

YOU KNOW YOU HAVE MASTERED THE MAIN TOPICS IN THIS CHAPTER IF YOU ARE ABLE TO . . .

- ∞ Introduce the concept of cognition, as it relates to mental images, concepts and problem solving.
- ∞ Describe artificial intelligence and creative thinking.
- ∞ Discuss the measurement of intelligence including the Stanford-Binet and Wechsler intelligence tests, test construction issues, and the determination of developmental delay.
- ∞ Describe several prominent theories of intelligence including the concepts of giftedness, mental retardation, heredity, and environment.
- ∞ Explain the basis of language and the relationship between language and thought processes.

RAPID REVIEW

Thinking, or **cognition**, can be defined as mental activity that goes on in the brain when a person is processing information. Cognition includes both verbal and nonverbal processes. Two examples of cognition are **mental images**, which are picture-like representations that stand in for objects or events, and **concepts**, or ideas that represent a class of objects. Concepts can be ranked from general to specific by applying the terms **superordinate**, **basic level** type, and **subordinate**. **Formal concepts** are defined by specific rules, while **natural concepts** are formed as a result of experience. A **prototype** is a specific example of a concept that closely resembles the defining features of a concept. Concepts are formed through experience and culture and have an impact on our thinking.

Problem solving involves using our thoughts or cognitions to reach a goal and consists of at least four different techniques. **Trial-and-error** problem solving makes use of mechanical solutions. When someone uses **algorithms** to problem-solve they are following step-by-step procedures to solve the problem. **Heuristics** are general “rules of thumb” that can be applied to many situations. **Means-end analysis** is an example of one type of heuristic where the difference between where you are and where you want to be is determined and then steps are taken to reduce that difference. **Insight** consists of solving the problem by having a sudden moment of inspiration or “aha!” moment. **Artificial intelligence** is the creation of a machine that can think like a human, and is represented today through computer program such as Deep Blue.

Some factors that interfere with problem solving include **functional fixedness**, which is when a person thinks about objects only in terms of their typical uses; **mental sets** which are tendencies to use the same problem-solving strategies that worked in the past; and **confirmation bias**, which consists of the search for evidence that fits your beliefs while ignoring any contradictory information. **Creativity** occurs when a person solves a problem by combining ideas and behaviors in a new way. Many methods of problem solving utilize **convergent thinking**, which assumes that one single answer exists for the problem. **Divergent thinking** is the opposite process of convergent thinking. When an individual uses divergent thinking, he or she starts from one point and comes up with many possibilities or ideas based on that point.

Intelligence can be defined as the ability to learn from one’s experiences, acquire knowledge, and use resources effectively in adapting to new situations or solving problems. Currently, there is still much disagreement on exactly what is meant by the term “intelligence.” In 1904, **Charles Spearman** proposed that intelligence was split between two abilities. The first ability was a general intelligence, labeled the **g factor**, and the other was a specific intelligence referred to as the **s factor**. Spearman believed that both the g and s factors could be measured using standardized intelligence tests. **Howard Gardner**, on the other hand, proposed that at least nine different kinds of intelligence exist. **Robert Sternberg** proposed the **triarchic theory of intelligence**, which states that intelligence can be divided into three types; **analytical**, **creative**, and **practical intelligence**.

In France in 1916, **Alfred Binet** and Theodore Simon developed the first formal test for intelligence in order to determine a child’s mental age. The Stanford-Binet test used a ratio of mental age to chronological age to determine an individual’s **intelligence quotient** or **IQ**. In the U.S., the Wechsler

intelligence tests are now used more frequently than the Stanford-Binet and IQ scores are now based on individual **deviation IQ scores** rather than a ratio. The Wechsler tests are designed for specific age groups and can be administered individually. To determine the quality of a psychological test, you need to look at the test's **validity**, **reliability**, and procedure used to obtain the **norms**. Validity refers to how well the test measures what it claims to measure, while reliability indicates the test's ability to produce the same result when given to the same person under similar conditions. Norms are determined by the **standardization group** selected by the researchers and should be a representative sample of the population who will be taking the test. All psychological tests should also be examined for the cultural biases. Adrian Dove created an intelligence test called the Dove Counterbalance General Intelligence Test (also known as the Chitling Test) to demonstrate the cultural biases present in many of the intelligence tests currently in use.

Mental retardation, now more commonly referred to as **developmental delay**, occurs in about 3 percent of the U.S. population and is defined by an IQ score of 70 (two standard deviations below the mean) or lower along with adaptive behaviors significantly below the expected level for the person's age group. Diagnosis of developmental delay is determined by the person's intellectual and adaptive behavior skills, psychological and emotional levels, physical health considerations, and environmental factors. Developmental delay is classified from mild to moderate, severe, and profound. The three most common biological causes of developmental delay are Down syndrome, fetal alcohol syndrome, and fragile X syndrome.

Individuals who receive scores of 130 or above on intelligence tests are referred to as **gifted**. **Lewis Terman** conducted a longitudinal study of the traits and behaviors of over 1,500 gifted children. The children were known as Terman's Termites and his findings showed that many of the common myths about the "nutty genius" were unfounded.

More recently, the concept of **emotional intelligence** has been suggested as an important factor for success in life. Further research in this area is still needed. The role of a person's environment or **nurture**, and heredity, also referred to as **nature**, on the development of intelligence continues to be debated. Studies of identical and fraternal twins raised together and apart have provided one method for investigating the role of nature and nurture.

Language is defined as a system for combining symbols (such as words) so that an unlimited number of meaningful statements can be made for the purpose of communicating with others and can be analyzed at many levels. **Semantics** is the rules for determining the meaning of words and sentences. **Phonemes** are the most basic units of sounds used in a specific language, **morphemes** combine the units of sound into the smallest units that have meaning, **grammar** includes all the rules for combining morphemes into words, and **syntax** is the rules for combining words into sentences. **Pragmatics** deals with the practical aspects of communicating with others. The relationship between language and thought has been studied extensively. The **Sapir-Whorf hypothesis**, also known as the **linguistic relativity hypothesis**, proposes that the words people use determine how they think about themselves and the world. An opposing theory, known as **cognitive universalism**, proposes that certain ways of thinking are shared among all groups of people and influence the development of language in similar ways. Animals other than humans demonstrate a diverse ability to communicate but it is unclear whether or not they have the capability for language as demonstrated by the ability to use abstract symbols to communicate. Kanzi, a bonobo chimpanzee, has demonstrated an ability to understand about 150 spoken English words. However, none of the animals studied to date appear to have been able to use and comprehend syntax.

Researchers have found that "exercising" the brain with activities such as reading, taking classes, and working on crossword puzzles can help increase the ability of the brain to build and maintain new neurons and connections. This potential for brain growth and repair is called **cognitive reserve**.