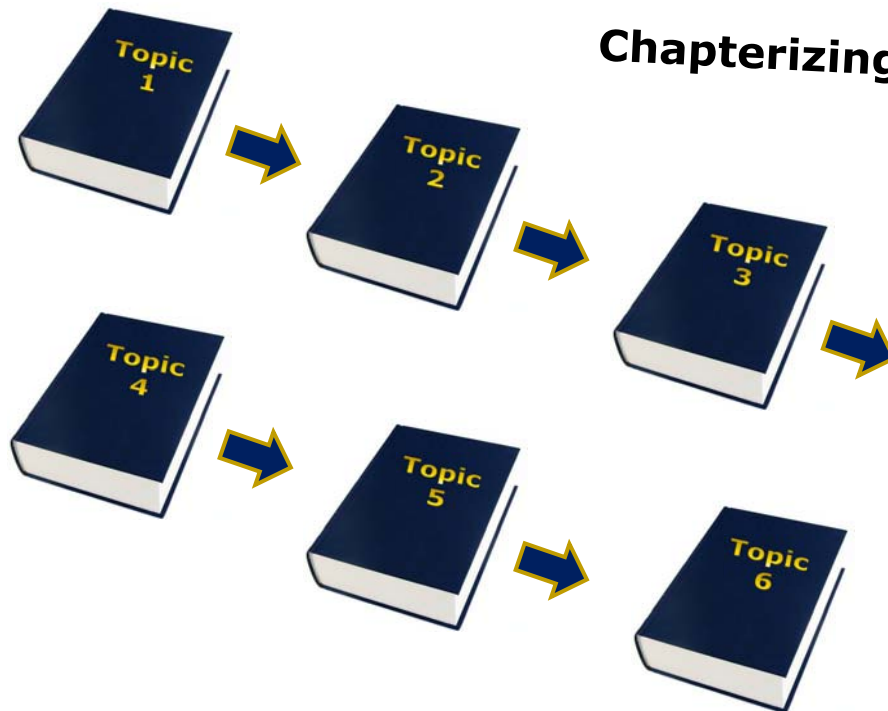


## Spacing Repetitions Over Time



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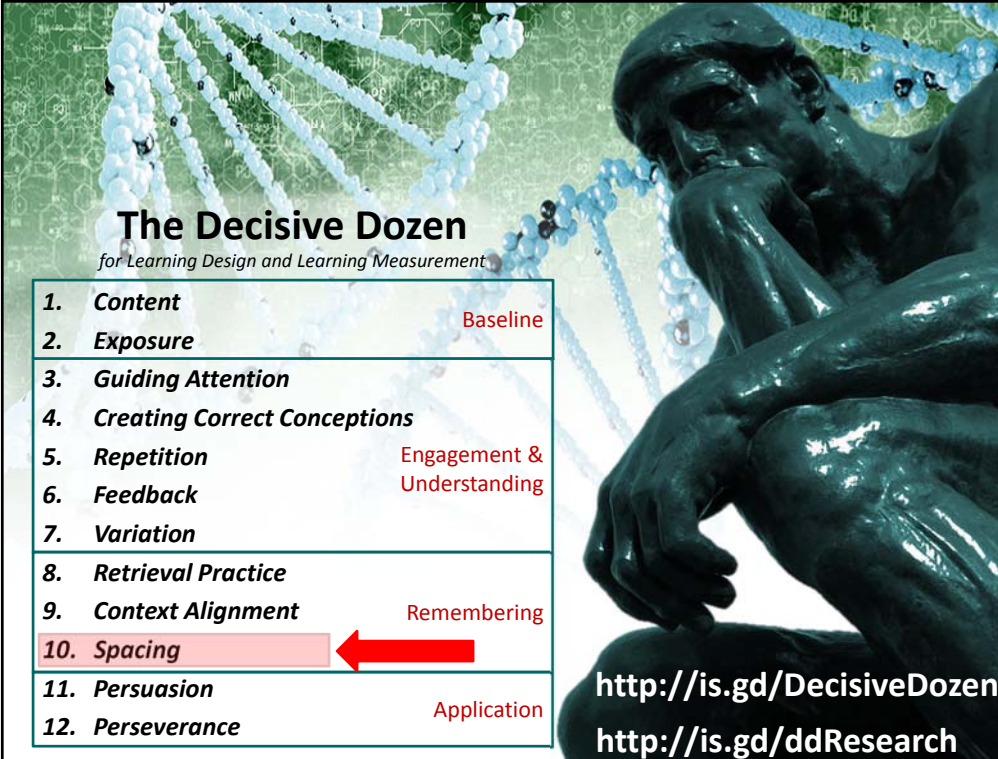
## Chapterizing



## Interspersing

Topic A  
Topic B  
Topic C  
Topic D

Topic A  
Topic B  
Topic A  
Topic B  
Topic C  
Topic B  
Topic C  
Topic D  
Topic A  
Topic B  
Topic C  
Topic D  
Topic A



### The Decisive Dozen

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**Two Topics: Employment Law (EL), and Antitrust Counseling & Compliance (ACC)**

**Want to Add Learning Objectives – to Present to Learners**

**What Happens – Add EL Objectives Only**

### **Adding EL Objectives**

- A. Info on both EL and ACC will be better recalled  
(compared to course with no LO's).

**EL +  
ACC +**

- B. Info on EL will be better recalled while info on ACC will  
be recalled about the same (compared to no LO's).

**EL +  
ACC =**

- C. Info on EL will be better recalled but info on ACC will  
be more poorly recalled (compared to no LO's).

