CHAPTER 8

Cognition and Language

AP Introduction

The 2019 AP Psychology Course and Exam Description (CED) framework has added some specifics to the unit on Cognitive Psychology. The unit is a heavily weighted unit and should not be overlooked, spending more time on the topic of memory and then allowing some time to review the other areas. Also, the new CED has incorportated the study of intelligence into the unit of cognition. I recommend testing over intelligence separately from memory, thinking and language. In this unit students should begin to see some overlap with previously covered units, it all depends on the sequencing of units. It would be worth your time to see which areas can be incorporated into other units too, some suggestions have been made to help you out.

AP Essential Questions

- What roles do memory and thinking play in our behaviors?

Module 23: Thinking and Reasoning

AP Learning Targets:

- Identify problem-solving strategies as well as factors that influence their effectiveness.
- Identify problem-solving strategies as well as factors that create bias and errors in thinking.

Pacing:
½ Block or 1 Traditional Class period

Module 24: Problem Solving

AP Learning Targets:

- Identify the contributions of key researchers in cognitive psychology.
- Identify problem-solving strategies as well as factors that influence their effectiveness.
- List the characteristics of creative thought and creative thinkers.
- Identify problem-solving strategies as well as factors that create bias and errors in thinking.

Pacing:
½ Block or 1 Traditional Class periods

Module 25: Language

AP Learning Targets:

- Identify the contributions of key researchers in cognitive psychology.
- Synthesize how biological, cognitive, and cultural factors converge to facilitate acquisition development, and use of language.

Pacing:
1 Block or 2 Traditional Class periods

Module 23: Thinking and Reasoning

AP Module Summary

Module 23 has students looking at thinking and reasoning. Nothing has been added to this specific topic therefore your instruction of this content can pretty much stay the same. It is recommended within this module that you spend some time reviewing the concepts of availability and representativeness heuristics both concepts have appeared on the AP exam in past years.

- *Cognitive psychology* is the branch of psychology that focuses on the study of higher mental processes including thinking, language, memory, problem solving, knowing, reasoning, judging, and decision making.
- Psychologists define *thinking* as brain activity in which we purposefully manipulate mental representations of information.

MENTAL IMAGES: EXAMINING THE MIND'S EYE *Mental images* are representations in the mind of an object or event. They are not just visual representations; our ability to "hear" a tune in our heads also relies on a mental image.

Concepts: Categorizing the World

- *Concepts* are mental groupings of similar objects, events, or people. Concepts enable us to organize complex phenomena into cognitive categories that are easier to understand and remember.
- *Prototypes* are typical, highly representative examples of a concept that correspond to our mental image or best example of the concept (see **Figure 2**).

REASONING: MAKING UP YOUR MIND Reasoning is the process by which information is used to draw conclusions and make decisions. It is only relatively recently that cognitive psychologists have begun to investigate how people reason and make decisions.

Formal Reasoning

- *Deductive reasoning* is reasoning from the general to the specific.
- *Inductive reasoning* is reasoning from the specific to the general.

ALGORITHMS AND HEURISTICS When faced with making a decision, we often turn to various kinds of cognitive shortcuts, known as algorithms and heuristics, to help us.

- *Algorithm* is a rule that, if applied appropriately, guarantees a solution to a problem.
- *Heuristic* is a thinking strategy that may lead us to a solution to a problem or decision, but—unlike algorithms—may sometimes lead to errors.
    - **Availability heuristic** involves judging the probability of an event on the basis of how easily the event can be recalled from memory.
    - **Representativeness heuristic** is estimating the likelihood of events in terms of how well they seem to represent, or match, particular prototyes; which can lead us to ignore relevant information.

COMPUTERS AND PROBLEM SOLVING: SEARCHING FOR ARTIFICIAL INTELLIGENCE Computers are making significant inroads in terms of the ability to solve problems and carry out some forms of intellectual activities. According to experts who study artificial intelligence, the field that examines how to use technology to imitate the outcome of human thinking, problem solving, and creative activities, computers can show rudiments of humanlike thinking because of their knowledge of where to look—and where not to look—for an answer to a problem. They suggest that the capacity of computer programs (such as those that play chess) to evaluate

potential moves and to ignore unimportant possibilities gives them thinking ability. Computers using artificial intelligence, such as Apple's Siri or Amazon's Alexa, are designed for tasks that require speed, persistence, and a huge memory. Artificial intelligence is also used to design algorithims to inform decision making about loan lending and other financial matters.

APPLYING PSYCHOLOGY IN THE 21ST CENTURY: ARE OUR ATTENTION SPANS BECOMING SHORTER? Attention span has decreased from 12 seconds in 2000 to approximately 8 seconds in 2015. Attention is worse for those who consume more media, particularly those who frequently use tablets or smartphones (McSpadden, 2015). This may suggest that brains are evolving to pay attention to the most useful information and to task-switch more easily across multiple stimuli.

AP Key Terms

algorithm
availability heuristic
cognitive psychology
concepts
deductive reasoning
heuristic
inductive reasoning
mental images
prototypes
representativeness heuristic
thinking

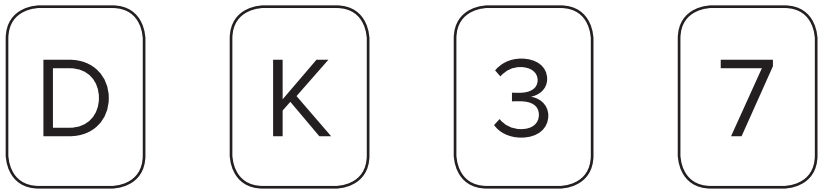
Class Discussion Ideas

CONCEPTS AND PROTOTYPES Compare answers among students from *Handout 1: Concepts and Prototypes.* Use this in the lecture to point out which concepts have clear prototypes and which do not.

THE WASON SELECTION TASK Although not discussed in the text, this classic logic problem is a fascinating one that has been analyzed in a number of psychological studies on reasoning.

The gist of the task is as follows:

Four cards are presented as follows:



The cards are labeled "D" or "K" on one side and "3" or "7" on the other.

A rule says that "if a card is D on one side then it is 3 on the other side."

Which cards need to be turned over to know whether this sample of cards is consistent with the rule?

