

# Unit XI - Answer Key

## Testing and Individual Differences

### Module 60 - Introduction to Intelligence

#### While You Read

##### 60-1

1. Answers will vary but should include the idea that psychologists debate whether intelligence is one aptitude or many, linked to cognitive speed, or even neurologically measurable.
2. Answers may vary but may include that the “smart” individual does well in school which may or may not be a reflection of their overall intelligence, rather, it might reflect their work ethic or their grit.
3. Spearman believed we have one general intelligence, *g*; he also thought that people have special abilities that stand out. Thurstone did not rank people on a single scale of general aptitude but identified seven clusters of primary mental abilities, but it did seem that those who excelled in one of the seven clusters generally scored well on the others so there might be evidence of *g*.
4. Spearman and Thurstone used factor analysis to identify clusters of related intelligence abilities.

##### 60-2

1. Gardner views intelligence as multiple abilities that come in different packages. He thought we had multiple intelligences. Gardner’s critics say it doesn’t work in that way—to be strong in one intelligence is not balanced by a weakness in another, for example. Factor analysis has shown that there is a general intelligence (*g*). Critics have claimed that what Gardner

identifies as intelligences may in fact be better described as talents and some like naturalistic or bodily-kinesthetic intelligence might be more valued in some cultures over others rather than being universally recognized as intelligences.

2. People with savant syndrome score low on intelligence tests and sometimes have limited language ability but possess an exceptional specific skill, such as computation or drawing.
3. **Thurstone:** Thurstone thought there were seven clusters of primary intelligence, so Bill Gates' quote would relate to his work in that Gates is agreeing that just because we are intelligent in one cluster, doesn't mean we are intelligent in all the others although Thurstone did find commonalities in those who scored well in one area often scored well in other areas of mental abilities.

**Spearman:** Gates' quote would conflict with Spearman's idea that we all have a general intelligence (*g*). Spearman found that those who score high in one area also score higher in other areas and that *g* underlies all intelligent behavior. He would argue that Gates is intelligent and has wisdom in all topics if he has the strong intelligence in software developing.

**Gardner:** Gardner, would agree with Gates' statement that intelligence in one area doesn't necessarily transfer to all areas.

4.
  - analytical intelligence (assessed by traditional intelligence tests, which present well-defined problems with a single right answer; grades in school)
  - creative intelligence (reacting adaptively to novel situations and generating novel ideas)
  - practical intelligence (required for everyday tasks, which may be ill-defined and with many possible solutions; shrewd ability to manage oneself, one's tasks, and other people)

5. Sternberg and Gardner agree that there are differing types of intelligence and both recognize that knowing how to work with others—referred to as interpersonal in Gardner’s theory and practical in Sternberg’s—is a mark of intelligence.

They differ in that Sternberg groups many of Gardner’s into just three categories. For instance, both inter- and intrapersonal might be found under Sternberg’s practical intelligence category. Sternberg believed that there was no need to such a wide array of differing categories for intelligence.

6. Current research seems to suggest that those who score well on general intelligence perform better in many different areas including educational level completed, income and number of academic publications which lends credibility to the historic ideas of Charles Spearman’s g factor.

7. Grit is defined as perseverance and determination even in the face of setbacks and some like Angela Duckworth (see Unit 10) believe that this may be even more important than natural talent in determining success.

### 60-3

#### 1.

- a. Perceiving emotions (recognizing them in faces, music, and stories)
- b. Understanding emotions (predicting them, and understanding how they change and blend)
- c. Managing emotions (to know how to express them in varied situations)
- d. Using emotions (for adaptive or creative thinking)

2. Answers will vary, but may include that even if a person is very upset they may be able to keep from crying or breaking down during the end of a relationship if they have high levels of Emotional Intelligence. On the other hand, understanding how one felt about the relationship may cause them to feel even worse during the break up.

### After You Read

### Module 60 Review

Theory	Brief Summary of the Theory
Spearman's general intelligence ( <i>g</i> )	Basic or general ( <i>g</i> ) intelligence predicts our abilities in varied areas.
Thurstone's primary abilities	Our intelligence may be broken down into seven factors.
Gardner's multiple intelligences	Our abilities are best classified into eight independent intelligences.
Sternberg's triarchic theory	Our intelligence is best classified into three areas that predict real-world success: analytical, creative, and practical.