**EL +  
ACC –**

## **There are many types of Instructional Objectives.**

### **For Learners**

**Table-of-Contents  
Objective**

**Performance  
Objective**

**Motivation  
Objective**

**Focusing  
Objective**

### **For Developers**

**Instructional-Design  
Objective**

**Evaluation  
Objective**

**Situation  
Objective**

**Organization  
Objective**

## Focusing Objective

### Definition

*A statement presented to learners before they encounter learning material—*

*Provided to help guide learner attention to the most important aspects of that learning material.*

### Examples

You will learn:

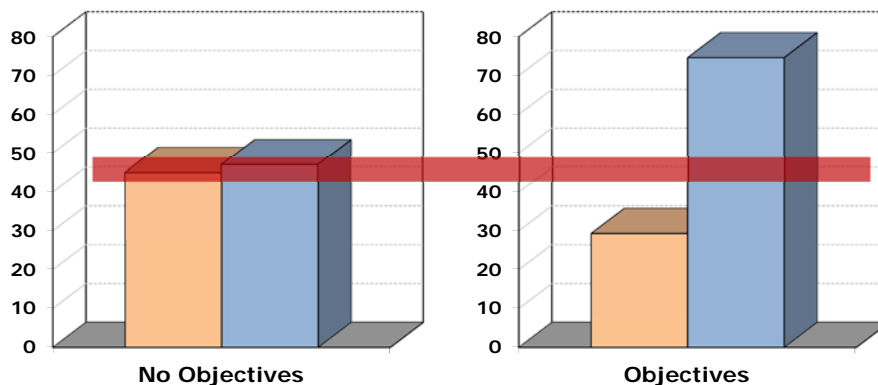
- The role of implementation intentions in health behavior change.
- The importance of providing both goal intentions AND implementation intentions.
- Etc.

Learner presented  
with focusing  
objectives



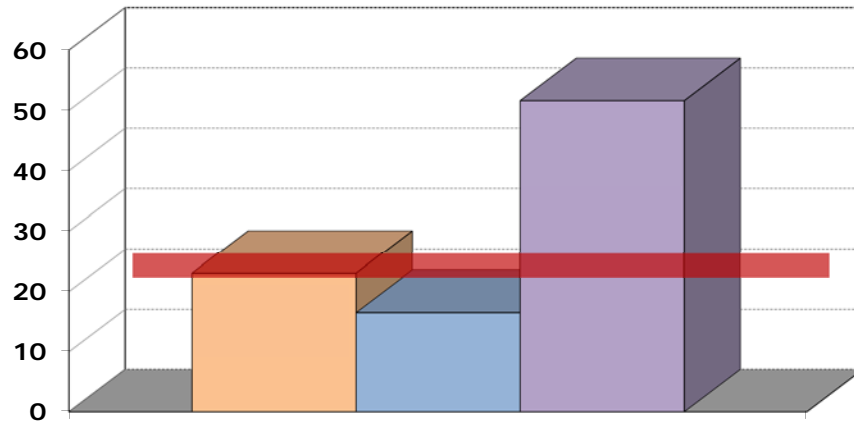
Learner pays  
attention  
to learning material

## Focusing Objective Research



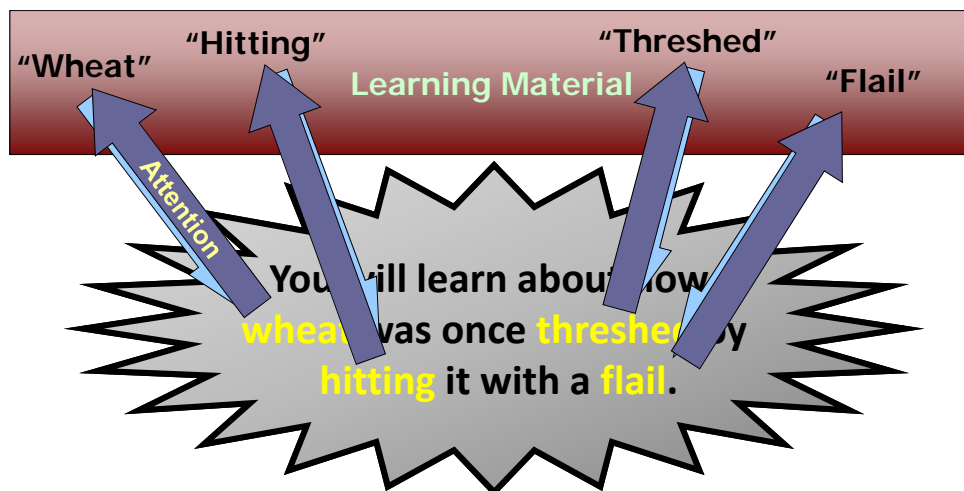
Rothkopf, E. Z., & Billington, M. J. (1979). Goal-guided learning from text: Inferring a descriptive processing model from inspection times and eye movements. *Journal of Educational Psychology*, 71, 310-327.