The answer is "D" and "7."

If there is a 3 on the other side of D, this proves the rule of those two cards. If there is a D on the other side of 7, this violates the rule.

Researchers have found that people have a great deal more difficulty handling this rule when presented in the abstract than when presented in concrete terms: http://www.cep.ucsb.edu/socex/wason.htm.

For instance, if these are tickets purchased at a party where underage drinkers are not allowed to drink alcohol, the four cards showing would be:

D = Beer

K = Soda

3 = Age 21

7 = Under 21

Therefore, all "Beer" tickets should have "Age 21" on the back and no "Under 21" tickets should have "Beer" on the back. This problem is easier to solve than the D-K-3-7 problem.

What's My Heuristic?

Benefits of Heuristics: You may want to spend some time going over the representativeness heuristic and availability heuristics. Remind students that all heuristics are fallible, but they allow us to make snap judgments quickly, and what we sacrifice for accuracy is the ability to make quick general appraisals. Point out the adaptive value of these devices. Both have strong survival implications.

Statistical Heuristics: Identify and describe a situation in which you have fallen prey to the availability heuristic. What factors affected your reasoning in this case?

Activities

HEURISTICS IN COGNITIVE MAPS Illustrate the operation of heuristics in cognitive maps, which are mental representations of geographic spaces:

- Two days before this lecture, ask students to draw a map of their house. Specify which rooms or areas to include. On the day before the cognition lecture, collect the maps.

CONCEPTS AND PROTOTYPES Have students complete *Handout: Concepts and Prototypes.*

LOGICAL REASONING: WORD PUZZLES Here are some good word puzzles that will test the logical powers of your students.

A murderer is condemned to death. He has to choose between three rooms. The first is full of raging fires, the second is full of assassins with loaded guns, and the third is full of lions that have not eaten in three years. Which room is safest for him?

ANSWER: The third. Lions that have not eaten in 3 years are dead.

Two different plastic jugs are filled with water. How could you put all of this water into a barrel, without using the jugs or any dividers, and still tell which water came from which jug?

ANSWER: Freeze them first. Take the ice out of the jugs and put it in the barrel. You will be able to tell which water came from which jug.

What is black when you buy it, red when you use it, and gray when you throw it away?

ANSWER: Charcoal.

Can you name three consecutive days without using the words *Monday, Tuesday, Wednesday, Thursday, Friday, Saturday,* or *Sunday*?

ANSWER: Yesterday, today, and tomorrow.

ALGORITHMS VERSUS HEURISTICS Define the difference between algorithms and heuristics. Algorithms are slow but always generate the correct solution; heuristics are quicker but may lead to the wrong answer.

Examples:

1. Baking cookies.

Heuristic: Allison decides to bake chocolate chip cookies to take to her boyfriend's house for dinner. She calls her mother to find out the "family" recipe. Allison's mother tells her to take

about a cup of butter, a bit of baking soda, two eggs, about a cup of brown sugar, and about the same amount of flour. Finally, add some chocolate chips.

Algorithm: Allison is nervous about making the cookies without having more exact amounts. She looks up a recipe in a cookbook and decides to use that one, which specifies how much to use of sugar, flour, butter, baking soda, and chocolate chips. The recipe also says exactly what order in which to add the ingredients.

Lecture demonstration:

What word can you form from this anagram?

ERET

The answer is *TREE*. Ask students if they tried all possible combinations before they reached the answer. This would be using an algorithm. It is possible to do this with a four-letter word.

Now show this:

LSSTNEUIAMYOUL

The answer is *SIMULTANEOUSLY*. Find out how many students tried all possible combinations. Chances are they did not, as this would be a much slower solution. Therefore, they had to use a heuristic.

Statistical Heuristics

Give students these problems in class:

Availability heuristic: People judge events that they can remember easily as more common than events that they cannot remember.

1. Which is more common—deaths from homicides or deaths from suicides?

ANSWER: Deaths from suicides. Newspapers place much more emphasis on deaths from homicides and therefore people can remember these deaths more readily and hence judge them as more frequent.

Another similar example is deaths from drowning versus deaths from fires. Drowning deaths are more frequent, but they do not get as much media attention.

2. Which is more common in the English language: Words that begin with the letter “r” or words that have the letter “r” as the third letter?

ANSWER: Words that have the letter “r” as the third letter. People can remember words that begin with a letter more readily than they can remember words that have an embedded letter.

Vividness and distinctiveness also play a role. You are more likely to believe a friend who tells you a dramatic story about the problems he had with his Camry than all the positive ratings you read in consumer reports. Similarly, people are more likely to buy flood insurance after reading about floods than at any other time, even though the probability of a flood is no different than it was before the flood.

Representativeness heuristic: People tend to ignore base rates, and fail to seek out base rates when base rate information is needed to make reliable probabilistic judgments.

For example, people believe that coincidences are unlikely. Out of 30 people, there is a 70 percent probability that two will share the same birthday, but people think it is a coincidence when that occurs.

People will also believe that a sequence of the same six numbers is less likely to win in a lottery than a sequence of six different numbers even though they are equally likely.

1. When flipping coins, which is the most likely sequence?

   HHHTTT

   HHHHHH

   TTTTTT

   HTHTHT

   HHTTHH

ANSWER: They are all equally probable; each coin toss is a separate event and each has a 50–50 chance of occurring.

2. Imagine you just met a man named Steve. Steve is very shy and withdrawn, invariably helpful, but with little interest in people or in the world of reality. A meek and tidy soul, he has a need for order and structure, and a passion for detail. Is Steve more likely to be a librarian or a salesperson?

ANSWER: A salesperson. Statistically, there are far more salespeople than librarians in the workforce. Therefore, although Steve may seem to have the attributes of a librarian, the odds are far more likely that he is a salesperson.

Representative heuristic: You may want to ask students if this could be a serious error. Point out that racial profiling is an example of the representativeness heuristic and thus could have very serious errors associated with it.

Polling Questions

I'M NOT BLIND! I SEE EXACTLY WHAT I WANT TO SEE! Let's talk about the bias blind spot, a concept that suggests even the smartest, deepest thinkers—the ones who are open minded and considerate of others—harbor a level of bias against others and even themselves. What do you think? Who thinks we are hard-wired (biologically) to create groups and show favoritism toward a certain set of individuals? Let's take a Social Attitudes test by Project Implicit: https://implicit.harvard.edu/implicit/. How many of you were surprised at your results?

