16 hr. Teaching Methods & Psychology

Methods of Problem Solving and Enhancing Creativity

Course Outline:

1. **Introduction**
   The study of Problem Solving has a universal application across a wide array of careers. For teachers this subject can open the door to a deeper understanding of the learning processes necessary to assist students. This segment of the course will provide an abstract look at the Methods of Problem Solving and Enhancing Creativity. Problem solving exercises are presented within the text for a more hands-on approach of the material you will be covering.

2. **Problem Solving Methods**
   a. Algorithms
   b. Problem- Solving Exercise
   c. Heuristics

3. **Obstacles and Aids to Problem Solving**
   a. Setting Sub-Goals
   b. Problem-Solving Exercise

4. **Approach to Representing Problems**
   a. Problem-Solving Exercise
   b. Rigidity
   c. Making Decisions

5. **Seeking Information to Confirm a Solution**
   a. Representativeness
   b. Problem-Solving Exercise

6. **Availability**

a. Comparison

b. Framing

7. Creativity

a. Defining Creativity

b. Measuring Creativity

c. Personal Factors in Creativity

8. Situational Factors in Creativity

a. Enhancing Creativity at Work

b. High Level Questions

Course Objectives:

Upon the completion of this course you will be able to:

1. Identify problem solving methods such as algorithms, and heuristics to develop applicable solutions in a class setting.
2. Practice problem solving skills by means of exercises presented within the course.
3. Recall obstacles and aids to problem solving.
4. Define an approach to representing problems.
5. Understand the method of seeking information to confirm a solution.
6. Review methods of enhancing creativity in situational and work environments.

Methods of Problem Solving and Enhancing Creativity

Introduction

The study of Problem Solving has a universal application across a wide array of careers. For teachers this subject can open the door to a deeper understanding of the learning processes necessary to assist students. This segment of the course will provide an abstract look at the Methods of Problem Solving and Enhancing Creativity. Problem solving exercises are presented within the text for a more hands-on approach of the material you will be covering.

Problem Solving Methods

When you recognize that a problem exists, you can search your memory to determine if you have faced a similar problem in the past; if so, you can retrieve the solution from memory and apply it to the current problem. If the problem is new and there is now solution in long-term memory, you can use several strategies to attack the problem. High-speed computers have provided scientists with a model that can be used to understand human thinking.

To use the computer as a model of human thought, however, researchers need to know what human beings do when they solve problems. Two general approaches to solving problems can be programmed into a computer: algorithms and heuristics.

Algorithms

One strategy you could use to solve some problems guarantees a correct solution in time (provided that a solution exists). An **algorithm** is a systematic procedure or specified set of steps for solving a problem, which may involve evaluating all possible solutions. This approach guarantees a solution, if there is one. One example of an algorithm is the mathematical formula used to determine the enclosed by a rectangle: Length multiplied by width gives the answer.

Problem-Solving Exercise

Here is an opportunity for you to solve a problem that could involve use of an algorithm. An *anagram* is a collection of letters that can be rearranged to form one or more words. Consider the following anagram:

O E V S L

How would you go about finding the word? As you try to solve this problem, pay attention to exactly what you do.

Finding the solution to our anagram problem is a bit more complicated than using the formula for the area of a rectangle. Before you start writing all the possible arrangements of the five letters, not that they can be arranged in 120 different ways. Of course, not all such arrangements are words and few of them are even remotely similar to real words.

Algorithms tell us exactly what to do to reach a solution, but they can be time consuming. If you spent 1 second on each combination of five letters, you could spend 2 minutes solving this simple anagram. Because most people solve the anagram in considerable less than 2 minutes, they probably use a method other than an algorithm. (The possible answers to the anagram are *solve, loves, an voles).*

Algorithms do not provide answers when the problems are not clearly specified. No procedures can be set up in advance to guarantee a solution for such problems. What's more, some problems are so vast that algorithms are impractical. For example, chess players do not rely on algorithms because it would take centuries to examine all the possible arrangements of the chess pieces!

Heuristics

While you were trying to solve the anagram, you may have decided that the vowels O and E should be separated. It might also be good idea to separate the V and the S because this combination of letters does not occur frequently in English words; on the other hand, SO is a common combination. These "rules of thumb" are examples of a problem-solving approach known as **heuristics.** Heuristics do not guarantee solutions, but they make more efficient use of time. Using heuristics may lead to quick solutions or to no solution at all.

Obstacles and Aids to Problem Solving

Researchers have compared the problem solving of experts and non-experts and found that experts know more information to use in solving problems. More important, experts know how to collect and organize information and are better at recognizing patterns in the information they gather. We can use the knowledge researchers have gained to improve our own problem-solving capabilities and avoid obstacles.

Setting Sub-Goals

As we have noted, one way to study problem solving is to ask people to think aloud. This procedure enables a researcher to follow a person's problem-solving efforts. Using this technique, psychologists have found that expert problem solvers are adept at breaking problems down into sub-goals, which can make problems more manageable and increase the chance of reaching a solution.

Problem-Solving Exercise

Try this problem. Nine adults and two children want to cross a river, using a raft that will carry either one adult or two children. The raft must be paddled by a person' it cannot be pulled across the river by a rope. How many times must the raft cross the river to accomplish this goal? (A round rip equals two crossings.) Write down your answer before reading further.

This is not an easy problem. Remember that effective problem solvers break down large problems into smaller sub-goals; it is difficult to solve such a massive problem in one swipe. First you need to know how many crossings are required to transport one adult across the river. You find that it takes four crossings to move one adult across the river and return the boat to the original dock. If the two children cross the river, one of the children can return the boat. When the child returns, an adult can cross alone and the other child returns the boat. To move the nine adults across the river you must repeat that sequence of four trips eight more times; it will take 36 trips to move nine adults. One final trip is needed to move the two children across, for a total of 37 trips.

The keys to solving this problem are (1) to identify the sequence needed to transport one adult across the river and (2) to determine that the sequence can be repeated. Finding the solution requires that you break the problem into manageable intermediate sub-goals (one person at a time).