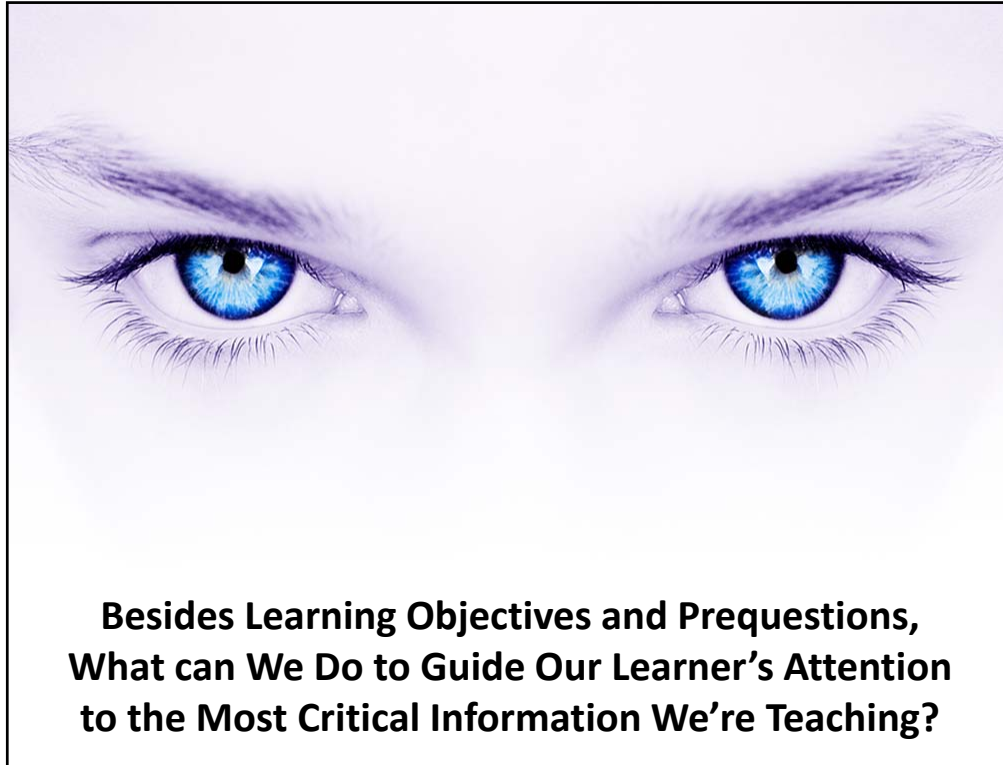
## Focusing Objective Research



Rothkopf, E. Z, & Billington, M. J. (1975). A two-factor model of the effect of goal-descriptive directions on learning from text. *Journal of Educational Psychology*, 67, 692-704.

## How do Focusing Objectives work?





**Besides Learning Objectives and Prequestions,  
What can We Do to Guide Our Learner's Attention  
to the Most Critical Information We're Teaching?**

The background of the slide features a green-tinted image. On the left, there is a glowing blue DNA double helix. On the right, there is a dark, metallic statue of a person in a 'The Thinker' pose, resting their chin on their hand. The overall theme is related to learning, design, and research.

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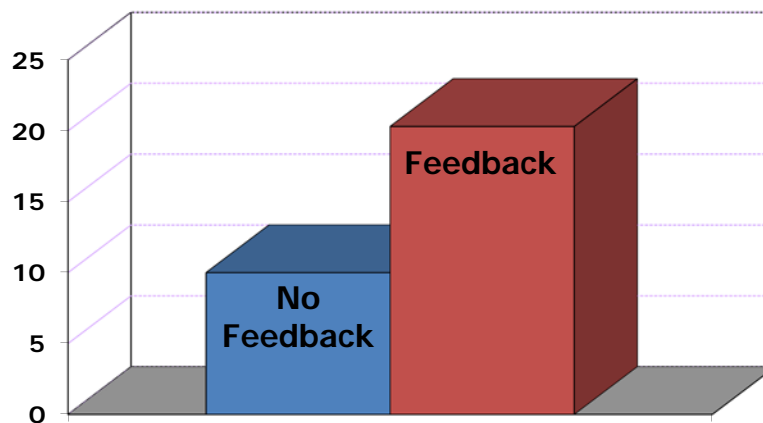
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### When is the best time to give feedback?

- A. *Immediately after each question.*
- B. *At the end of the test.*
- C. *After a delay of two hours or more.*
- D. *After a delay of a day or more.*

### Feedback Research



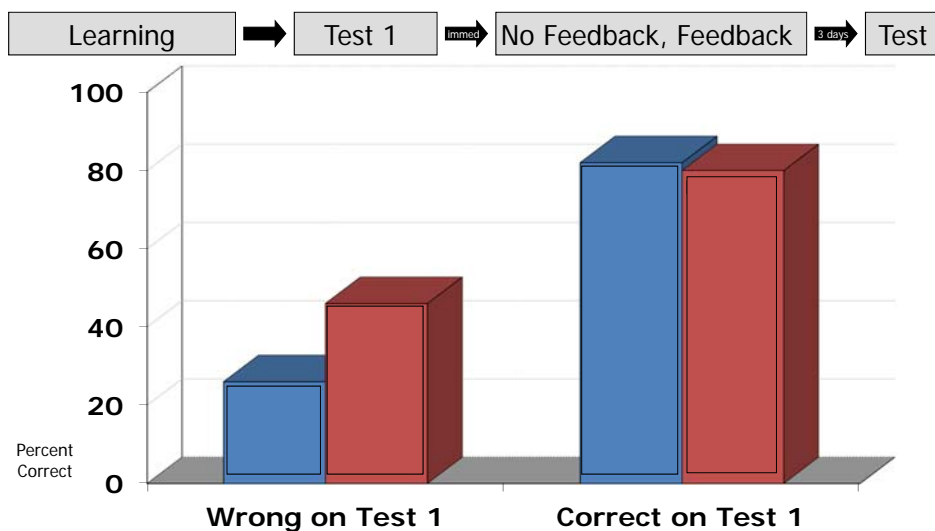
Kulhavy, R. W., & Anderson, R. C. (1972). Delay-retention effect with multiple-choice tests. *Journal of Educational Psychology*, 63, 505-512.

## What's more important?

In most circumstances, what is more important, giving feedback on **correct** or **incorrect** answers?

- A. *Equally important.*
- B. *Correct answers more important.*
- C. *Incorrect answers more important.*

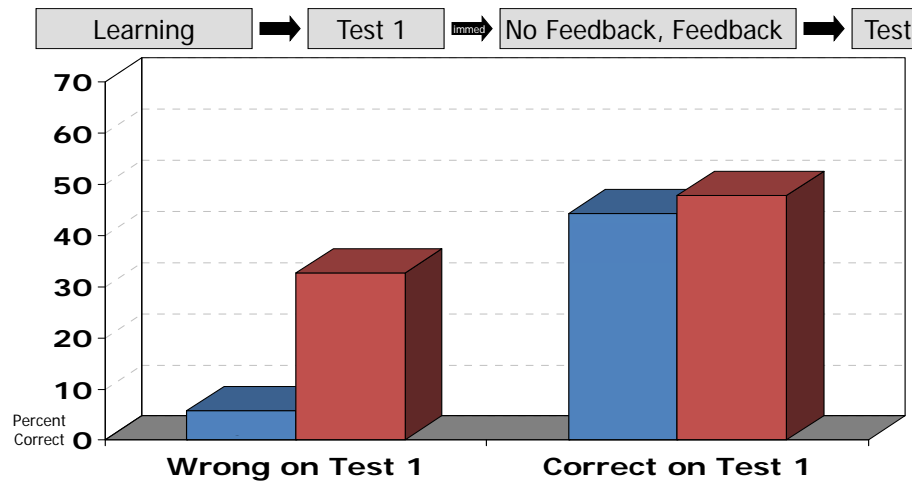
## Research Example Feedback



Kang, McDermott, Roediger (2007). Test format and corrective feedback modify the effect of testing on long-term retention. *The European Journal of Cognitive Psychology*.