Suggested Media

- *Heuristics Demonstrations:* http://cat.xula.edu/thinker/decisions/heuristics/.
- *Thinker:* http://cat.xula.edu/thinker/decisions/heuristics/ranking. This site discusses decision making and errors:

Additional Readings

Ariely, D. (2010). Predictably irrational, revised and expanded edition: The hidden forces that shape our decisions. Houghton-Mifflin.

AP Student Edition Answer Key

Applying Psychology in the 21st Century: Are Our Attention Spans Becoming Shorter?

Answer Suggestions

- There is a negative correlation between increased social media use and lowered attention span. Negative correlations tell us that as one variable increases, the value of the other decreases.
- Boredom can lead to increased creativity.

AP Test Practice

Section I: Multiple Choice

1. **A** *(Skill 1.B, Learning Target 5.I)*
2. **C** *(Skill 1.A, Learning Target 5.I)*
3. **A** *(Skill 1.B, Learning Target 5.I)*

Section II: Free Response

Concepts are mental groupings of similar objects, events, or people that enable us to organize complex phenomena into cognitive categories that are easier to understand. Brian has a concept, or mental grouping, for a car. This will help him organize the different vehicle options so he can select a new car.

Prototypes are typical, highly representative examples of a concept. Brian may rely on a prototype (model) for each car brand (make) to help create a list of pros and cons when selecting a new car.

Inductive reasoning is reasoning from the specific to the general. Brian may use inductive reasoning and look at several models of cars (Fiesta, Mustang, or Taurus) and then form a conclusion about the broader brand (Ford). Or he might have had a problem while test driving a convertible (specific), so he concludes that all convertibles are problematic (general) and he should not purchase one.

Deductive reasoning is reasoning from the general to the specific. Brian may use deductive reasoning and start with a general theory, such as convertibles have problems. Then, he will derive a more specific hypothesis that he should not buy a Ford Mustang convertible because it will have problems.

An availability heuristic involves judging the likelihood of an event occurring on the basis of how easy it is to think of examples. Brian uses the availability heuristic and uses car commercials that readily come to mind when deciding what car to buy.

Module 24: Problem Solving

AP Module Summary

In module 24 the topic of cognition focuses on problem solving. Nothing new has been added to this specific area and just like with module 23 your instruction of this content can pretty much stay the same. It is recommended that time be spent on the concepts of convergent and divergent thinking. Both have appeared on the AP exam in the past. If you didn't introduce Wolfgang Kohler in the unit on Learning, this would be another opportunity for you to do so!

PRODUCTION: GENERATING SOLUTIONS In place of trial and error, complex problem solving often involves the use of heuristics, cognitive shortcuts that can generate solutions. Probably the most frequently applied heuristic in problem solving is a *means-ends analysis*, which involves repeated tests for differences between the desired outcome and what currently exists. Although this approach is often effective, if the problem requires indirect steps that temporarily increase the discrepancy between a current state and the solution, means-ends analysis can be counterproductive. For other problems, the best approach is to work backward by focusing on the goal, rather than the starting point, of the problem.

INSIGHT: SUDDEN AWARENESS Some approaches to generating possible solutions focus less on step-by-step heuristics than on the sudden bursts of comprehension that one may experience during efforts to solve a problem. In a classic study, the German psychologist Wolfgang Köhler examined learning and problem-solving processes in chimpanzees (see **Figure 7**). Köhler noticed the chimps exhibiting new behavior and called the cognitive process underlying the behavior *insight*, which refers to a sudden awareness of the relationships among various elements that had previously appeared to be independent of one another.

IMPEDIMENTS TO SOLUTIONS: WHY IS PROBLEM SOLVING SUCH A PROBLEM? Significant obstacles to problem solving can exist at each of the three major stages. Although cognitive approaches to problem solving suggest that thinking proceeds along fairly rational, logical lines as a person confronts a problem and considers various solutions, several factors can hinder the development of creative, appropriate, and accurate solutions.

FUNCTIONAL FIXEDNESS AND MENTAL SET The difficulty most people experience with the candle problem (see **Figure 8**) is caused by *functional fixedness*, the tendency to think of an object only in terms of its typical use. Functional fixedness is an example of a broader phenomenon known as *mental set*, the tendency for old patterns of problem solving to persist. A mental set is a framework for thinking about a problem based on our prior experience with similar problems. Mental set can affect perceptions as well as patterns of problem solving. It can prevent you from seeing beyond the apparent constraints of a problem (see **Figure 10**).

INACCURATE EVALUATION OF SOLUTIONS *Confirmation bias* is the tendency to prefer one's first hypothesis and ignore contradictory evidence that supports alternative hypotheses or solutions. Confirmation bias occurs for several reasons.

- Because rethinking a problem that appears to be solved already takes extra cognitive effort, we are apt to stick with our first solution.
- We give greater weight to subsequent information that supports our initial position than to information that is not supportive of it.

CREATIVITY AND PROBLEM SOLVING Despite obstacles to problem solving, many people adeptly discover creative solutions to problems.

Creativity is the ability to generate original ideas or solve problems in novel ways. Several characteristics are associated with creativity.

Divergent thinking, thinking that generates unusual, yet appropriate, responses to problems or questions.

Convergent thinking, which is thinking in which a problem is viewed as having a single answer and which produces responses that are based primarily on knowledge and logic.

BECOMING AN INFORMED CONSUMER OF PSYCHOLOGY: THINKING CRITICALLY AND CREATIVELY Research suggests that critical and creative thinkers are made, not born. Consider, for instance, the following suggestions for increasing critical thinking and creativity: Redefine problems, use subgoals, adopt a critical perspective, consider the opposite, use analogies, think divergently, think convergently, use heuristics, experiment with various solutions, and walk away.