Approach to Representing Problems

Information that is not organized effectively can hinder problem solving. At times we may rely on memory; at other times external representations of a problem are helpful.

Consider the following problem. There are three boxes of equal size. Inside each box are two smaller boxes. Inside each of the smaller boxes are four even smaller boxes. How many boxes are there all together? The chances of solving this problem improve if it is represented somewhere other than in our heads. Students who were prompted to draw the problem solved it more frequently.

What is 2/3 of ½? When you first read this problem, you may become confused and conclude that it is difficult. Now let's represent the problem as 2/3 x ½. This shows us that we could represent it as "What is ½ of 2/3?" This small change in representation converts a moderately difficult problem into a simple one in which the answer almost jumps off the page.

Problem-Solving Exercise

How would you put 27 pigs into four pens with an odd number of pigs in each pen? Most problem solvers try to figure a way to divide 27 into four odd numbers. This approach seems reasonable until you realize it is not possible. You tried this approach because you perceived the solution to involve four separate and distinct pens. Hint: Try looking at the relationship among the pens again.

Rigidity

Using past experience is often helpful in solving problems, but sometimes it can block the path of our problem-solving efforts. Rigidity is the tendency to rely too heavily on past experience in solving problems. A specific example of rigidity is the difficulty we experience in using familiar objects in new ways, which is termed **functional fixedness.** One example of functional fixedness is Maier's classic two-string problem (Maier, 1931). The two strings hanging from the ceiling are to be tied together. Among the objects in the room are a chair and a set of pliers.

The strings are too far apart to allow the person to grasp both of them and tie them together.

Not surprisingly, most of the solutions tried by participants in Maier's study involved the chair, although unsuccessfully. What is the solution? Think about it for a while.

The solution to this problem is to tie the pliers to the end of one string, set the string in motion like a pendulum, then catch it and tie it to the other string. The solution may seem obvious to you now, but only 39% of participants solved the problem in 10 minutes allotted. Why did they experience so much trouble with this problem? They displayed functional fixedness: They did not see that the pliers could be used in an unusual way.

Making Decisions

Each day we make dozens perhaps hundreds of decisions. What is the easiest way to get to the family reunion next week? Should I go to the bank today, or wait until tomorrow? Some of these decisions are easy; others are more difficult. How do we make such decisions?

The human brain enables us to process vast amounts of information quickly and accurately. Heuristics are often helpful and economical and can lead to good decisions; at times, however, they may also lead to bad decisions. The same principles that allow us to make judgments easily and often successfully are also responsible for some of our errors. For example, suppose that you see a red car that was involved in an accident. Have you ever decided that people who drive red cars drive faster and less safely than other drivers? If you were asked to estimate the number of crimes in which people plead “not guilty by reason of insanity, “ it is very likely that you would overestimate the actual number by quite a bit.

Seeking Information to Confirm a Solution

The series 2, 4, 6 follows a rule concerned with how the numbers relate to one another. Your task is to discover the rule by suggesting other sets of numbers that follow it. Because the numbers increase by 2, many people suggest a series such as 12, 14, 16 followed by one like 22, 24, 26. Both series follow the rule. Buoyed by these two confirmations of the proposed rule, you might feel confident in announcing that the rule requires that the numbers increase by 2; however, you would be wrong! In fact 79% of participants in a study confidently stated an incorrect rule when given this problem.

A common mistake in testing hypotheses is to commit to one hypothesis without adequately testing other possibilities; this is known as **confirmation bias**. In our example, the correct rule is that the series must consist of three positive numbers that increase. If you tried series like 1, 2, 3 we would tell you that the series follows the rule and you could modify your initial hypothesis. People who found the correct rule earliest had generated more negative instances, which provided them with information that they could use to modify their hypotheses. This example illustrates an important aspect of our problem-solving and decision making behavior: the tendency to seek instances that confirm our beliefs, solutions, or hypotheses and to avoid instances that dis-confirm them.

The following story illustrates the power of the confirmation bias. A group of children were playing a game of “20 Questions”; the goal in this case was to find a number between 1 and 10,000, and to groan when the answer was “No, it is not between 0 and 5,000.” Although both answers conveyed the same

amount of information, confirmation was met with jubilation, and lack of confirmation was greeted with disappointment. As adults we do not outgrow the tendency to seek confirmation.

Representativeness

When we use the **representativeness heuristic,** we determine whether an event, an object, or a person resembles (or represents) a prototype. Suppose that Ted, a college graduate, is very careful and concerned about details. He rarely tells jokes and seems to lack creativity. Give him a task, and he will carry it out according to the rules. Is Ted an accountant or a writer? Your conclusion would most likely be based on the similarity you perceive between Ted's characteristics and those you believe are common among accountants and writers; you would be using the representativeness heuristic. In essence you are looking for a match between Ted and the prototype of either an accountant or a writer. Including information about the number of accountants (30%) and writers (70%) in a group did not alter predictions of Ted's occupation.

Participants were swayed by the similarity of Ted's personality characteristics to commonly held stereotype of an accountant, which is quite different from the stereotype of a writer, who may be perceived as creative, tolerant, and open to experience. Because Ted's profile sounds like one we associate with accountants, it therefore represents our prototype of accountants. In this case the representativeness heuristic a rule of thumb leads us to assume that the similarity in the personality profile is a more powerful predictor than the odds of selecting an accountant from a group with a small number of accountants.

Here is a simple exercise that will illustrate the representativeness heuristic. Take a few pennies from your pocket and drop them on the table.

Problem-Solving Exercise

Suppose that you and a friend are tossing coins. Your friend tosses five heads in a row. It is your turn to bet on the next coin toss. Will it be heads or tails? Write down your choice and your reason for making the choice before reading further.