## Research Example Feedback

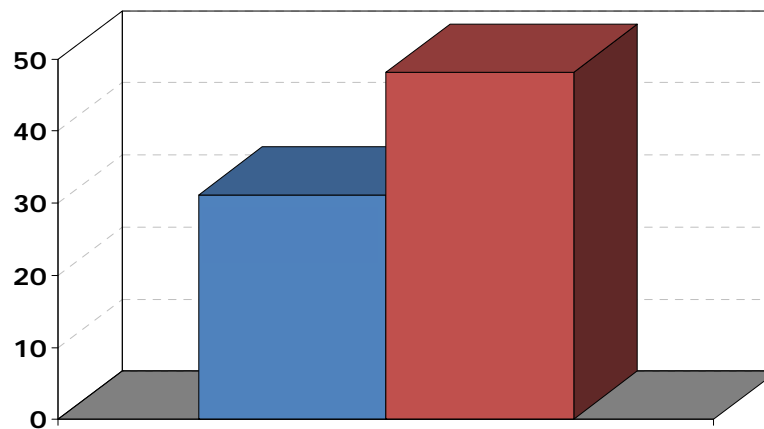


Guthrie, J. T. (1971). Feedback and Sentence Learning. *Journal of Verbal Learning and Verbal Behavior*, 10, 23-28.

## Is Feedback Enough?

If NOT, what else should we provide?


Learner gets answer wrong. We give them good feedback.



Phye, G. D., & Andre, T. (1989). Delayed retention effect: Attention, perseveration, or both? *Contemporary Educational Psychology*, 14, 173-185.

## Feedback Summary

- Feedback Provides Significant Benefits
- Feedback More Important for Corrections
- Feedback Supports Retrieval Practice
- Provide Retrieval Practice After Feedback
- Immediate or Delayed Feedback?

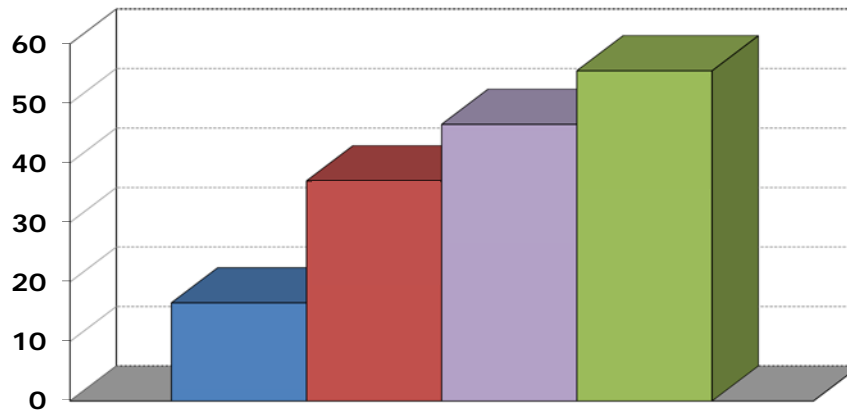


Delayed Feedback?

**When is the best time to give feedback?**

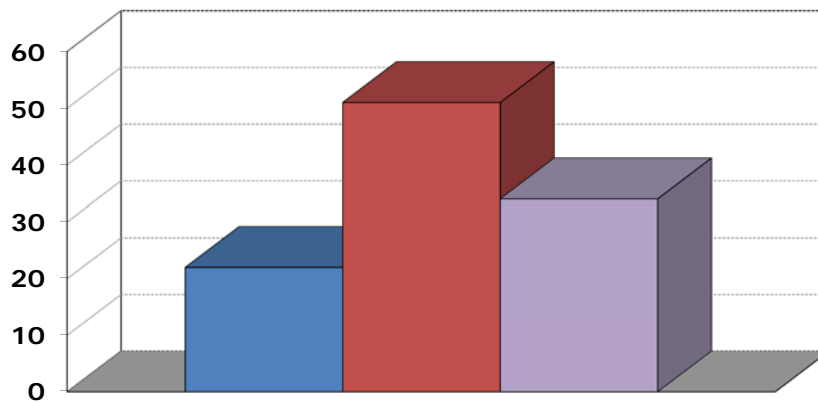
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## Feedback Research



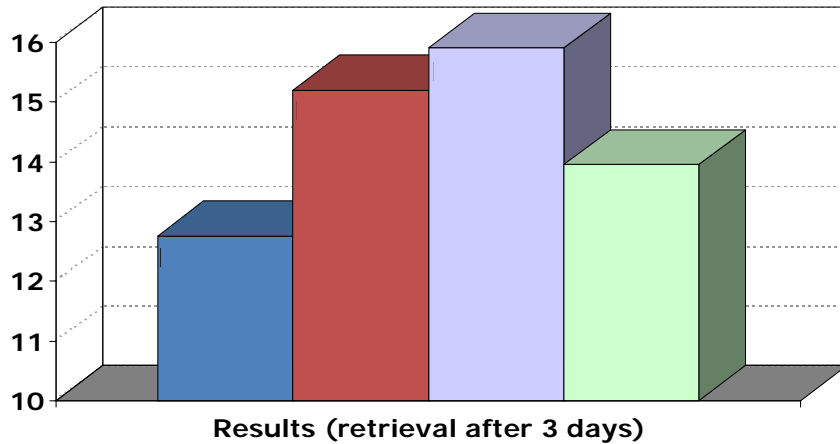
Butler, A. C., & Roediger III, H. L. (2008). Feedback Enhances the Positive Effects and Reduces the Negative Effects of Multiple-Choice Testing. *Memory & Cognition*. 36 (3), 604-616.