AP Key Terms

confirmation bias
convergent thinking
creativity
divergent thinking
functional fixedness
insight
means-ends analysis

AP Key People

Wolfgang Kohler

Class Discussion Ideas

Approches to Solving Problems

Four ways to obtain solutions:

1. Trial and error—most primitive and time-consuming. For example, if you do not know how to use a remote control, you push every button until what you want happens.
2. Means-ends analysis—most frequently used. Involves heuristics. Example: Planning route to center of town around beltway.
3. Subgoals—divide problem into steps if possible—making a meal involves going through a set of subroutines so that everything is finished on time.
4. Insight—burst of comprehension ("aha" experience). For some reason, the word *aha* always draws a laugh.

Types of Problems

Anagrams (Arrangement problem):

Here are some humorous anagrams. For an "anagram maker" website, go to http://www.wordsmith.org/anagram/.

listen = silent

dormitory = dirty room

schoolmaster = the classroom

Elvis = lives

slot machines = cash lost in 'em

conversation = voices rant on

The Hilton = Hint: hotel

snooze alarms = alas, no more Z's

Presbyterian = Best in prayer

eleven plus two = twelve plus one

debit card = bad credit

psychology = cop go shyly (not very funny, but relevant)

Transformation Problem

Go to this Tower of Hanoi website: http://www.cut-the-knot.org/recurrence/hanoi.shtml.

Alternatively, you can purchase an inexpensive Tower of Hanoi and have a student volunteer try to solve it as a class demonstration.

This is a great time to discuss Gazzaniga's work on split brain and the problems folks have solving problems. You may want to show a clip of Gazzaniga with his patient talking about split brain: http://www.youtube.com/watch?v=ZMLzP1VCANo. Here is a clip of Gazzaniga discussing his early research: http://www.youtube.com/watch?v=0lmfxQ-HK7Y.

Inducing Structure Problem

Give students this puzzle:

This is an unusual paragraph. I am curious how quickly you can find out what is so unusual about it. It looks so plain you would think nothing was wrong with it! In fact, nothing is wrong with it. Study it, and think about it, but you still may not find anything odd. But if you work at it a bit, you might find out. Try to do so without any coaching.

Write your answer here: _____

Answer: The letter "e," which is the most common letter in the English language, does not appear even once in the paragraph.

Functional Fixedness

For an excellent example of functional fixedness or mental set, present these examples:

A construction detour leads you to take the long way around to get to your psychology class. After the construction is finished and the detour removed, you continue to go the long way around.

Overcoming functional fixedness can save your life: Jan Demczur, a window cleaner who was stuck on an elevator in the World Trade Center attack, was able to rescue himself and a group of people with him on the elevator by using his "squeegee" to open a hole in the wall.

A failure in logic also was involved in the World Trade Center construction. Although explicitly designed to withstand an airplane's impact, the engineers had not taken into account the effect of a full load of jet fuel.

INSIGHT: MATCHSTICK ARITHMETIC For another example of functional fixedness and insight, go to http://creativethinking.net/the-matchstick-problem/.

CREATIVITY DEMONSTRATION: DIVERGENT THINKING Guilford developed tests of creativity as part of his structure of intellect model. In the "Alternative Uses Task," the respondent answers questions such as "Name all the uses for a brick." Scoring is based on four dimensions: originality, fluency, flexibility, and elaboration. Ask students to provide answers to this question. Have them share their answers either by switching papers or contributing their answers while you write them down. Then have other students rate the uses along the four dimensions.

See this website: http://www.indiana.edu/~bobweb/Handout/d1.uses.htm.

CONVERGENT THINKING Traditional problems that have one correct solution provide examples of convergent thinking. An entertaining example of such a problem is: "I have two coins in my pocket that add up to $.30 in value. One of the coins is not a nickel. What is the other coin?" The answer is—a nickel! One of the coins is not a nickel, but the other one is.

Impediments to Problem-Solving

Mental set:

A very silly example of this was suggested by Tammy Rahhal. Have the class repeat after you:

Coast

Coast

Coast

Then say: What do you put in a toaster?

The class will all shout out "Toast!"

Of course, that is ridiculous because you would put bread in a toaster, not toast.

Activities

Examples of Problem-Solving Terms

PROBLEM SOLVING: Tell the class that sometimes a problem-solving exercise just comes together in an "aha" moment often called insight. Write the words *you just me* on the board or another type of visual presenter. Ask students what this means. Typically, they look blankly at you. Provide a hint: "What is the relative position of *just*?" If you think of this problem in terms of the relative position, then the phrase "just between you and me" becomes obvious. Write the following on the board:

stood

well

view

What is communicated in these three words? If needed, give your students a hint. Tell them that stood is above well and both words are above view. With this reorganization most students will suddenly come up with "well understood overview." Source: Wertheimer, M. (1999). Reorganization and productive thinking. In L. T. Benjamin et al. (Eds.), *Activities handbook for the teaching of psychology* (Vol. 4). Washington, DC: American Psychological Association.

DIVERGENT AND CONVERGENT THINKING: Have students take 10 minutes to jot down all the uses for a cardboard box, including every possibility that they can think of, even if it seems unreasonable. Explain that this list is divergent thinking. Next, have students look the list over and determine which of the possible uses are most usual or most likely to be worthwhile. Explain that this is convergent thinking.

DECISION MAKING: Discuss decision making, especially the areas of decision making without awareness, confirmation bias, and hindsight bias. Have the students come up with an example from their own lives where these three concepts have played a part. Have them write down and explain the example. Next, break the class into groups and have them discuss their examples with the other students in the group. The students will get a better understanding of decision making when they come up with their own examples, and they will gain knowledge from the other students in their group by hearing their examples.

Creativity

Have students read the article "Biological Basis for Creativity Linked to Mental Illness" in *Science Daily* (http://www.sciencedaily.com/releases/2003/10/031001061055.htm) and then find a scholarly article on this topic and write a brief review of the research.

CREATIVITY AND PLAY: Watch the video of Tim Brown's TED Talk on "Tales of Creativity and Play" (http://www.ted.com/talks/tim_brown_on_creativity_and_play?language=en) and consider using one of the examples discussed in the video in class or assign students to pick one activity and report their experience to the class on the following meeting.

CREATIVITY: Make copies of the Remote Associates Test or have students go to the website at http://www.cengage.com/collegesuccess/book_content/1413031927_santrock/ch05/ch05exe6.html and take the test. You could have students take the test individually or in groups and then discuss their findings.