**2.**

**a.** Savant Syndrome

**b.** Logical-Mathematical

## Module 61 - Assessing Intelligence

### While You Read

#### 61-1

1. An aptitude test predicts how one will do on some future measure while an achievement test measures what an individual has learned thus far.

An aptitude test might be the SAT or ACT test which are used to predict college performance while an achievement test is an AP exam or a unit test for a course you are taking after you have covered the material.

#### 61-2

1. Galton thought to measure “natural ability” by assessing reaction time, sensory acuity, muscular power, and body proportion of more than 10,000 visitors of the 1884 London Exposition. He was unable to show correlations. He did give us some statistical techniques (psychometrics, see Unit 1) that are still in use and the phrase *nature and nurture*.
2. France instated compulsory education for all children around the turn of the twentieth century and many seemed unable to do the work. Rather than rely on the subjective reports of teachers, the French government commissioned Binet to devise an objective assessment of intelligence.
3. Binet emphasized reasoning and problem solving. Binet also believed that intelligence was not fixed from birth and could be improved upon through “mental orthopedics”.
4. His idea of mental age was the level of performance typically associated with a certain chronological age. The average 9-year-old should have a mental age of 9. This indicated that the cognitive assessments placed the child at the same level as was expected based on tests of

other children of the same age.

5. He hoped it would improve children's education but feared it would be used to label children and limit their opportunities.
6. He added items, established new age norms, and extended the upper end of the test's range from teenagers to "superior adults."
7. Binet did not believe his intelligence test measured inborn intelligence, but Terman, initially at least, did believe that his revision of Binet's test took into account the "inequalities of children in original endowment." Terman used Binet's exam to promote the idea that intelligence was inborn and predetermined at birth.
8. The test questions written for French school children did not work for those tested in the United States. Terman had to create new items and new norms for those he was testing in California.
9.
  - a. a 10-year-old boy who answers questions at an 8-year-old level 80
  - b. a 6-year-old boy who answers questions at a 10-year-old level 166
  - c. a 7-year-old girl who answers questions at the 7-year-old level 100
10. Most current intelligence tests no longer compute IQ in this manner, although the term IQ still lingers as a term for intelligence test score. Today, the score represents the test-taker's performance relative to the average performance of others the same age—the average is assigned a score of 100 and about 2/3 of all scores fall between 85 and 115.
11. Intelligence testing has been used to encourage only smart and fit people to reproduce (eugenics). Terman envisioned that the use of intelligence tests would ultimately result in curtailing the reproduction of feeble-mindedness and in the elimination of an enormous

amount of crime, pauperism, and industrial inefficiency.

Intelligence tests were also given to waves of immigrants and, obviously, since they did not speak the language or understand the culture and customs, they had low scores and were thought to be unintelligent. This led to the 1924 immigration law reducing the number of Southern and Eastern European immigrants that could enter the United States.

12. The WAIS includes 15 subtests, including similarities, vocabulary, block design, and letter-number sequencing, among others. It is different from the Stanford-Binet in that it yields separate scores for verbal comprehension, perceptual organization, working memory, and processing speed.

### 61-3

1. The AP<sup>®</sup> Psychology Exam is designed to assess your performance in a college-level introduction to psychology course; thus, it should be standardized using a population of college students after completing an introduction to psychology course in college. The same test should be given to the college students and the AP<sup>®</sup> students and the scores can then be meaningfully compared to one another. It is also important that everyone who takes the exam takes in under the same conditions, with the same time constraints in order to authentically compare the group's performance.
2. Drawing should match Figure 61.2.
3. It allows a comparison to others who are similar to the test taker on some measure and allows the individual to understand where they fall in the population compared to others.
4. The Flynn effect shows that intelligence test performance has been improving since the 1930s. The cause has been a mystery, but people think it may be due partly to better



nutrition, more education, more stimulating environments, less childhood diseases, and/or smaller families. The increase in scores may also be due to the testing effect and people (specifically students) who are tested so often that they simply have become better at taking tests.

5. In developing a test, it is important that it yield consistent results. To measure the reliability of a test, researchers use the test-retest method (taking a version of a test more than once) or the split-half method (comparing the results of odd to even numbered questions).
6. Reliability tells us that the test yields consistent results; validity speaks to the extent to which the test measures what it intends to measure.
7. A test can yield consistent results every time it is administered (reliability), but it may not measure or predict what it is supposed to (validity).
8. Content validity is the extent to which a test samples the behavior that is of interest; predictive validity is the success with which the test predicts the behavior it is designed to predict.

