

# What We Know About Learning - 25 Principles

Explanations and references for each of these principles is given in a Word document, 25Principles.doc, downloadable from the Life Long Learning at Work and at Home web site, <http://psyc.memphis.edu/learning/whatweknow/25principles.doc>.

1. **Contiguity Effects.** Ideas that need to be associated should be presented contiguously in space and time.
2. **Perceptual-motor Grounding.** Concepts benefit from being grounded in perceptual motor experiences, particularly at early stages of learning.
3. **Dual Code and Multimedia Effects.** Materials presented in verbal, visual, and multimedia form richer representations than a single medium.
4. **Testing Effect.** Testing enhances learning, particularly when the tests are aligned with important content.
5. **Spacing Effect.** Spaced schedules of studying and testing produce better long-term retention than a single study session or test.
6. **Exam Expectations.** Students benefit more from repeated testing when they expect a final exam.
7. **Generation Effect.** Learning is enhanced when learners produce answers compared to having them recognize answers.
8. **Organization Effects.** Outlining, integrating, and synthesizing information produces better learning than rereading materials or other more passive strategies.
9. **Coherence Effect.** Materials and multimedia should explicitly link related ideas and minimize distracting irrelevant material.
10. **Stories and Example Cases.** Stories and example cases tend to be remembered better than didactic facts and abstract principles.
11. **Multiple Examples.** An understanding of an abstract concept improves with multiple and varied examples.
12. **Feedback Effects.** Students benefit from feedback on their performance in a learning task, but the timing of the feedback depends on the task.
13. **Negative Suggestion Effects.** Learning wrong information can be reduced when feedback is immediate.
14. **Desirable difficulties.** Challenges make learning and retrieval effortful and thereby have positive effects on long-term retention.
15. **Manageable Cognitive Load.** The information presented to the learner should not overload working memory.
16. **Segmentation Principle.** A complex lesson should be broken down into manageable subparts.
17. **Explanation Effects.** Students benefit more from constructing deep coherent explanations (mental models) of the material than memorizing shallow isolated facts.
18. **Deep questions.** Students benefit more from asking and answering deep questions that elicit explanations (e.g., why, why not, how, what-if) than shallow questions (e.g., who, what, when, where).

19. **Cognitive Disequilibrium.** Deep reasoning and learning is stimulated by problems that create cognitive disequilibrium, such as obstacles to goals, contradictions, conflict, and anomalies.
20. **Cognitive Flexibility.** Cognitive flexibility improves with multiple viewpoints that link facts, skills, procedures, and deep conceptual principles.
21. **Goldilocks Principle.** Assignments should not be too hard or too easy, but at the right level of difficulty for the student's level of skill or prior knowledge.
22. **Imperfect Metacognition.** Students rarely have an accurate knowledge of their cognition so their ability to calibrate their comprehension, learning, and memory should not be trusted.
23. **Discovery Learning.** Most students have trouble discovering important principles on their own, without careful guidance, scaffolding, or materials with well-crafted affordances.
24. **Self-regulated Learning.** Most students need training on how to self-regulate their learning and other cognitive processes.
25. **Anchored Learning.** Learning is deeper and students are more motivated when the materials and skills are anchored in real world problems that matter to the learner.

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