We expect the numbers of heads and tails to be approximately equal in the long run. Research findings and our own experience tell us that fair coins behave this way across many tosses. Although we also expect to find this approximate equality in the short run, chance does not operate that way. Betting that the next toss will be tails after your friend has tossed five heads in a row is like saying the coin "knows" what happened on the previous five tosses and therefore heads is "due". Although a run of five heads does not seem to be representative of a random distribution of heads and tails, the odds on the next coin toss are still 50:50. Those prior tosses do not affect the odds. This faulty assumption is called the *gambler's fallacy* another example of the representativeness' heuristic. A series of heads and tails that does not look like chance is taken as evidence that some non-chance process is operating. Surprisingly, consecutive runs of heads and tails in random sequences can appear to be quite ordered. Some gamblers may misread the series of heads and tails and assume they have a better chance of predicting the next toss than is actually the case.

Availability

The **availability heuristic** involves making judgments of revaluations based on what comes to mind first. Consider the following: Are there more words with r as the first letter than as the third letter? A quick word inventory leads you to conclude that there are more words that begin with r, but you are wrong. Why? Words that begin with r—rich, reward, right come to mind easily is also more likely to occur in the future. Ease of recall often but not always is correlated with actual data. Who is most likely to be killed in a drunken driving accident? Most people believe the answer is an innocent victim. According to the National Highway Traffic Safety Administration (2001), however, the person most likely to die in a drunk-driving accident is a drunk driver. Why do we give the wrong answer? It is easier to recall incidents in which an innocent person was the victim of a drunken driving accident because such events are considered newsworthy. Drunk drivers die on the nation's highways every day, yet few of those accidents receive media attention.

Although the events covered by the media may not affect us directly, they play a role in how we assess our risk of accidents, catastrophes, or diseases. Imagine two of your friends discussing the relative safety of traveling to a vacation destination by either plane or automobile. News coverage of a recent plane crash leads them to decide in favor of travel by car, which they believe is safer. We may be misled because examples of airline accidents are dramatic and thus easy to recall. Yet more people are killed in cars and trucks during a single week than in plane crashes over the course of an entire year. For example, in 1998 there were 47,471 deaths in motor vehicle accidents (an average of almost 800 a week), whereas aviation-related accidents caused 667 deaths (U.S. Bureau of the Census, 2000). Almost all of the aviation deaths occurred in charter operations or general aviation, not the major carriers.

Comparison

We often make decisions by comparing the information we have obtained to some standard. Your standards are constantly changing, and these changes can affect your judgments. For example, a temperature of 68 degrees F seems pleasant in the winter but cool in the summer.

Would you drive 20 minutes to save 5? Your answer may depend on the basis of comparison. If a toaster costs $45 at one store and the same toaster is available for $40 at another, are you likely to drive to the store with the lower price? Would you make the drive to buy a suit priced at $295 instead of $300? Most people say they would make the drive for the toaster but not for the suit, yet the amount of money saved would be the same. These choices are examples of the just noticeable difference. In short, we tend to see the benefits or gains of a comparison in relative rather tan absolute terms.

Framing

When we make decisions we are also influenced by whether our attention is drawn to positive or negative outcomes; psychologists refer to this presentation of an issue as **framing.** When we make decisions we are generally risk avers; that means we want to stay away from negative outcomes. Unfortunately, this tendency has the potential to mislead us at times, causing us to fail to see that the way identical information is presented (framed) can make a dramatic difference in decision making.

Consider an example. Imagine that you have lung cancer, and the treatment options are surgery or radiation. To help you make an informed decision, your physician tells you the results for lung cancer patients who selected surgery: 68% are alive after 1 year, and 34% are alive after 5 years. For lung cancer patients who selected radiation, 77% are alive after 1 year and 22% are alive after 5 years. Given this information, which treatment do you select? The vast majority of people would select surgery.

Now let's change the framing a bit and see what happens. Suppose you are given the following information: Among patients who selected surgery, 32% are dead after the following information: Among patients who selected surgery, 32% are dead after 1 year and 66% are dead after 5 years. Among patients who selected radiation, 23% are dead after 1 year and 78% are dead after 5 years. Which treatment do you select now? Only a slight majority would select surgery. Not that the choices framed in terms of living or dying are identical, yet the framing affects the option selected.

Keep in mind that the scenarios we have just described did not result from stupidity or a malfunctioning brain: "They illustrate how the mind actually works. Put in evolutionary terms, the mind has evolved to be effective in situations that are most likely to arise. We have developed some tried-and-true methods of making decisions that work most but not all of the time.

Creativity

Although we often face difficulties when trying to solve problems and making decisions, we are capable of impressive and creative solutions and judgments. Yet **creativity**, or the ability to produce work that is both novel and appropriate, is a difficult concept to actually explain.

Defining Creativity

If there is no absolute standard for creativity, how can we judge whether a work is creative? Teresa Amabile (1982) has proposed a consensual assessment of creativity. She asked a group of judges to make global ratings based on their own definitions of creativity. The judges' ratings of both verbal and artistic products were consistent and reliable. People seem to agree on what is and is not creative.

Measuring Creativity

Intelligence tests were not designed to measure creativity, so it is not surprising that the correlation between measures of creativity and intelligence is not strong (it is generally positive but low to moderate at best).

High intelligence does not guarantee high creativity; low intelligence does not halt creativity. In many cases, "The creative solution is not known beforehand, and there is an immense range of possibility for new developments once we get into a problem. Not only are there no 'right or wrong' answers at all, until they have been tested in someone else's perception, or by external reality. This analysis suggests that many examples of creativity may begin as ill-defined problems.

Imagine that thinking is like a line. When all lines of thought converge on one correct answer, we have an example of *convergent thinking*. By contrast *divergent thinking* takes our thinking in different directions in search of multiple answers to a question. Of the two, divergent thinking is related more closely to creativity.

Creativity typically involves seeing non-typical yet plausible ways of associating items or seeing aspects of an item that are real and useful but not usually the primary focus of our attention. You can gain insight into this process by completing items from the Remote Associates Test. This test was designed to measure the process of making new associations. Success on the test calls for flexibility in making associations, fluency in the use of language, and originality.