Real-life examples will differ but may include a unit exam for a class which addressed the content covered in class and in the textbook for a given chapter.

9. The ACT and SAT do not accurately predict how students will perform in college classes (less than +0.5)

### **After You Read**

### **Module 61 Review**

1. Western attempts to assess intelligence differences began over a century ago in the mid-late 1800s. Alfred Binet's work with intelligence tests began in 1904 to identify children who

were in need of special help.

2. Alfred Binet referred to children's actual age in years as their chronological age and their performance ability level as their mental age.
3. The rising average intelligence test score over the last century is referred to as the Flynn effect Flynn effect.
4. The Advanced Placement<sup>®</sup> exam you will take this year is an example of an achievement test.
5. c. Louis Terman.
6. d. WAIS.
7. e. standardizing the test.
8. Draw and label the normal curve of intelligence scores in the space below. Once finished, use it to answer questions 9 and 10.
9. d. 84%
10. c. 55-145
11. a. reliability.
12. c. content validity.

## Module 62 - The Dynamics of Intelligence

### While You Read

#### 62-1

1. Researchers compare people of various ages at one point in time and have found that older adults give fewer correct answers on intelligence tests than do younger adults. Wechsler concluded that the decline of mental ability with age is part of the general aging process of the organism as a whole.
2. Psychologists retested the same cohort over a period of years and found that until late in life, intelligence remained stable—on some tests it even increased.
3. Crystallized intelligence—our accumulated knowledge as reflected in vocabulary and analogies tests—increases up to old age.

Fluid intelligence—our ability to reason speedily and abstractly as when solving novel logic problems—decreases starting around middle age, slowly up to age 75 or so, then more rapidly, especially after age 85.

4. Older adults show increased social reasoning, taking multiple perspectives, appreciating knowledge limits, and offering helpful wisdom.

#### 62-2

1. A cross-sectional design compare individuals or different cohorts (age groups, gender, ethnicity) at the same time to determine if there are similarities or differences between cohorts.

A longitudinal design follows one group over a long-period of time to detect trends and changes over time.

2. As the Flynn effect demonstrates, people have been getting smarter. Cross-sectional research suggested that people were becoming less intelligent as they grew older, but when comparing people of different ages, one must take into consideration cohort effects.

### 62-3

1. By age 4, children's performance on intelligence tests begins to predict their adolescent and adult scores; the consistency of scores over time increases with the age of the child. In Scotland, Deary et al. conducted longitudinal studies on over 87,000 people. Around age 11, they were all given an intelligence test, and 65 years later those results were compared to a retesting of the 542 survivors of the original test. The correlation was significant (a positive correlation of +0.54).
2. Better education may lead to better jobs, better pay and a healthier environment. Higher intelligence may translate to better life decisions. Not smoking, better diets and more exercise.

### 62-4

1. A person must have both a low intelligence test score (two standard deviations below the mean) and difficulty adapting to the normal demands of independent living.
2. A strict cutoff of an intelligence test score can be an arbitrary marker. What is to distinguish a person who scores a 68 from one who scores a 70? This has also played a role in determining sentencing for death row inmates. The Supreme Court only recently agreed to take into consideration other factors than an IQ score of 70 or lower when sentencing those who have committed crimes.
3. Over time, as tests are periodically restandardized, the mean and standard deviation change.

As such, a person who scored near 70 on an earlier version of the test might now score 63 on the same test, and two people with the same ability level could thus be classified differently based on when they were tested. As boundaries shift, more people become eligible for special education services.

4. The Termites were the people in Lewis Terman's study group over seven decades. These were high-scoring children who he followed longitudinally. Most of the Termites went on to attain high levels of education and became doctors, lawyers, and professors, for example.
5. A recent study of precocious youths who aced the math SAT exam at age 13 were at age 38 twice as likely to have patents as were those in the bottom quarter of the top 1 percent. Compared with the math aces, verbal whiz kids were more likely to have become humanities professors or written a novel.

### **After You Read**

#### **Module 62 Review**

1. **b. cross-sectional**
2. **e. Coming up with as many different and novel uses for a brick.**
- 3.

- a. fluid intelligence:

Roger's ability to reason speedily and abstractly has been decreasing slowly and will continue to decrease slowly for another 10 or so years, and then decline rapidly.