## Feedback Research



Brosvic, Epstein, Cook, Dihoff (2005). Efficacy of error for the correction of initially incorrect assumptions and of feedback for the affirmation of correct responding: Learning in the classroom. *Psychological Record*, 55, 401-418.

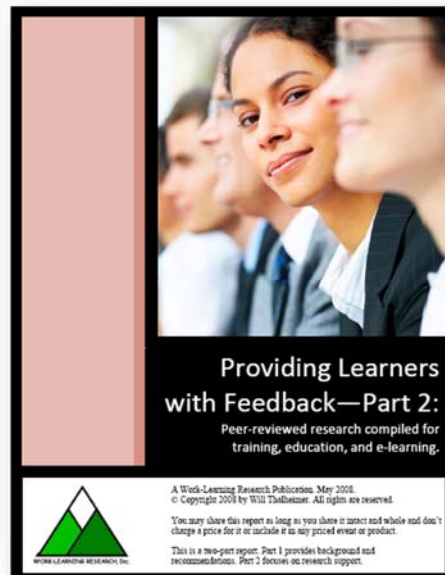
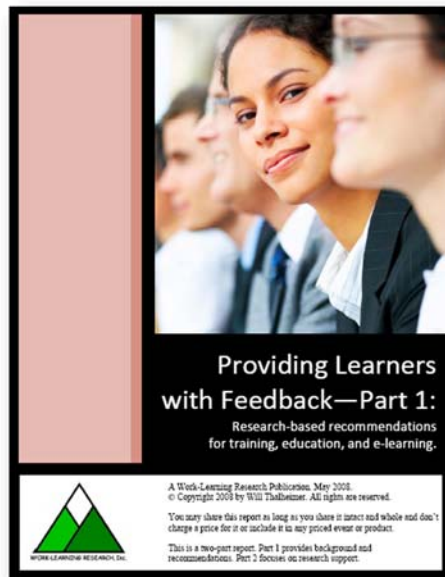
## Feedback Research



More, Arthur, J. (1969). Delay of feedback and the acquisition and retention of verbal materials in the classroom. *Journal of Educational Psychology*, 60, 339-342.

**Would you give different feedback for hard versus easy material?**

**For learners new to material vs. learners more knowledgeable?**



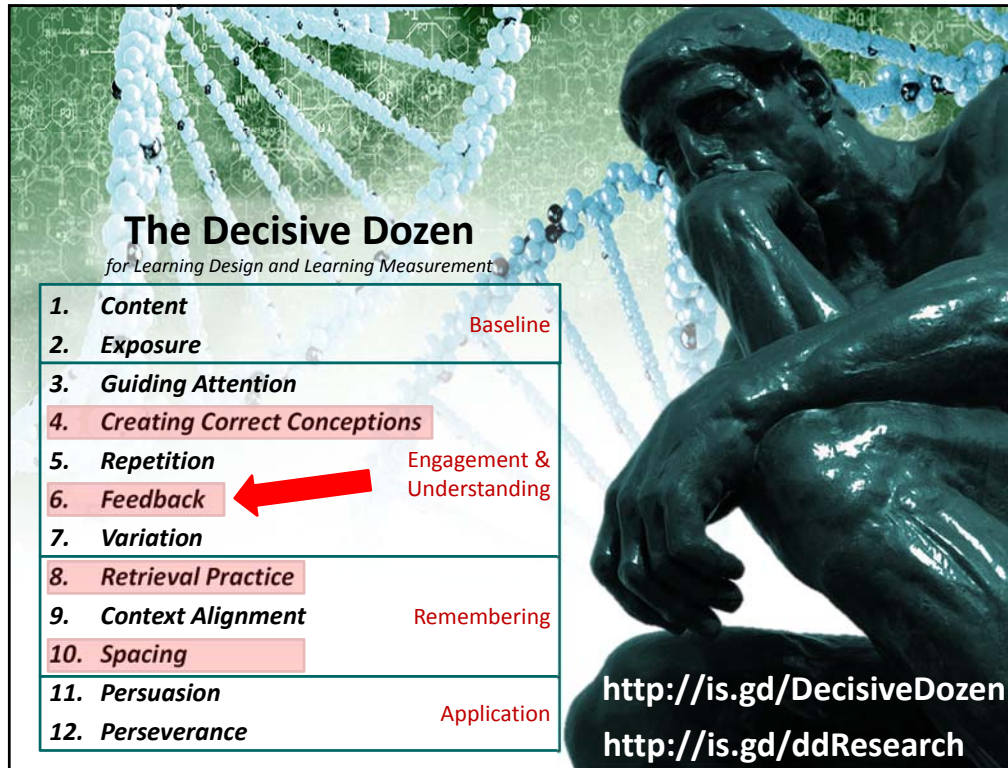
[www.work-learning.com/catalog.html](http://www.work-learning.com/catalog.html)

### Early in Learning Complex Material

- More Feedback Needed
- More Elaborate Feedback
- More Emotional Support
- More Important to Give Feedback on Correct Answers

### Later in Learning Simple Material

- Less Feedback Needed
- Less Elaborate Feedback
- No/Less Emotional Support
- Less Important to Give Feedback on Correct Answers



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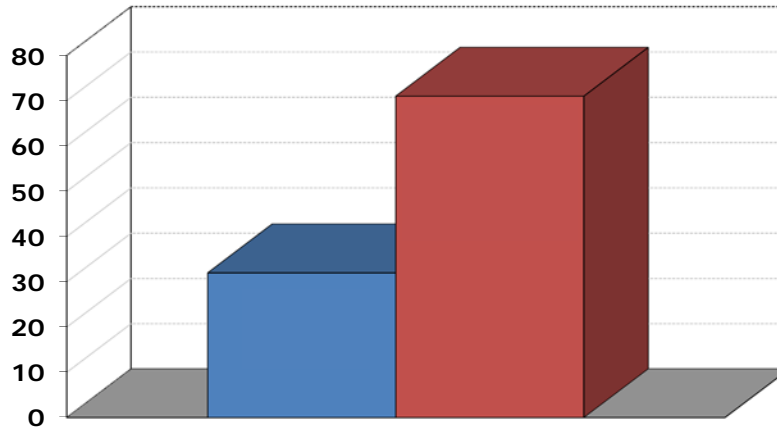
## Goal Setting vs. Trigger Setting