Psychologists have devised other ways to measure creativity. In the Unusual uses Test, for example, you would be asked to think of unusual uses for common objects such as a brick, a ball, or a paper clip. In another measure of creativity, the Consequences Test, you would offer responses to questions such as "What would happen if people could become invisible at will? What would happen if all electrical generating plants closed at noon each day?" What would happen if everyone could read each other's mind?" The responses are judged on the basis of novelty and appropriateness.

For example, in response to the first item, you could say, "It would rain for 40 days and 40 nights." Although this response is novel (statistically rare), it is not appropriate in the context of the question. Conversely, if someone replied, "We couldn't see other people," the response would be appropriate but not novel. Thus there are two key elements in the definition of creativity as the ability to produce work that is both novel and appropriate.

Personal Factors in Creativity

Are there other keys to understanding creativity? Several personal characteristics distinguish creative people from less creative people. Creative people are not afraid of hard work; they give it their undivided attention and often persevere in the face of obstacles: "Almost every major creative thinker has surmounted obstacles at one time or another and the willingness not to be derailed is a crucial element of success". For example experts declared Fred Smith's concept for Federal Express to be unworkable. Today

Federal Express is the world overnight. Creative people seem able to tolerate ambiguity, complexity, or a lack of symmetry. According to one expert, "It is clear that creative persons are especially disposed to admit complexity and even disorder into their perceptions without being made anxious by the resulting chaos. It is not so much that they like disorder per se, but that they prefer the richness of the disordered to the stark barrenness of the simple".

Situational Factors in Creativity

Creativity often emerges when we rearrange what is known in new and unusual ways that can yield creative ideas, goods, and services. Humor and playfulness provide fertile ground for forming new

associations and arrangements. Mozart recognized this possibility when he wrote, “When I feels well and in a good humor, or when I am taking a drive or walking after a good meal,…thoughts crowd into my mind as easily as you could wish”.

In a study, participants were asked to tell a story or make a collage. Some of them completed the work in exchange for a reward; others were not rewarded. Judgments of the creativity exhibited in the stories or collages were lower when the participants had received a reward. This result was consistent with other studies that have found that extrinsic rewards (as opposed to intrinsic rewards) can change the perceptions of activities and also lower interest in them.

Another perspective on motivation underlying creativity focuses on how the motivator actually affects the person: Does it direct attention toward the task rather than the goal? A *task-focusing* motivator energizes a person to work and keeps the person’s attention on the task. By contrast, a *goal-focusing* motivator leads a person to focus attention on rewards are noticeable and distinct from the task. People vary, however, as to how they focus on the task. Thus extrinsic motivators may have either benefits or negative effects, depending on how they influence the person’s focus.

Creativity often flourishes under the right mix of intrinsic and extrinsic motivation. Thomas Edison’s first invention was an automatic vote recorder for Congress. When he presented it to a member of Congress, he was told that efficiency in lawmaking was the last thing Congress wanted. From that point on, Edison stated that the only reason he invented was to make money; he didn’t have the time or interest to modify the world to fit his inventions.

Enhancing Creativity at Work

Businesses grow and prosper by adapting and creating new products and developing markets. Consequently, the business community has an interest in developing their employees’ creativity. Such companies as Frito-Lay and Texas Instruments have introduced creativity-enhancing creativity; it takes the right attitude and technology in a work climate that is receptive to creative thinking and new ideas. Individual and organizational creativity are closely interlocked. For example, environmental conditions at work—including freedom over one’s work and sufficient time to think facilitate creativity.

One key to developing creativity is to be alert to potential problems that might be solved with creative solutions. For example, a track coach paid attention when his runners complained their running shoes were causing blisters. The coach, Bill Browerman, was confident he could improve the design of existing shoes. He cut patterns for the shoes out of grocery bags and found lightweight materials that improved cushion and traction. Browerman’s shoes are known today by the brand name *Nike*.

We could also learn from the story of Swiss inventor George de Mestral. The name may be unfamiliar, but his invention is well known. One day he went hunting with his dog; they accidentally brushed against a bush that left both of them covered with burrs. When he tried to remove them, they clung stubbornly to his clothes. To most of us this would be a minor annoyance, not to de Mestral. After he got home, he looked at the burrs under a microscope and discovered that hundreds of tiny hooks on each burr had snagged the threads on his pants. The result of this accident was the invention of Velcro fasteners.

We may not all brush up against new ideas like de Mestral did, but we can set the table for creativity. Unfortunately, most people believe the world is divided into two types of people: the creative ones and the rest of us. Yet if you spend some time watching children play, you'll see a great deal of creativity. What happens to diminish creativity as we become adults?

Children's imaginations roam freely and are not limited by reality because they are not constrained by adult rules of thinking: "They don't know that they have to color inside the lines". Adults are expected to be serious, yet playfulness and humor can help develop flexible thinking. We need to be open to "fooling around" with ideas to explore new mental connections. Injecting a bit of humor and playfulness into the work situation can stimulate a creative mind-set, including using games and puzzles designed to enhance creativity.

Quite often people fail to develop creative ideas because they do not believe they can be creative. The first step in developing one's creativity is to acknowledge and confront these negative thoughts and replace them with positive thoughts. For example, many workers say to themselves, "Ill never be able to do it." This thought can be altered to the following: "Ill do a little bit at a time to get started. There's no reason that I have to do it all on a crash schedule."

Creativity consultants also aim to inject change into the lives of employees. They encourage employees to break habits by taking a different route to work, listening to a different radio station, or reading a different newspaper. These minor changes are designed to help employees break out of a rut, expose them to new ideas, and get them thinking rather than operating on automatic pilot. Employees are encouraged to look around, to make notes, and to collect lots of ideas.

We also need to recognize that creativity can take many forms. Henry Ford said he invented nothing new; he combined the inventions of others into a car. Ivory soap was run through an ice cream machine to add air that increased the sudsing and allowed bar to float. Sometimes the creativity is remarkable simple: The key to the initial success of Domino's pizza was promising home delivery in 30 minutes or less.