- b. crystallized intelligence:

Roger should see no decrease in his accumulated knowledge or his ability to recall vocabulary or perform analogies and might even experience an increase in these abilities.

4. Cross-sectional studies might suggest that Roger's cognitive abilities will be below those of younger people. However, longitudinal studies will demonstrate that Roger should see no significant change and that his intelligence and cognitive abilities will remain relatively stable until extreme old age.
5. Generally, those who are found to be more than 2 standard deviations below the norm on IQ tests (70 or below) are eligible for special education services.

## Module 63 - Studying Genetic and Environmental Influences on Intelligence

### While You Read

#### 63-1

1. Answers will vary, but should provide an explanation that emphasizes the degree of variation of a given trait (intelligence) which is attributable to genes.
2. Heritability is a measure of the proportion of variation among individuals that can be attributed to genes. The range indicates the amount of role the environment plays in explaining those differences. The amount of environmental influence may be different for different individuals.
3. Heritability is not a measure of how much of your individual intelligence is due to your genes—it is a measure of how much the difference between your intelligence and others' intelligence can be attributed to genes.
4. Fraternal twins are genetically no more similar than biological siblings. However, fraternal twins do share identical womb environments and likely very similar childhood environments, so their intelligence scores would be more correlated with each other.
5. During childhood, the intelligence test scores of adoptive siblings correlate modestly. Over time, adopted children accumulate experience in their differing adoptive families; however, genetic influences become more apparent as we accumulate life experience so mental similarities between adopted children and their adoptive families decrease with age and those who were adopted become more similar to their biological parents over time.

#### 63-2

1. Among those economically impoverished, environmental conditions can depress cognitive

development. Researchers trained caregivers to play language-fostering games with 11 infants and by 22 months of age, infants could name more than 50 objects and body parts. Although malnutrition, sensory deprivation, and social isolation can delay normal brain development, there is no environmental recipe for fast forwarding a normal infant into a genius. Programs like Head Start have been successful at assisting low income students in becoming ready for school, however the effects seem to diminish over time. Early interventions such as nutritional supplements, quality preschool programs and interactive reading programs have demonstrated a positive impact on intelligence scores.

2. Genes have the potential to influence the development of intelligence, but the environment can trigger them on or off. Environmental factors such as diet, drugs, and stress can affect the epigenetic molecules that regulate gene expression.
3. Schooling is one intervention that pays intelligence score dividends. Being exposed to new material, given many opportunities to work with that material, being among like-minded peers, and so on, all foster the development of intelligence.
4. If one believes that intelligence cannot be changed they have a fixed-mindset according to Dweck. This mindset will lead them to believe that there is nothing they can do to change their level of intelligence. They may say things like “they are just smart that is why they did well on the exam” without realizing that the level of work that was needed in order to be successful. Having a growth mindset and believing intelligence is changeable and results in a focus on learning and growing. Those with a growth mindset take feedback and criticism to determine how they can improve while those with a fixed mindset take criticism as a sign of failure not as a learning opportunity. Dweck’s findings suggest that those with a growth mindset take advantage of learning opportunities and can make the most of their inherited



genes.

## **After You Read**

### **Module 63 Review**

1. Provide a rational explanation based on your reading.

There is a 0.70 correlation between identical twins' scores when they are reared apart. It is likely Chantelle's score will be near Janelle's, that is to say in the high range, but environment will be a factor as they were reared separately.

2. Unrelated individuals living together have a very low 0.30 correlation between their intelligence scores. There is no real way to tell what Timothy's score will be. Environment certainly impacted both of them, but they share no genetic commonality.
3. Dweck reports that a "growth mindset" results in a focus on learning and growing, and thinks of the brain like a muscle that grows stronger with use as neural connections grow. Effort and practice, coupled with a growth mindset, lead to happy flourishing. If teachers emphasize that feedback on papers and other assignments is not meant as a criticism but rather as an opportunity for the students to grow and learn the students may eventually adopt this idea as well. Exams should be viewed as a learning opportunity rather than an end point.