METACOGNITION Ask students to engage in a metacognitive exercise. Ask them to think about their study habits from the last test. Did they work? What could they do differently to improve performance? This will not only demonstrate what metacognition is but also prove useful in their studying for the next exam.

Discussion Questions

APPLYING PSYCHOLOGY IN THE 21ST CENTURY: DOES PLAYING VIDEO GAMES IMPROVE YOUR THINKING? Have students review the related box in their text and answer the following questions:

- Why might dividing the sample into nonplayers and frequent players exaggerate the effects of playing video games?
- When different studies reach very different conclusions like this, how can the question be resolved?

Polling Questions

CALLING ALL GENIUSES—YOUR PSYCHOTHERAPIST IS READY TO SEE YOU NOW "Genius and insanity may actually go together, according to scientists who found that mental illnesses such as schizophrenia and bipolar disorder are often found in highly creative and intelligent people." Let's critically evaluate this statement. There is research that indicates a link between creativity and mental health; however, there is also research that suggests the opposite. So, what do you think? Given the numerous examples of creative geniuses and their reported mental health status, who thinks that those who are super intelligent are more likely to possess a psychological disorder? List four psychological disorders, and have students vote on the disorder most likely to be associated with creative genius. Collectively discuss why the disorder with the highest votes is perceived to be related to being a genius.

Do you consider yourself to be a creative person?

Do you believe that it is possible to test for creativity?

Suggested Media

- *Curiosity.com:* https://curiosity.com/. Register for free on this website to access current videos and topics related to life-long learning, creativity and problem-solving.
- *Decision Making,* Khan Academy: https://www.khanacademy.org/science/health-and-medicine/executive-systems-of-the-brain/cognition-2014-03-27T18:40:04.738Z/v/decision-making.
- *Mindtools:* http://www.mindtools.com/pages/main/newMN_TMC.htm.

This site provides a test of problem-solving abilities and gives some problem-solving techniques.

POPULAR MOVIES OR TELEVISION SHOWS: PROBLEM SOLVING Show a scene from a movie such as *Cast Away,* in which Tom Hanks demonstrates the ability to avoid functional fixedness in escaping from the island where his airplane crashed. Alternatively, show a scene from the television show *Survivor* in which the contestants find novel ways to use familiar objects. The ABC show *Lost* also involves similar situations, especially in Season 1, when the survivors were challenged to make use of their crashed airplane to fashion living quarters for themselves.

Additional Readings

Kotovsky, K., Hayes, J. R., & Simon, H. A. (1985). Why are some problems hard? Evidence from the tower of Hanoi. *Cognitive Psychology, 17,* 248–294.

AP Student Edition Answer Key

AP Test Practice

Section I: Multiple Choice

1. **A** *(Skill 1.C, Learning Target 5.C)*
2. **C** *(Skill 1.A, Learning Target 5.J)*
3. **E** *(Skill 1.B, Learning Target 5.K)*

Section II: Free Response

A.

Confirmation bias is the tendency to seek out information that supports one's initial hypothesis and ignore contradictory evidence. Mrs. Karlin uses confirmation bias when she finds articles to support her belief that misbehaving students should sit in the front of the classroom.

Convergent thinking is thinking in which a problem is viewed as having a single answer. Mrs. Karlin has convergent thinking because she can only think of putting misbehaving students in the front of class. She cannot generate multiple and unusual solutions.

Insight is the sudden awareness of a solution to a problem. Mrs. Karlin could suddenly find a solution for her third hour class, such as spreading the talkative students around the room.

B.

Positive reinforcement is when a pleasant stimulus is added to the environment that brings about an increase in a preceding response. When the misbehaving students talk, Mrs. Karlin provides attention (pleasant stimulus) that increases their misbehavior of talking out of turn.

Observational learning is learning by watching the behavior of others. Students are learning to misbehave and talk out of turn by watching others do this behavior in the classroom.

Module 25: Language

AP Module Summary

The study of language can be a dull one to cover. But, if you incorporate some of the activities along with the class discussion ideas, I'm sure you could make it an enjoyable learning experience! This module can be split up into two parts if time and student engagement is running short. For example, the development of human language can be added to the unit on human development. Leaving the remaining material to be presented with the unit on cognition. Or, you can keep it as is expecting students to know that cognition is memory, thinking, problem-solving, and language.

The use of *language*—the communication of information through symbols arranged according to systematic rules—is a central cognitive ability, one that is indispensable for us to communicate with one another. Not only is language central to communication, but it is also closely tied to the very way in which we think about and understand the world.

GRAMMAR: LANGUAGE'S LANGUAGE *Grammar*, the system of rules that determine how our thoughts can be expressed. Grammar deals with three major components of language:

- *Phonology* is the study of *phonemes*, the smallest basic units of speech that affect meaning, and of the way we use those sounds to form words and produce meaning.
  - Example: "a" sound in *fat* and the "a" sound in *fate* represent two different phonemes in English.
- *Syntax* refers to the rules that indicate how words and phrases can be combined to form sentences. Every language has intricate rules that guide the order in which words may be strung together to communicate meaning.
- *Semantics*, the meanings of words and sentences. Semantic rules allow us to use words to convey the subtle nuances in meaning.

Language Development: Developing a Way with Words

Babbling (3 mos.-1.5)—make speechlike but meaningless sounds

PRODUCTION OF LANGUAGE: By the time children are approximately 1 year old, they stop producing sounds that are not in the language to which they have been exposed. It is then a short step to the production of actual words. In English, these are typically short words that start with a consonant sound such as b, d, m, p, and t. Of course, even before they produce their first words, children can understand a fair amount of the language they hear. Language comprehension precedes language production.

After the age of 1 year, children begin to learn more complicated forms of language. By age 2, the average child has a vocabulary of more than 50 words. They produce two-word combinations, the building blocks of sentences, and sharply increase the number of different words they are able to use. Just 6 months later, that vocabulary has grown to several hundred words. At that time, children can produce short sentences, although they use *telegraphic speech*—sentences that sound as if they were part of a telegram, in which only essential words are used. Rather than saying, "I showed you the book," a child using telegraphic speech may say, "I show book."

By age 3, children learn to make plurals by adding *s* to nouns and to form the past tense by adding *-ed* to verbs. This skill also leads to errors, since children tend to apply rules inflexibly. *Overgeneralization* is the phenomenon by which children apply language rules even when the application results in an error.