Creative people can look at the same thing as everyone else but see something different. For example, Arthur Fry, a chemist, was working with glue that was to be used on fixed surfaces like bulletin boards.

Unfortunately, it did not work well. One day while singing he had a creative insight: The adhesive could be used on a bookmark that would replace the little pieces of paper he used to mark his hymn book. Fry used the glue to develop Post-It notes.

While learning the psychology of the way a student learns, teaching is basically a combination of art and science. While research tells us in a systemic way differences between effective and less effective teaching strategies {the science of teaching), teachers must practice and apply what is known according to their own personality and to a certain extent their own intuition (the art of teaching). There is no one best way to teach, no super strategy. Having identified goals, you are now prepared to attempt to help learners reach these goals. The specific experiences and learning tasks you design for students to reach

or master your goals fall under the umbrella of implementation. Implementation is simply how you teach.

A cornerstone for all effective teaching is classroom questioning. In the classroom teachers ask questions for a variety of reason. What teachers should be checking for is:

- Does the student understand the instruction?
- Evaluating the effectiveness of the lesson
- Increasing higher-level thinking

Asking questions is an essential teaching strategy that can be used with virtually any subject matter or teacher personality. When done effectively it can promote involvement, enhance learning, motivate students and provide both teachers and students with valuable feedback about the learning process.

The qualities of effective questions are that they are brief, clear, focused, relevant, constructive, neutral and open –ended. Additional practices that enhance effective questioning include planning your questions carefully, listening to students responses and asking fewer questions. Questioning also helps promote a student- centered learning environment while maintaining a goal focused activity. The effective use of questioning techniques will significantly improve this interaction by expanding student understanding and getting them actively involved. Teachers use questions for five major purposes:

- To involve students in the lesson
- To promote students thinking and comprehension
- To review important content
- To control students
- To assess students progress

The key to effective questioning is to ask questions that allow you to reach your instructional goal most effectively. The difference between good and effective teachers is that in addition to doing all the things good teachers have always done, effective teachers direct their instruction at a clear and specific goal. Different types of questions are effective at different times and teachers ask questions for several reason, some which include:

- Asking questions that help teachers keep students actively involved in the lesson
- While answering questions, students have the opportunity to openly express their ideas and thoughts
- Questioning students enables other students to hear different explanations of the material by their peers
- Asking questions helps teachers to pace their lessons and moderate student behavior
- Questioning students helps teachers to evaluates student leaning and revise their lessons as necessary

At certain times, questions that establish knowledge of informational foundation recall are required, whereas at other times we want students to link information and apply it to thinking about our world.

Often low level questions elicit a yes or no response or simply allow for a choice between two alternatives. In that the teacher cannot be absolutely sure that the student has truly conceptualized the material, the use of these kinds of questions should be limited. However, when used, the technique of probing can be used to check the depth of student's perceptions and knowledge. Teachers use low levels questions to:

- Assess student background knowledge
- Establish an informational base that will be used in higher-level operations.

High Level Questions

For certain goals low level questions are important and valuable, but at other time we want students to connect ideas and expand their thinking. The characteristic that separates a low level question from a high level question is that the latter requires intellectual processing or the connecting or transforming of ideas by students, whereas the former is limited to memorization with the information being recalled upon demand. A high level question is any question that requires the student to do more than recall previously learned information.

Obviously, high level questions vary in difficulty and demands placed on the students, but the key characteristic they posses is that they required more than mere recall. Research on the relative merits of high and low level questions underscores the complexity of teaching and the importance of clear goals. While it might seem that higher level questions are intrinsically better than lower ones because they are more challenging, teachers must also consider the fact that low level questions can expand and reinforce the students knowledge base. This suggests the need for teachers to first consider goals or reasons for asking particular questions.

If the purpose is to identify or reinforce a particular bit of information such as a color fact questions then lower level questions would be appropriate. If your goal is to encourage students to think about the content they're learning, higher-level questions are more effective at accomplishing that goal. Research has now established that asking higher-level questions, alone does not ensure academic success. Your students must also have the knowledge base necessary to engage in complex thinking task.

By asking students questions beginning with phases such as "why do you suppose" and "how does the United States seek" the teacher extends students thinking beyond memory. Both students had to integrate prior information and were therefore working at a high level.

An alternate way to encourage student thinking is to ask students to provide and explain examples of abstract ideas. Consider the statement "Give me an example that we haven't previously discussed, of a color wheel." A student responding to this question must generate, on the basis of previous information, a new example of the concept color wheel. Because it requires students to think about content in a deep, rather than superficial, manner, it is another excellent way to stimulate higher level thinking.

Another effective high level question asks students to state an idea or definition in the students owns words, high level questions can also require students to provide the solution to a problem, such as and

Item originally selling for $40.00 us marked 30% off. What is the sale price? The solution to the problem requires a high level response.

Summary

While learning the psychology of the way a student learns, teaching is basically a combination of art and science. While research tells us in a systemic way differences between effective and less effective teaching strategies {the science of teaching), teachers must practice and apply what is known according to their own personality and to a certain extent their own intuition (the art of teaching). There is no one best way to teach, no super strategy. Having identified goals, you are now prepared to attempt to help learners reach these goals. The specific experiences and learning tasks you design for students to reach or master your goals fall under the umbrella of implementation. Implementation is simply how you teach.

