

encoding and retrieval, as well as counteract the effects of interference, other tactics are appropriate, such as using imagery and representing information in multiple ways.

Graphic representations have been particularly effective in facilitating encoding and memory storage of information. Beissner, Jonassen, and Grabowski (1994; see also Jonassen, Beissner, & Yacci, 1993) reviewed the use of graphic techniques in acquiring structural knowledge, which represents relationships between concepts in a content domain. They concluded that graphic techniques (such as semantic maps, concept maps, networking) analyze, elaborate, and integrate subject matter content, as well as illustrate concept relations. The result is enhanced structural knowledge on the part of the learner. The concept maps that introduce each chapter of this book are a good example of graphic representations. If designed well, they should assist you in organizing and understanding the concepts discussed.

Arranging Extensive and Variable Practice

"Practice makes perfect" is a dictum well known to most learners, and in fact, there is some truth to the saying. As noted earlier in the chapter, automaticity of basic skills is a desirable educational goal, and extensive practice is one of the ways to help achieve it. Behavioral theorists referred to overlearning, or practicing a skill until it is so habitual as to require very little conscious attention. As will be seen in the discussion of learning motor skills (see Chapter 10), the amount of practice is not the only important variable. The kind of practice also matters. (As motor learning theorists are apt to say, "Perfect practice makes perfect!")

As noted from the evidence on encoding specificity, if the context changes substantially from encoding to retrieval, learners' performance may be impaired. Providing a great deal of varied practice helps learners to attach multiple cues to what they are learning, so they are more likely to recall it at test time in a range of appropriate contexts.

Enhancing Learners' Encoding and Memory

Many students come to college lacking study skills that will help them be successful as learners in the post-high school environment. Often, the goals they are asked to achieve are sufficiently more difficult than what they experienced in high school to put them at risk for failing. To help these students become better learners, community colleges and universities offer a variety of courses and experiences aimed at enhancing learners' encoding and memory. The strategies that are taught in these courses come directly from research on CIP that has been discussed in this chapter, and although they are aimed at college students, they are by no means limited to this population. Elementary and secondary school teachers, as well as instructional designers and trainers, can