Understanding Language Acquisition: Identifying the Roots of Language

Learning Theory Approaches: Language as a Learned Skill

LEARNING-THEORY APPROACH suggests that language acquisition follows the principles of reinforcement and conditioning discovered by psychologists who study learning. This view suggests that children first learn to speak by being rewarded for making sounds that approximate speech. Ultimately, through a process of shaping, language becomes more and more like adult speech

*At this point if you have covered the unit on learning you can ask for the name of the psychologist who is known for the principles of reinforcement.

Nativist Approaches: Language as an Innate Skill

The linguist Noam Chomsky argued that humans are born with an innate linguistic capability that emerges primarily as a function of maturation. According to his *nativist approach* to language, all the world's languages share a common underlying structure that is prewired, biologically determined, and universal. Chomsky suggested that the human brain has an inherited neural system that lets us understand the structure language provides—a kind of universal grammar.

Interactionist approach suggests that language development is both biological and social, produced through a combination of genetically determined predispositions *and* circumstances in one's social environment growing up that help teach language.

EXPLORING DIVERSITY: TEACHING WITH LINGUISTIC VARIETY: BILINGUAL EDUCATION How to appropriately and effectively teach the increasing number of children who do not speak English is not always clear. Many educators maintain that *bilingual education* is best. With a bilingual approach, students learn some subjects in their native language while simultaneously learning English. In contrast, other educators insist that all instruction ought to be in English from the moment students, including those who speak no English at all, enroll in school. In *immersion* programs, students are immediately plunged into English instruction in all subjects.

Although the controversial issue of bilingual education versus immersion has strong political undercurrents, evidence shows that the ability to speak two languages provides significant cognitive benefits over speaking only one language. Individuals who are bilingual have more linguistic tools for thinking because of their multiple-language abilities. In addition, the advantages of bilingualism start early: by the time bilingual children are 3 or 4 years old, their cognitive development is superior to that of children who speak only one language. Furthermore, speaking several languages changes the organization of the brain. See the "Neuroscience in Your Life: Being Bilingual Affects Processing in the Brain" box in the text.

Related to questions about bilingual education is the matter of biculturalism—that is, being a member of two cultures and its psychological impact. Some psychologists argue that society should promote an alternation model of bicultural competence. Such a model supports members of a culture in their efforts to maintain their original cultural identity as well as in their integration into the adopted culture. In this view, a person can belong to two cultures and have two cultural identities without having to choose between them.

AP Key Terms

babble
grammar
interactionist approach (to language development)
language
learning-theory approach (to language development)
linguistic-relativity hypothesis
nativist approach (to language development)
overgeneralization
phonemes
phonology
semantics
syntax
telegraphic speech

AP Key People

Noam Chomsky

Class Discussion Ideas

Although language can be a very dry topic (unless you are a specialist in this area), there are many ways to spice up this lecture by poking fun at our use of language through understanding ambiguities, puns, Freudian slips, and the nonverbal aspects of communication, as in dialects. Here are some ideas to incorporate into the lecture and, taken together, can easily occupy an entire class period.

ANIMAL LANGUAGE This is a great time to ask students what they think about animal language. You may want to show a clip of the bee waggle dance: http://www.youtube.com/watch?v=-7ijI-g4jHg. Ask students what they feel are potential barriers to studying animal cognition and language. Ask if they think their dog is thinking. Communicating with other dogs? Engaging in reflective thinking? Problem solving and reasoning? Do they think that we are currently underestimating other species' abilities in thinking and overestimating our own? Another great clip on this is Susan Savage-Rumbaugh talking about her work with bonobos and language: http://www.ted.com/index.php/talks/susan_savage_rumbaugh_on_apes_that_write.html.

LANGUAGE AND THINKING This is a good time to also point out that language and memory go hand in hand. You may also want to tie in for students the relationship between thought and language being the representation of things symbolically. Point out that Piaget and Vygotsky both argued that language is required for higher-order thinking. Ask students if they think metacognition, for example, would be possible without language.

EVOLUTIONARY APPROACHES Ask students which approach to language acquisition they think best explains universal grammar. They should answer "nativist." Discuss evolutionary pressures that could pressure language to be selected for.

VISUAL REPRESENTATION Hormones affect our way of thinking. Moderately high levels of testosterone, in both men and women, are associated with the ability to perform spatial and mental rotation tasks such as finding one's way around a new building or playing a three-dimensional video game. You may want to discuss the role of evolution in selecting a male bias in spatial thinking. Evolutionary psychology would suggest that the male advantage in spatial thinking comes from hunter-gatherer days when males would need to travel great distances and to hunt, skills that would require good mental rotation and spatial orientation.

FERAL CHILDREN Discuss the case of Genie. Show part or all of the BBC's series on Genie. You may also want to mention the case of Itard's Victor, the first documented feral child. These cases support the critical period and illustrate the link between thought and language.

GENIE Assign students to watch *The Mockingbird Don't Sing,* a 2001 movie based on the case of Genie. Have them write a paragraph on the interaction of species-typical genes in a species-atypical environment. Make sure they grasp that species-typical genes require a species-typical environment to develop in a species-typical manner.

LEARNING A SECOND LANGUAGE Ask if there are any bilingual students in the room. Ask them if they think more in one language than another. You may also want to point out that early plasticity in the brain may also account for these differences.

HUMOROUS INSTRUCTIONS These state the obvious, so that although they are grammatically correct, they are semantically empty. Students will readily come up with other examples of their own:

In Microsoft Word: To undo the last action, click the Undo button.
On a Sears hair dryer: Do not use while sleeping.
On a bag of Fritos: You could be a winner! No purchase necessary. Details inside.
On a bar of Dial soap: Directions: Use like regular soap.
On some Swanson frozen dinners: Serving suggestion: Defrost.
On a hotel-provided shower cap in a box: Fits one head.
On Tesco's Tiramisu dessert: Do not turn upside down. (Printed on the bottom of the box.)
On Marks & Spencer's Bread Pudding: Product will be hot after heating.
On packaging for a Rowenta Iron: Do not iron clothes on body.
On Boots Children's Cough Medicine: Do not drive car or operate machinery.
On Nytol (a sleep aid): Warning: may cause drowsiness.
On a Korean-made kitchen knife: Warning: keep out of children.
On a string of Chinese-made Christmas lights: For indoor or outdoor use only.
On a Japanese food processor: Not to be used for the other use.
On Sainsbury's peanuts: Warning: contains nuts.
On an American Airlines packet of nuts: Instructions: open packet, eat nuts.
On a Swedish chainsaw: Do not attempt to stop chain with your hands.
On many promotional offers: Void where prohibited.
On a Knorr soup mix packet: To prepare with low-fat milk: Prepare as directed above using low-fat milk.