The Psychology of Learning

Course Outline:

1. Introduction
2. Psychology of Learning Overview
    a. Relationships and Practices
    b. Tools and Environment
    c. Professional Responsibility
3. Subliminal Perception
    a. Vision
    b. Amplitude
    c. Audition
4. Defining Learning

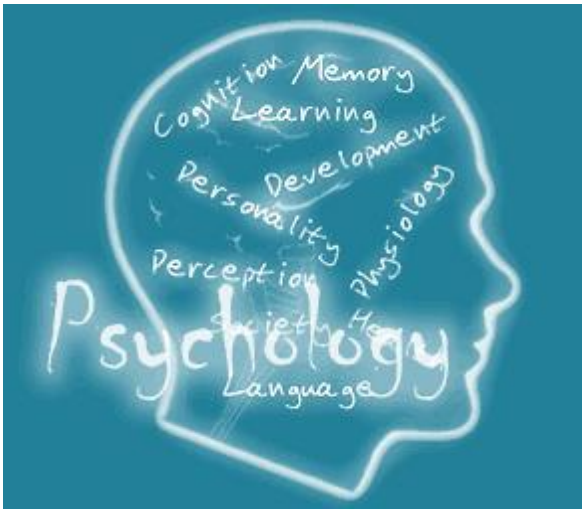
   a. Classical Conditioning
   b. Basic Elements of Classical Conditioning
   c. Cognitive and Social Perspectives on Learning
5. The Role of Cognition
   a. Insight Learning
   b. Latent Learning
   c. Observational Learning
6. Summary

Course Objectives:

Upon the completion of this course you will be able to:

1. Recall research thesis on the psychology of learning.
2. Understand relationship and practices of traditional teaching.
3. Decipher the environmental affects and tools used in the learning process.
4. Identify professional responsibilities associated with learning process.
5. Review the events of subliminal stimuli based on studies.
6. Comprehend the use of vision, amplitude, and audition in the psychology of learning.
7. Define learning from a psychologist's perspective.
8. Differentiate between classical conditioning and the cognitive and social perspectives on learning.
9. Develop an understanding of the role of cognition in the learning process.

The Psychology of Learning



Introduction

From the day we our born, we begin a process of learning that lasts throughout life. While there are many ways to define and describe learning, it is typically defined as a relatively permanent change in behavior as a result of experience. This section of your course will highlight the psychology of the learning process.

Psychology of Learning: Overview

Imagine a school where teaching is considered to be a profession rather than a trade. The role of teachers in a student's education -- and in American culture -- has fundamentally changed. Teaching differs from the old "show-and-tell" practices as much as modern medical techniques differ from practices such as applying leeches and bloodletting.

Instruction doesn't consist primarily of lecturing to students who sit in rows at desks, dutifully listening and recording what they hear, but, rather, offers every child a rich, rewarding, and unique learning experience. The educational environment isn't confined to the classroom but, instead, extends into the home and the community and around the world. Information isn't bound primarily in books; it's available everywhere in bits and bytes.

Students aren't consumers of facts. They are active creators of knowledge. Educational centers are centers of lifelong learning. And, most important, teaching is recognized as one of the most challenging and respected career choices, absolutely vital to the social, cultural, and economic health of our nation.

Today, the seeds of such a dramatic transformation in education are being planted. Prompted by massive revolutions in knowledge, information technology, and public demand for better learning, schools nationwide are slowly but surely restructuring themselves.

Leading the way are thousands of teachers who are rethinking every part of their jobs -- their relationship with students, colleagues, and the community; the tools and techniques they employ; their rights and responsibilities; the form and content of curriculum; what standards to set and how to assess whether they are being met; their preparation as teachers and their ongoing professional development; and the very structure of the schools in which they work. In short, teachers are reinventing themselves and their occupation to better serve schools and students.

Relationships and Practices

Traditionally, teaching was a combination of information-dispensing, and sorting out academically inclined students from others. The underlying model for schools was an education factory in which adults, paid hourly or daily wages, kept like-aged youngsters sitting still for standardized lessons and tests.

Teachers were told what, when, and how to teach. They were required to educate every student in exactly the same way and were not held responsible when many failed to learn. They were expected to teach using the same methods as past generations, and any deviation from traditional practices was discouraged by supervisors or prohibited by myriad education laws and regulations. Thus, many teachers simply stood in front of the class and delivered the same lessons year after year, growing gray and weary of not being allowed to change what they were doing.

Many teachers today, however, are encouraged to adapt and adopt new practices that acknowledge both the art and science of learning. They understand that the essence of education is a close relationship between a knowledgeable, caring adult and a secure, motivated student. They grasp that their most important role is to get to know each student as an individual in order to comprehend his or her unique needs, learning style, social and cultural background, interests, and abilities.

This attention to personal qualities is all the more important as America continues to become the most pluralistic nation on Earth. Teachers have to be committed to relating to students of many cultures, including those young people who, with traditional teaching, might have dropped out -- or have been forced out -- of the education system.

Their job is to counsel students as they grow and mature in their field -- helping them integrate their social, emotional, and intellectual growth -- so the union of these sometimes separate dimensions yields the abilities to seek, understand, and use knowledge; to make better decisions in their personal lives; and to value contributing to society.

They must be prepared and permitted to intervene at any time and in any way to make sure learning occurs. Rather than see themselves solely as masters of subject matter such as history, math, or science, teachers increasingly understand that they must also inspire a love of learning.

In practice, this new relationship between teachers and students takes the form of a different concept of instruction. Tuning in to how students really learn prompts many teachers to reject teaching that is primarily lecture based in favor of instruction that challenges students to take an active role in learning.

They no longer see their primary role as being the king or queen of the classroom, a benevolent dictator deciding what's best for the powerless underlings in their care. They've found they accomplish more if they adopt the role of educational guides, facilitators, and co-learners.

The most respected teachers have discovered how to make students passionate participants in the instructional process by providing project-based, participatory, educational adventures. They know that in order to get students to truly take responsibility for their own education, the curriculum must relate to their lives, learning activities must engage their natural curiosity, and assessments must measure real accomplishments and be an integral part of learning.

Students work harder when teachers give them a role in determining the form and content of their schooling -- helping them create their own learning plans and deciding the ways in which they will demonstrate that they have, in fact, learned what they agreed to learn.

The day-to-day job of a teacher, rather than broadcasting content, is becoming one of designing and guiding students through engaging learning opportunities. An educator's most important responsibility is to search out and construct meaningful educational experiences that allow students to solve real-world problems and show they have learned the big ideas, powerful skills, and habits of mind and heart that meet agreed-on educational standards. The result is that the abstract, inert knowledge that students used to memorize from dusty textbooks comes alive as they participate in the creation and extension of new knowledge.