- ◆ Setting a Goal = "I intend to Lose Weight"
- ◆ Setting a Trigger =
  - "I intend to Walk for 30 Minutes on Monday, Wednesday, and Friday as soon as I wake up."
- ◆ IF Situation, THEN Action



## Trigger-Setting Research

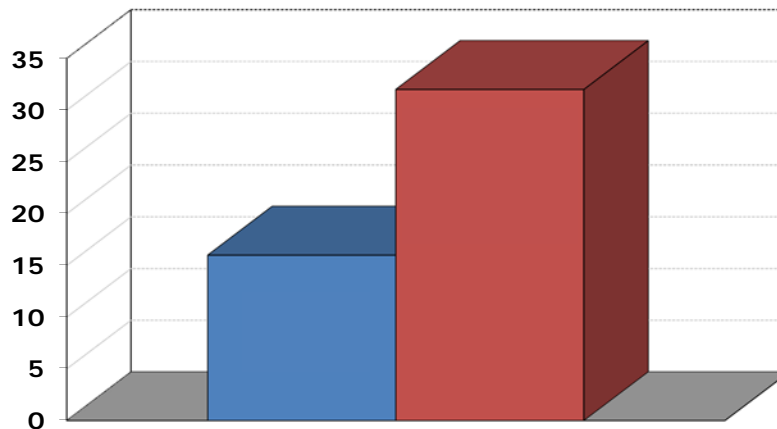
### Setting Triggers to Write a Paper



Gollwitzer, P. M., & Brandstatter, V. (1997). Implementation intentions and effective goal pursuit. *Journal of Personality and Social Psychology*, 73, 186-199.

## Trigger-Setting Research

### Setting Triggers to Attend a Health & Safety Workshop



Sheeran, P., & Silverman, M. (2003). Evaluation of three interventions to promote workplace health and safety: evidence for the utility of implementation intentions. *Social Science & Medicine*, 56, 2153-2163.



Review Article: Gollwitzer, P. M., & Sheeran, P. (2006). Implementation intentions and goal achievement: A meta-analysis of effects and processes. *Advances in Experimental Social Psychology*, 38, 69-119.

*Reviewed 94 separate experiments and found a medium-to-high magnitude ( $d = .65$ ) for the benefits of implementation intentions. 92 of 94 experiments showed positive results!!*

Attending a workshop, self-examination, buying organic, recycling, exercise, diet, solving law cases, taking vitamins.

## Set a Trigger

Prepare to Use What You've Learned

**GOAL:** To consider threat-finance issues in my work as an intelligence analyst.

**SITUATION:** The next time I review message traffic, I will do the following:

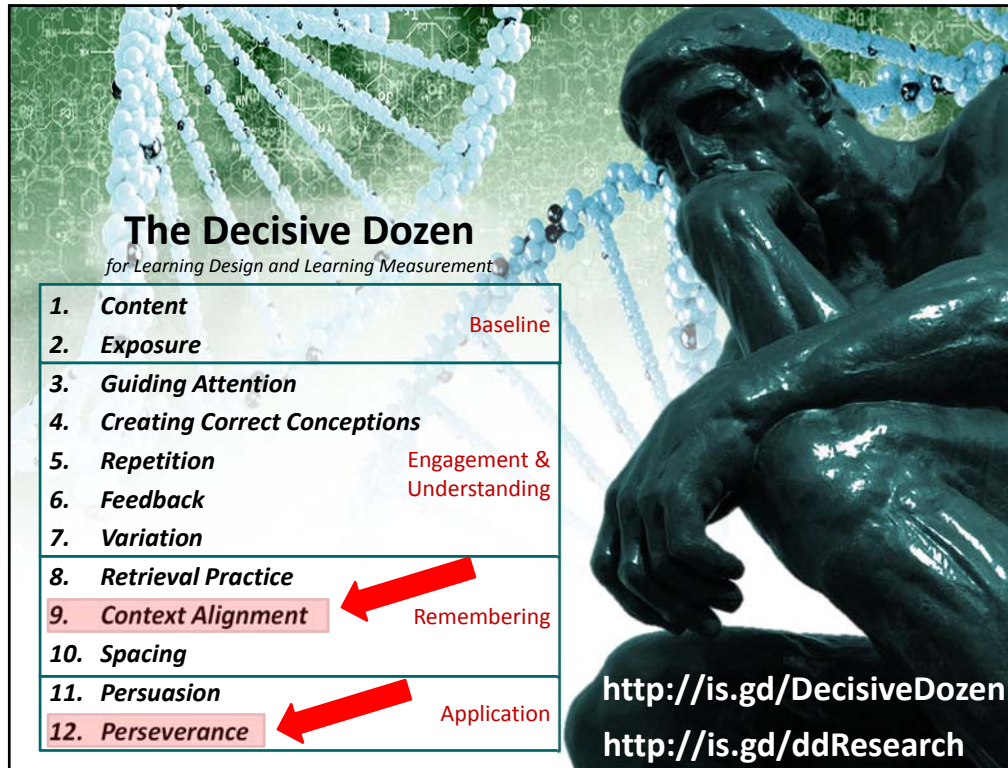
**ACTIONS:**

A.

B.

C.

D.