## Module 64 - Group Differences and the Question of Bias

### While You Read

#### 64-1

1. In the 1932 testing of the Scottish children, boys' and girls' average intelligence test scores were the same. Generally speaking, there are typically more differences among girls and among boys than there are between boys and girls, but researchers and the general public find sex differences more intriguing to discuss. Some studies have shown girls to have stronger spelling scores and higher verbal fluency and boys to have higher spatial abilities and math computation skills. These differences are believed to be the result of both inherited and environmental influences.
2. Some evolutionary arguments still exist to explain some males' higher spatial skills and some females' higher memory skills come from men's ancestors tracking animals and women remembering the location of food sources. Sociological factors also play a significant role in these differing abilities. Societies that are more gender-neutral, such as Sweden, exhibit little of the gender math gap shown in gender-unequal societies, such as the United States which is likely due to girls and boys having the same opportunities and expectations in math courses.

#### 64-2

1. Racial groups differ in their average intelligence scores. Also, high-scoring people (and groups) are more likely to attain high levels of education and income. European-New Zealanders outscore native Maori New Zealanders; White Americans tend to outscore Black Americans, and so on. Group differences however, may be explained by environmental differences such as experiences and exposure to stimuli that may be on traditional IQ tests.

2. The same species of seeds (genes) from the same container (the seeds are not cloned or identical) have been randomly planted in each soil container, but the container on the right has more fertile soil (environment) and thus the flowers are able to grow taller. The differences in height between the two containers is thus not due to genes (the seeds) but to the potentially drastically different environments (the soil condition). We could predict that the heritability of height between the two containers is closer to 0.
3. The difference between the heights of the flowers in the same box is likely due to seed quality (genes) since they all had the same soil condition (environment). We could determine that the heritability is closer to 100 percent (or 1.0) in this situation.
4. Scores of white students from eighth grade through the end of high school exceed scores of black students of the same age. However, in college when exposed to similar environments black students increased four times as much as the white students. These gains can be attributable to environmental rather than genetic factors.

### 64-3

1. A test is considered biased if it detects not only innate differences in intelligence but also performance differences caused by cultural experiences. For instance, Eastern European immigrants to the United States appeared feeble-minded when taking an intelligence test because they were unfamiliar with the language, customs, and culture of the test.  
  
The second meaning of bias—its scientific meaning—hinges on a test's validity—whether it predicts future behavior only for some groups of test-takers. If the SAT<sup>®</sup> predicted the college achievement of women but not men, it would be biased.
2. Answers may vary but can include the example from the test which explains that if a

question expects that a cup goes along with a saucer, those cultures who do not use saucers may be at a disadvantage, but this is no reflection on their level of intelligence.

3. When reminded of their race right before taking a verbal aptitude test, Blacks performed worse than Whites. When taking a math test, women performed worse than men unless led to expect that women usually do as well. Those taking a test must be aware that others hold a stereotype about their performance and decrease their own performance as a result.
4. Answers will vary, but may include test-takers can write brief self-confidence building exercises prior to an exam. If test-takers are not reminded of their membership to a group about which stereotypes exist.

### **After You Read**

#### **Module 64 Review**

1. The average intelligence between the sexes is almost identical. There are some studies that show differences in particular skills, such as verbal fluency, spatial ability, detecting emotion, and sensitivity to touch, taste, and color.
2. Males tend to have an edge in spatial ability tests, which may have aided in tracking prey and returning home. Females tend to have keen memory for location of items, which may have aided them in remembering where the medicinal or nutritious plants were located.  
  
Evidence to refute this statement will vary. Example evidence to refute: Males outperform girls in spatial ability tasks, which would have been handy when deciding how to pack and store gatherable items; also, females tend to have stronger verbal skills, and communication is necessary when hunting in groups. Differences between men and women start to become pronounced in middle school, if these differences were exclusively genetic, the differences

should be seen earlier in life.

3. In the popular sense, tests are biased because of their assumptions—for instance, assuming one knows that a cup and saucer should be paired together. In the scientific sense, tests are not biased because they do have a predictive validity for all groups taking them. So both friends are correct.
4. Heredity—the genes you inherit from your biological parents—may contribute to your intelligence, while your friend’s genetic inheritance may make her intelligence different. Group differences may be much more due to environment—culture, socioeconomic status, stereotypes, and experiences in life.

### ✓ Check Yourself

1. His score of 150 is outside the 99 percent of scores that fall in the normal curve.
2. musical—NSO and recognized violinist  
interpersonal—many friends, well-liked, class president
3. high analytical intelligence—high IQ scores  
high creative intelligence—new ideas for homework, service, and the lunch trays  
low practical intelligence—forgets his lunch, gets lost in school, does not have assignments or materials for class
4. high reliability—test-retest scores similar (150, 149, 150)