Tools and Environment

One of the most powerful forces changing teachers' and students' roles in education is new technology. The old model of instruction was predicated on information scarcity. Teachers and their books were information oracles, spreading knowledge to a population with few other ways to get it.

But today's world is awash in information from a multitude of print and electronic sources. The fundamental job of teaching is no longer to distribute facts but to help students learn how to use them by developing their abilities to think critically, solve problems, make informed judgments, and create knowledge that benefits both the students and society. Freed from the responsibility of being primary information providers, teachers have more time to spend working one-on-one or with small groups of students.

Recasting the relationship between students and teachers demands that the structure of school changes as well. Though it is still the norm in many places to isolate teachers in cinderblock rooms with age-graded pupils who rotate through classes every hour throughout a semester -- or every year, in the case of elementary school -- this paradigm is being abandoned in more and more schools that want to give teachers the time, space, and support to do their jobs.

Extended instructional periods and school days, as well as reorganized yearly schedules, are all being tried as ways to avoid the chopping learning into often arbitrary chunks based on limited time. Also, rather than inflexibly group students in grades by age, many schools feature mixed-aged classes in which students spend two or more years with the same teachers.

In addition, ability groups, from which those judged less talented can rarely break free, are being challenged by recognition that current standardized tests do not measure many abilities or take into account the different ways people learn best.

One of the most important innovations in instructional organization is **team teaching**, in which two or more educators share responsibility for a group of students. This means that an individual teacher no longer has to be all things to all students. This approach allows teachers to apply their strengths, interests, skills, and abilities to the greatest effect, knowing that children won't suffer from their weaknesses, because there's someone with a different set of abilities to back them up.

To truly professionalize teaching, we need to further differentiate the roles a teacher might fill. Just as a good law firm has a mix of associates, junior partners, and senior partners, schools should have a greater mix of teachers who have appropriate levels of responsibility based on their abilities and experience levels. Also, just as much of a lawyer's work occurs outside the courtroom, so, too, should we recognize that much of a teacher's work is done outside the classroom?

Professional Responsibility

Aside from rethinking their primary responsibility as directors of student learning, teachers are also taking on other roles in schools and in their profession. They are working with colleagues, family members, politicians, academics, community members, employers, and others to set clear and obtainable standards for the knowledge, skills, and values we should expect America's students to acquire. They are participating in day-to-day decision making in schools, working side-by-side to set priorities, and dealing with organizational problems that affect their students' learning.

Many teachers also spend time researching various questions of educational effectiveness that expand the understanding of the dynamics of learning. And more teachers are spending time mentoring new members of their profession, making sure that education school graduates are truly ready for the complex challenges of today's classrooms.

Reinventing the role of teachers inside and outside the classroom can result in significantly better schools and better-educated students. But though the roots of such improvement are taking hold in

today's schools, they need continued nurturing to grow and truly transform America's learning landscape. The rest of us -- politicians and parents, superintendents and school board members, employers and education school faculty -- must also be willing to rethink our roles in education to give teachers the support, freedom, and trust they need to do the essential job of educating our children.

A critical teacher role in promoting student learning is increasing student's desire or motivation to learn. To accomplish this task, teachers need to know their students well enough to be able to provide learning experiences that they will find interesting valuable, intrinsically motivating, challenging and rewarding. There is clear support in the research of literature for positive relationship between student's motivation and important variable such as self-esteem, academic achievement and school success. Some educators are critical of motivational factors based upon extrinsic worth.

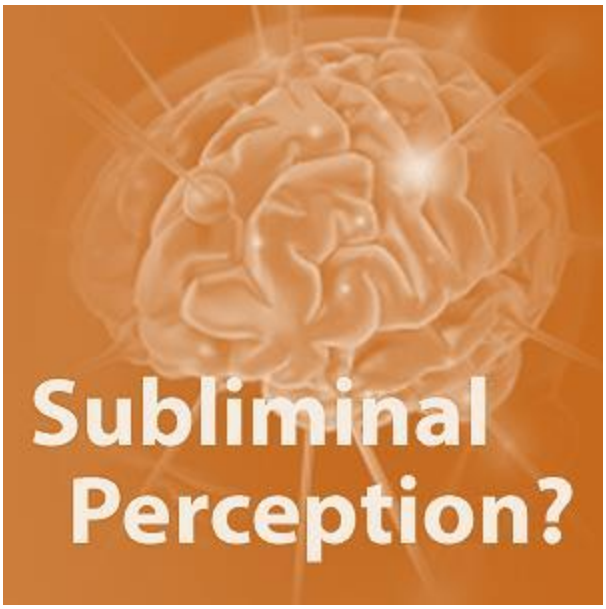
Pleasing others and receiving rewards may result in short term learning gains but may not prepare students for life long learning. Many educators believe it is equally important to assists students in making the transition from a focus on tangible external rewards to self motivated learning. This means students are making the transition from the extrinsic need to please others and participate in order to obtain a reward to the intrinsic need to obtain knowledge or satisfy an interest. Teachers should emphasize the value of the learning activity and structure that activity in ways to make all students believe they will succeed.

Teachers facilitate the internalization process and the most effectively way to do so is by designing learning activities to promote a positive academic or cognitive self concept. One of the most important teacher roles is to convince students that they are involved with them in each and every challenge and are in their corner. This requires both organizational and personal strategies that focus on the worth and power of intrinsic motivational and its positive impact on student's academic achievement. It is difficult for students to achieve if they lack the motivation to stay focused during challenging extended tasks.

During the course of this class you will learn the psychology of learning and the basic guideline to critical thinking and advance achievements.