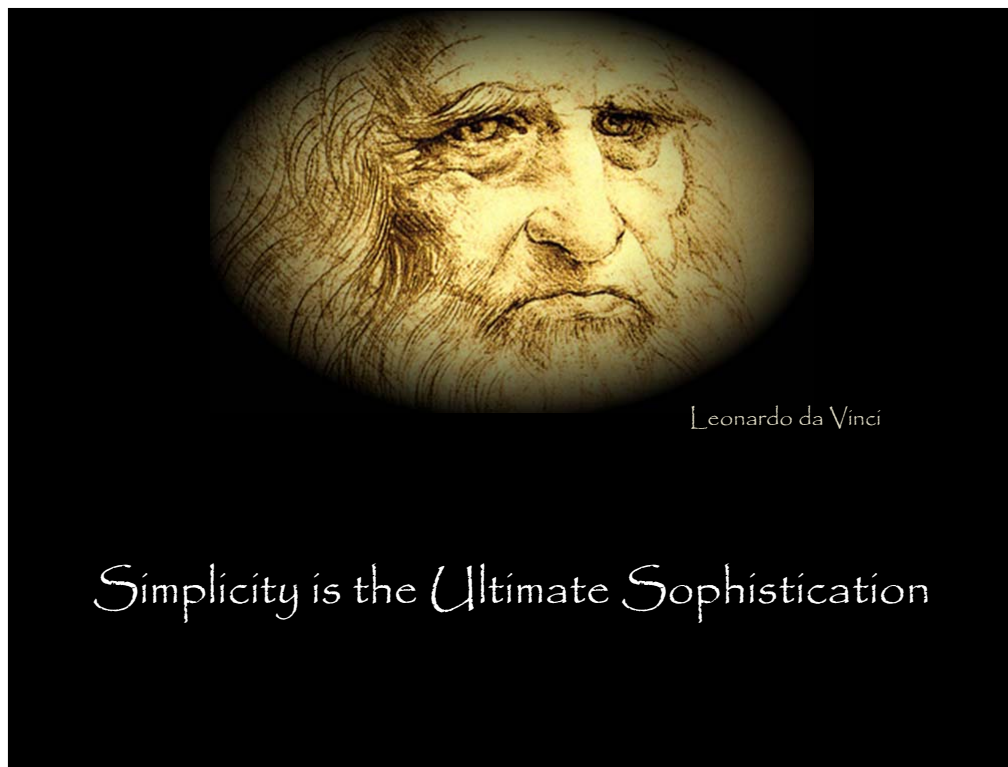
The image features a background with a DNA double helix on the left and a bronze statue of 'The Thinker' on the right. A table lists twelve principles of learning design, with red arrows pointing from specific principles to the right. The principles are: 1. Content, 2. Exposure, 3. Guiding Attention, 4. Creating Correct Conceptions, 5. Repetition, 6. Feedback, 7. Variation, 8. Retrieval Practice, 9. Context Alignment, 10. Spacing, 11. Persuasion, and 12. Perseverance. Red arrows point from 'Context Alignment' to 'Remembering' and from 'Perseverance' to 'Application'. The title 'The Decisive Dozen' is at the top, followed by the subtitle 'for Learning Design and Learning Measurement'. Two URLs are at the bottom right: 'http://is.gd/DecisiveDozen' and 'http://is.gd/ddResearch'.

## The Decisive Dozen

for Learning Design and Learning Measurement

1. <b>Content</b>	Baseline
2. <b>Exposure</b>	
3. <b>Guiding Attention</b>	Engagement & Understanding
4. <b>Creating Correct Conceptions</b>	
5. <b>Repetition</b>	
6. <b>Feedback</b>	
7. <b>Variation</b>	Remembering
8. <b>Retrieval Practice</b>	
9. <b>Context Alignment</b>	Application
10. <b>Spacing</b>	
11. <b>Persuasion</b>	
12. <b>Perseverance</b>	

<http://is.gd/DecisiveDozen>  
<http://is.gd/ddResearch>



# What a Model Needs to Be

## Simple:

Simple enough to be understood, practical, and easy to convey

## Informed:

Based on empirical or testable evidence

## Clarifying:

Guides thoughts and actions appropriately

## Better:

Produces better results than other models or practices

### **Bold Claim:**

*"If you put all 12 of these factors into practice, your learning interventions are likely to be more effective than 95% of all workplace learning interventions currently being utilized!!"*

<http://is.gd/DecisiveDozen>

100%

100%

50%

+ 50%

300%

- Most Learning Interventions don't provide sufficient **REPETITIONS**, even though repetitions often improve learning results by over 100%.
- Most Learning Interventions don't provide sufficient **REALISTIC PRACTICE**, even though retrieval practice has been shown to improve learning results by over 100% with an additional 50% improvement when learning and performance contexts are properly aligned.
- Most Learning Interventions don't provide effective **FEEDBACK**, even though feedback easily improves learning results by over 50%.

## First Principles of Instruction

□ M. David Merrill

For the past several years the author has been reviewing instructional design theories in an attempt to identify prescriptive principles that are common to the various theories. This paper is a preliminary report of the principles that have been identified by this search. Five first principles are elaborated: (a) Learning is promoted when learners are engaged in solving real-world problems. (b) Learning is promoted when existing knowledge is activated as a foundation for new knowledge. (c) Learning is promoted when new knowledge is demonstrated to the learner. (d) Learning is promoted when new knowledge is applied by the learner. (e) Learning is promoted when new knowledge is integrated into the learner's world.

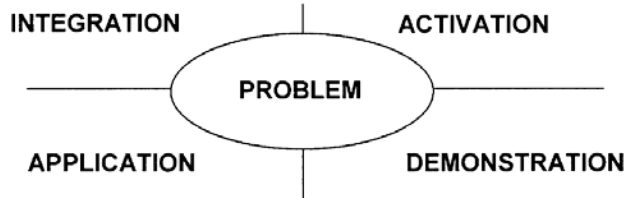
Representative instructional design theories are briefly examined to illustrate how they include these principles. These include: Star Legacy by the Vanderbilt Learning Technology Center, 4-Mat by McCarthy, instructional episodes by Andre, multiple approaches to understanding by Gardner, collaborative problem solving by Nelson, constructivist learning environments by Jonassen, and learning by doing by Schank. It is concluded that, although they use a wide variety of terms, these theories and models do include fundamentally similar principles.

