THE SCIENCE OF LEARNING AND ITS IMPLICATIONS FOR PROFESSIONAL TRAINING AND DEVELOPMENT

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How to train someone?

How to help someone learn?
Which of the following is probably the MOST important ingredient for successful learning?

A. the intention and desire to learn
B. paying close attention to the material as you study
C. encountering information in a way that matches your personal learning style
D. the time you spend studying
E. what you think about while studying
Well-Established Principles of Learning

1. The ways in which we acquire knowledge (e.g., \( E = mc^2 \)) and acquire skills (e.g., riding a bicycle) follow many of the same “rules.”

2. The benefit of practice and repetition with variation.

3. Performance improves when we receive prompt and frequent feedback.

4. We learn a great deal by simply observing others.

5. The positive effect of incentives on performance.

6. The spacing effect.

7. LTM is a function of depth of processing (e.g., mental elaboration).

8. The testing effect.
Distance achieved by a shot putter across 15 repetitions.
Optimal ratio of positive comments to criticisms is about 5:1.
Observing an expert

Observing yourself
The Spacing Effect

<table>
<thead>
<tr>
<th>Leslie</th>
<th>1/2 hour</th>
<th>1/2 hour</th>
<th>1/2 hour</th>
<th>1/2 hour</th>
<th>1/2 hour</th>
<th>1/2 hour</th>
<th>1/2 hour</th>
<th>A grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lee Ann</td>
<td>1 hour</td>
<td>1 hour</td>
<td>1 hour</td>
<td>1 hour</td>
<td></td>
<td></td>
<td></td>
<td>B grade</td>
</tr>
<tr>
<td>Nora</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4 hours</td>
<td></td>
<td></td>
<td>C grade</td>
</tr>
</tbody>
</table>

The diagram illustrates the spacing effect in learning, where smaller intervals of spaced learning lead to better performance compared to a single extended study session.
Let’s do an experiment!

**Instructions**

• Group 1 (Jan-April) = 
  Remember each word’s **color** and **number of letters**.

• Group 2 (May-August) = 
  Remember the **opposite** of each word.

• Group 3 (Sept-December) = 
  Make up a **story** that uses all 10 words.

10 words

<table>
<thead>
<tr>
<th>sand</th>
<th>computer</th>
</tr>
</thead>
<tbody>
<tr>
<td>hat</td>
<td>lunch</td>
</tr>
<tr>
<td>war</td>
<td>easy</td>
</tr>
<tr>
<td>nurse</td>
<td>song</td>
</tr>
<tr>
<td>running</td>
<td>weight</td>
</tr>
</tbody>
</table>
How many words did you remember?

sand  computer
hat    lunch
war    easy
nurse  song
running weight
Which of the following is probably the MOST important ingredient for successful learning?

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B. paying close attention to the material as you study
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D. the time you spend studying
E. what you think about while studying
The Testing Effect

![Graph showing the proportion of idea units recalled over different retention intervals (5 minutes, 2 days, 1 week) for two conditions: Study, Study and Study, Test. The bar chart indicates a higher recall for the Study, Study condition compared to Study, Test at each interval.](image-url)
1. Weekly Quizzes

I propose we have a quiz every Friday (worth 20 points). Each quiz will test your knowledge of assigned readings and lecture material. People learn best when they are tested frequently and receive prompt feedback. These quizzes will give you an incentive to read carefully and listen carefully in class—and what we do in class will benefit greatly if everyone has done the reading. There will be 14 quizzes altogether. You may not take a missed quiz at a later date, but you can drop your lowest quiz score.
Video-gaming as an acquired skill
May all your professionals be high flyers!