STUPID SPORTS QUOTES The following quotes are also semantically empty. They say nothing that is not patently obvious. Here is one of my favorites from a coach at my university on his thoughts about the weekend's game with Rhode Island:

> "We just have to keep playing the way we have. It's nice to be home. We know it will be another tough game. Rhode Island is a rival and a conference opponent. They've struggled a little and a win might turn their year around."

Others can be heard on sports commentaries:

- They didn't have their game face on.
- They didn't come out to play.
- We wanted it more.
- You've got to play with emotion.
- The game was closer than the score indicated.

Specific sports quotes are variants on these:

- "Any time Detroit scores more than 100 points and holds the other team below 100 points, they almost always win." (Doug Collins, sports commentator)
- "Ninety percent of this game is half mental." (Yogi Berra)
- "I ain't in no slump, I just ain't hittin'." (Yogi Berra)
- "I want to rush for 1,000 or 1,500 yards, whichever comes first." (New Orleans Saints running back George Rogers when asked about the upcoming season)
- "Nobody in football should be called a genius. A genius is a guy like Norman Einstein." (Football commentator and former player Joe Theismann)
- "I can't really remember the names of the clubs that we went to." (Shaquille O'Neal on whether he had gone to the Parthenon during his visit to Greece)
- "We can't win at home. We can't win on the road. As general manager, I just can't figure out where else to play." (Pat Williams, Orlando Magic general manager, on his team's 7–27 record in 1992)

GOOD POLITICAL QUOTES Politicians are also able to devise their own special brand of language:

"All the partisanship is on their side." (Senator Trent Lott)
"When I was coming up, it was a dangerous world and we knew exactly who the they were. It was us versus them, and it was clear who them was. Today, we're not so sure who the they are, but we know they're there." (President George W. Bush)
Their most important job "is not to be Governor or First Lady, in my case." (Presidential candidate George W. Bush)
"I've never professed to be anything but an average student." (Senator Dan Quayle)

AMBIGUOUS OR OTHERWISE RIDICULOUS NEWSPAPER HEADLINES There are many, many of these floating around on the Web. Here is a sampling:

Juvenile court to try shooting defendant
Red tape holds up new bridge
Deer kill 17,000
Chef throws his heart into helping feed needy
Arson suspect is held in massachusetts fire
Lansing residents can drop off trees
Prostitutes appeal to pope
Air head fired
Police begin campaign to run down jaywalkers
Safety experts say school bus passengers should be belted
Farmer bill dies in house
Iraqi head seeks arms
Shipping workers nabbed with Oscars
Sox fan accused of verbally abusing horse with anti-Yankee slur.
Tighter seat belt rule rejected
Eye drops off shelf
Teacher strikes idle kids
Squad helps dog bite victim
Enraged cow injures farmers with ax
Killer sentenced to die for second time in 10 years
Miners refuse to work after death
Kids make nutritious snacks
Local high school dropouts cut in half
Steals clock, faces time
Typhoon rips through cemetery: Hundreds dead
Two sisters reunited after 18 years in the checkout counter
Hospitals are sued by 7 foot doctors
Some pieces of Rock Hudson sold at auction
Include your children while baking cookies
Something went wrong in jet crash, expert says
Plane too close to ground, crash probe told
War dims hope for peace
If strike isn't settled quickly, it may last a while
Enfield couple slain: Police suspect homicide
Panda mating fails, veterinarian takes over
Soviet virgin lands short of goal again
Postal service to mail warning
Police arrest seven armed men

Ridiculous Signs

DRIVE WITH CAUTION (as opposed to with reckless abandon?)
DRIVE SAFELY (same as above)
DUE TO RECENT PLUMBING CONCERNS, ONLY TOILET PAPER MAY BE FLUSHED DOWN TOILETS (in a bathroom)
SIGNS POSTED ON THIS GLASS WILL BE REMOVED IMMEDIATELY (sign on a window in a building, ironically next to a sign that says "Think")
VOID WHERE PROHIBITED

FREUDIAN SLIPS Mistakes in speaking are very common, estimated at one error for every 10 to 20 utterances. Although Freud believed that our unconscious desires are reflected in slips of the tongue, linguistics experts attribute these mistakes to such mundane processes as phonemic substitution. For example, sounds may be rearranged between two or more separate words, such as "snow flurries" becomes "flow snurries." Words may be rearranged, as in "passing the rusher" instead of "rushing the passer."

Some examples:

- "Yosef Burg, leader of the National Religious Party (in Israel), a Bedouin (instead of veteran) in Israeli politics" (*The New York Times,* Sept. 13, 1984).
- Misquote in a book review: "Your goal should be to help your daughter become a sexually active, healthy adult" (instead of—I assume—"sexually healthy adult") (*The New York Times,* March 19, 2001).
- At other times, though, a Freudian interpretation may hold some weight. At a meeting of a group of women's psychologists that I attended, the speaker stated, "We must work in condom" (rather than "in tandem").

Of course, the most famous Freudian slips were Spoonerisms, named after Reverend William A. Spooner, dean and warden of New College, Oxford, who uttered such memorable lines as "queer old dean" instead of "dear old queen" when referring to Queen Victoria.

DIALECTS Students find it amusing to hear about dialects, especially their own! Below is a list of Boston dialects. You can probably find some from your own part of the country as well:

When we say . . . We mean . . . .
bizah = odd
flahwiz = roses, etc.
hahpahst = 30 minutes after the hour
Hahwahya? = How are you?
cawkees = what we staht the cah with
shewah = of course
wikkid = extremely
yiz = you (plural)
popcahn = popular snack
bubblah = water fountain
haht dahgs = hot dogs

INTONATIONS AND OTHER STYLISTIC IDIOSYNCRASIES Point out that students often will end a verbal statement with a question mark (women are more likely to do this than men), so when you ask where someone is from, the answer sounds as though the person is not sure, as in "Shrewsbury?" Do you know where you are from, or are you asking? On my campus, people from Massachusetts are more likely to do this (because there are so many small towns), but people from the New York area rarely do, just stating "the Bronx." No questions there!