□ Recent years have seen a proliferation of instructional design theories and models. Tennesson, Schott, See, and Dijkstra (1997) and Reigeluth (1999) summarize a number of these different positions. Instructional design theory, as represented in Reigeluth, varies from basic descriptive laws about learning to broad curriculum programs that concentrate on what is taught rather than on how to teach. Are all of these design theories and models merely alternative ways to approach design? Do all of these design theories and models have equal value? Do these design theories and models have fundamental underlying principles in common? If so what are these underlying first principles? The purpose of this paper is to identify and articulate the prescriptive design principles on which these various design theories and models are in essential agreement.

Reigeluth (1999) distinguishes two major kinds of instructional methods: basic methods and variable methods. This paper identifies what Reigeluth calls basic methods but which I prefer to call first principles of instruction. This paper refers to variable methods as programs and practices. A principle (basic method) is a relationship that is always true under appropriate conditions regardless of program or practice (variable methods). A principle is an instructional action consisting of a set of conditions always implying an underlying principle specified or not. It may only emphasize or more of these same principles in a variety of programs.

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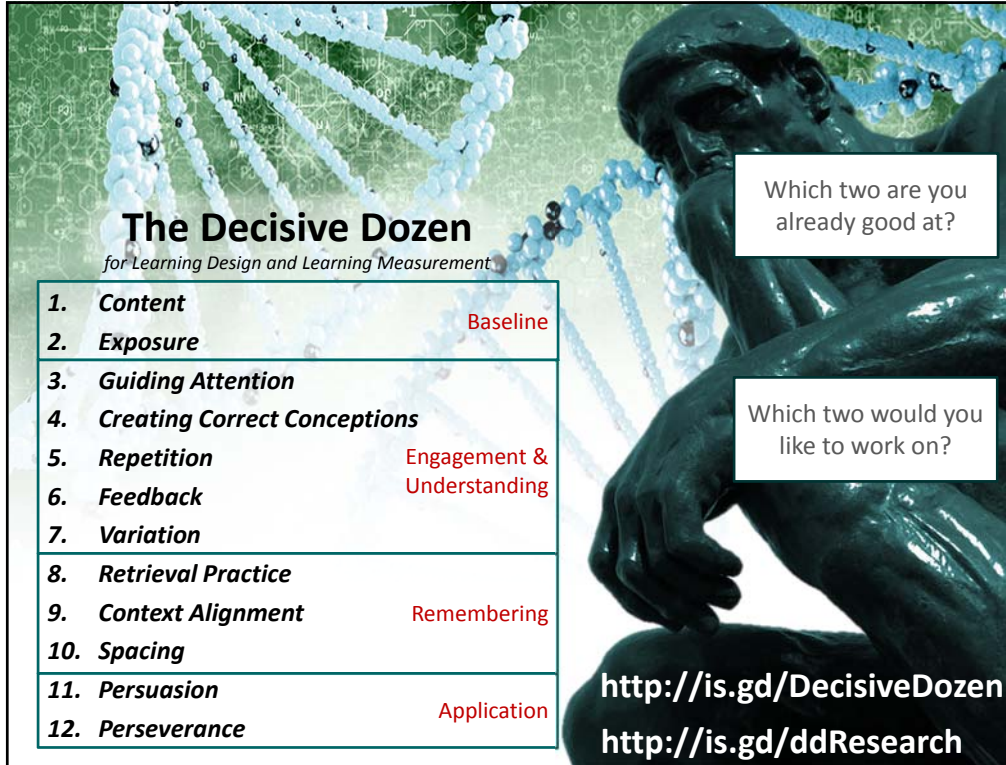
- |                                        |                            |
|----------------------------------------|----------------------------|
| 1. <b>Content</b>                      | Baseline                   |
| 2. <b>Exposure</b>                     |                            |
| 3. <b>Guiding Attention</b>            | Engagement & Understanding |
| 4. <b>Creating Correct Conceptions</b> |                            |
| 5. <b>Repetition</b>                   |                            |
| 6. <b>Feedback</b>                     |                            |
| 7. <b>Variation</b>                    | Remembering                |
| 8. <b>Retrieval Practice</b>           |                            |
| 9. <b>Context Alignment</b>            |                            |
| 10. <b>Spacing</b>                     | Application                |
| 11. <b>Persuasion</b>                  |                            |
| 12. <b>Perseverance</b>                |                            |



1. **Content** – When learners learn, they ought to learn from content that is correct and true.
2. **Exposure** – When learners need to learn, they must be exposed to the right learning content.
3. **Guiding Attention** – When we guide learners' attention to the most critical information, their learning improves.
4. **Creating Correct Conceptions** – When we structure learning so that learners can quickly build correct understandings, they learn more effectively and more efficiently.
5. **Repetition** – When we provide repetitions, learners more effectively understand and remember.
6. **Retrieval Practice** – When we provide practice in memory retrieval, learners are better in future memory retrieval.
7. **Context Alignment** – When we integrate workplace cues in learning, future memory retrieval is more likely to be triggered.
8. **Feedback** – When we utilize feedback appropriately, we correct learners' misconceptions and support correct retrieval.
9. **Variation** – When we vary the learning materials, learners stay more engaged and memory retrieval is improved.
10. **Spacing** – When we space repetitions of content over time, future memory retrieval is improved.
11. **Persuasion** – When we persuade learners about the importance of what they are learning, they will be more likely to reinforce memory accessibility and persevere during future on-the-job implementation attempts.
12. **Perseverance** – Most meaningful learning requires that learners persevere over time with energetic goal-directed metacognitive effort; whether that effort is utilized in training or in self-directed learning.







**The Decisive Dozen**  
*for Learning Design and Learning Measurement*

1. <b>Content</b>	Baseline
2. <b>Exposure</b>	
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10. <b>Spacing</b>	Application
11. <b>Persuasion</b>	
12. <b>Perseverance</b>	

Which two are you already good at?

Which two would you like to work on?

<http://is.gd/DecisiveDozen>  
<http://is.gd/ddResearch>

50 minutes



# The Decisive Dozen

Research-Supported Learning Factors



## Questions??

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**Book:** [willsbook.net](http://willsbook.net)  
**Twitter:** [@WillWorkLearn](https://twitter.com/WillWorkLearn)