Another stylistic idiosyncrasy is to use the word *like* as every other word in a sentence.

Gestures, eye contact, and facial expressions are also fun to examine, often reflecting cultural influences (this ties into the video segment below).

FOOT IN MOUTH AWARD This website presents awards given in the United Kingdom for particularly bad use of language:
http://www.plainenglish.co.uk/awards/foot-in-mouth-award.html.

Activities

HUMOR IN LANGUAGE Assign students the task of finding ambiguous headlines, humorous instructions, and quotes.

Language in Other Species

- Talk to students about Irene Pepperberg's work with Alex the gray parrot. Do they think that Alex has language? Why or why not? You may want to show the clip about Alex the gray parrot and language at http://www.youtube.com/watch?v = WGiARReTwBw&feature = related.
- This may be a good time to ask students what they think about animal language and communication. Ask students what they feel are potential barriers to studying animal cognition and language. Ask if they think their dog is thinking. Communicating with other dogs? Engaging in reflective thinking/problem solving and reasoning? Do they think that we are currently underestimating other species' abilities in thinking and overestimating our own? It may be interesting to show "Orangutan Found to Mimic Human Speech," https://www.youtube.com/watch?v=dpoydpDHT8A.

Discussion Questions

THEORIES OF LANGUAGE DEVELOPMENT Of the three theories of language development discussed in your text, which do you believe best explains how we learn language? Provide evidence from the text along with examples from your own life to support your position.

- Ask students to discuss how culture plays a role in language development.
- Ask students if males and females use language differently and why.
- Ask student why gender differences are so fascinating to people.
- Have students explain why some people talk a lot and others are quieter.

Most colleges and universities have a foreign language requirement for graduation. Is this a good idea? Why or why not? What are the advantages of bilingualism or multilingualism? In what ways might bilingualism or multilingualism increase thinking and creativity? Are there any disadvantages?

THE INFLUENCE OF LANGUAGE ON THINKING: DO ALASKA NATIVES HAVE MORE WORDS FOR SNOW THAN TEXANS DO? The contention that Alaska Native languages are especially abundant in snow-related terms led to the *linguistic-relativity hypothesis*, the notion that language shapes and, in fact, may determine the way people in a specific culture perceive and understand the world. According to this view, language provides us with categories that we use to construct our view of people and events in the world around us. Consequently, language shapes and produces thought.

On the other hand, suppose that instead of language being the cause of certain ways of thinking, thought produces language. The only reason to expect that Alaska Native languages might have more words for snow than English is that snow is considerably more relevant to Alaska Natives than it is to people in other cultures. Most recent research refutes the linguistic-relativity hypothesis and suggests, instead, that thinking produces language. New analyses of Alaska Native languages suggest that Alaska Natives have no more words for snow than English speakers. Still, the linguistic-relativity hypothesis has not been entirely discarded. A newer version of the hypothesis suggests that speech patterns may influence certain aspects of thinking. In short, although research does not support the linguistic-relativity hypothesis that language causes thought, it is clear that language influences how we

think. It certainly is the case that thought influences language, suggesting that language and thinking interact in complex ways.

DO ANIMALS USE LANGUAGE? One question that has long puzzled psychologists is whether language is uniquely human or if other animals are able to acquire it as well. Many animals communicate with one another in rudimentary forms. Researchers have yet to demonstrate conclusively that animals use true language, which is characterized in part by the ability to produce and communicate new and unique meanings by following a formal grammar.

Psychologists, however, have been able to teach chimps to communicate at surprisingly high levels. Even more impressively, Kanzi, a bonobo, has linguistic skills that some psychologists claim are close to those of a 2-year-old human being. Kanzi's trainers suggest that he can create grammatically sophisticated sentences and can even invent new rules of syntax. Despite the skills primates such as Kanzi display, critics contend that the language such animals use still lacks the grammar and the complex and novel constructions of human language. Instead, they maintain that the chimps are displaying a skill no different from that of a dog that learns to lie down on command to get a reward.

Polling Questions

Do you believe that animals are capable of learning and using language?

AP Student Edition Answer Key

Neuroscience in Your Life: Being Bilingual Affects the Brain

Answer Suggestions

- Possible hypotheses include: Spanish-English monolinguists have more grey matter volume in frontal and parietal brain regions than English monolinguists, or managing the use of two separate languages affects the structure and functioning of the brain.
- The frontal and parietal lobes are associated with executive control, including attention, inhibition, and short-term memory.

AP Test Practice

Section I: Multiple Choice

1. **D** *(Skill 1.C, Learning Target 5.C)*
2. **C** *(Skill 1.A, Learning Target 5.S)*
3. **B** *(Skill 1.C, Learning Target 5.S)*

Section II: Free Response

A.

The independent variable is the variable being manipulated in the experiment. The learning method is the independent variable because it is being manipulated.

The operational definition of the dependent variable is the precise method of measurement. The operationally defined dependent variable is the score of 0-100 on the oral assessment.

Random assignment allows for cause-and-effect conclusions to be drawn. Also the learning method was being manipulated. Some participants received an electronic translator, while others received traditional learning methods.

A control group is the group participating in an experiment that receives no treatment. In this study it was the second group that received traditional methods of learning a language.

B.

Phonemes are the smallest unit of sound in speech. Young infants can distinguish and produce all 869 phonemes, but this ability declines after 6 to 8 months. The difficulty in pronouncing phonemes is one reason people have difficult learning other languages as they get older.

Universal grammar is the theory that humans are genetically prewired to learn language at certain times and in particular ways. Humans are born with an innate linguistic capability that emerges with maturation. However, as you get older it becomes more challenging to learn a new language.

A critical period is the time period when a skill can easily be acquired. Some theorists argue a critical period exists for language development early in life. Children are more sensitive to language cues and can easily acquire language.