Subliminal Perception

The study of thresholds raises an interesting question. Can stimuli that are below the threshold for perception have any effect on us? Such events are called **subliminal stimuli** because, even though they do activate our receptors, we are not consciously aware of them. For example, if a persuasive message could arouse our unconscious motives, it might stand a better chance of succeeding because we would not consciously try to resist it. This is the premise behind the use of subliminal perception in advertising. Because subliminal perceptions are below the level of conscious awareness, they should have a direct effect on unconscious motivation. To accomplish this goal, visual stimuli may be presented so rapidly that we do not consciously perceive them, or tape recordings may be played during sleep. Thus, some researchers believe that both subliminal visual and auditory stimuli may have an effect on our learning and behavior.



Many people would argue that vision is the most important and most highly valued sense. Ask several people which of their senses they would least be willing to lose, and almost all of them would say vision. We fear blindness because we are primarily visual creatures. Why? Our brain has more neurons devoted to vision than to hearing, taste, or smell.

What adjustments would you have to make in your lifestyle if you lost your sight? Compare these changes to the adjustments that would be required if you lost your sense of smell. Given the importance of vision and the ease with which the eyes can be studied, it is not surprising that vision is the sense that has been studied most thoroughly.

LET'S DISCUSS VISION……..

Vision

To appreciate our visual abilities, we need to know two things: what we see and the components of our visual system.

WHAT WE SEE

Vision is a process that involves the reception of electromagnetic waves by visual receptor cells. This kind of energy travels in waves that vary greatly in length. For example, gamma waves are very short, whereas some of the waves involved in broadcasting are miles long (Block & Yuker 1989). We measure **wavelengths**, or the length of waves in nanometers (nm), which are billionths of a meter. The only light waves that humans can detect have wavelengths between approximately 380 nm and 760 nm. This limited range of stimuli (the human eye can see only a small portion of the spectrum) Is called the *visible spectrum.* Different light wavelengths are associated with different colors. For example, we see a wavelength of 425 nm as violet and a wavelength of 650 nm as red. Thus the psychological counterpart of wavelength is *hue* or color.

Amplitude

Amplitude refers to the strength or intensity (brightness) of the light. **Saturation** refers to the "trueness" or purity of the colors we perceive. The more saturated a color seems; the more likely you are to be seeing only one wavelength. To understand the concept of saturation we need to distinguish between radiant light and reflected light. With **radiant light,** visible energy is emitted (released) directly by an object. There are only a few sources of radiant energy: the sun, light bulbs, and other hot, energy-releasing objects. If you place a piece of red cellophane in front of a light bulb, you will see a red light because red wavelengths are shown through the red cellophane.

What happens when you simultaneously look at red and green lights? If you add a blue light to the red and green mixture, you will see white. Why? Because the three primary wavelengths are added together and are being sensed at the same time. Adding the three primary wavelengths results in the perception of white (in other words, no specific wavelength is dominant.

With **reflected light,** by contrast energy is reflected by objects. Most of the light waves we receive are not radiant; they are reflected from objects in our environment. In other words, the light waves strike an object and bounce off it; we receive the waves that have bounced off the object. You perceive the colors of grass, a rose, and your sweater as a direct result of the reflection of light from those objects.

ANOTHER WAY WE LEARN IS THROUGH HEARING…….

Audition (Hearing)

Next to vision, the sense of hearing, or **audition**, is our most important link to the environment. Just as we see light waves, we hear sound waves. In this section we explore what we hear (the auditory stimulus) and how we hear (the auditory system).

WHAT WE HEAR: THE AUDITORY STIMULUS.

Have you ever stopped to ask, 'What is a sound wave"? To understand audition, we need to answer that question. A *sound wave* is essentially moving air. Objects that vibrate cause air molecules to move, and the movements of these molecules make up sound waves.

Like light waves, sound waves have three distinct characteristics: wavelength (frequency), amplitude (intensity), and purity (also known as *timbre).* Shorter wavelengths occur more frequently; longer wavelengths occur less frequently. Frequency is measured in cycles per second and expressed in **hertz (Hz).** People with longer vocal cords have lower voices (lower-voiced people do not vibrate as rapidly.

As with light waves, the amplitude, or height, of the sound wave affects its intensity. Greater amplitude results in a more intense sound. The volume control on your CD player adjusts the amplitude or intensity of the sound you hear. The amplitude of sound waves is measured in **decibels (db)**. Decibel

levels represent the amount of energy producing the pressure of the vibrations we perceive as sound; the greater the pressure, the stronger or more intense the vibration.

Just as we seldom see pure colors, we do not hear only one pure tone at a time. Consider the variety of sounds you hear when you listen to the radio. Then add your roommate talking, traffic noise from the street, and a ringing phone. The purity or *timbre* of a sound wave can be measured, but we do not experience many pure tones in our lifetimes.

Like the visual receptors, the auditory receptors are sensitive to a limited range of sound waves. Basically, we hear sounds with wavelengths between 20 and 20,000 Hz. Even within this "normal" range of hearing, we do not hear all sounds equally well. Our hearing is more acute at 1,000 Hz; greater intensity (amplitude) is required if we are to hear tones at lower and higher frequencies. Thus to hear all of the low and high frequencies on a CD, we would need to turn the volume up very high.

HOW WE HEAR: THE AUDITORY SYSTEM

The remarkable range of our auditory ability suggests the presence of an intricate system. The auditory system is divided into three components: the outer ear, the middle ear, and the inner ear.

The outer ear, especially the *pinna*, gathers sound waves and starts them on their way to the auditory receptors. The sound waves are then funneled down the *auditory canal*. Ultimately they strike the *eardrum* and cause it to move. Movement of the eardrum in turn causes the three bones (hammer, anvil, and stirrup) of the middle ear collectively called the **ossicles,** to vibrate. **The *hammer*** (malleus), which is attached to the eardrum, strikes the anvil (incus). The anvil in turn strikes the stirrup (stapes). The stirrup is connected to the **oval window,** which connects the middle ear to the snail shaped cochlea of the inner ear.

When the stirrup causes the oval window to vibrate, fluid located in the cochlea is set in motion. The motion of the fluid produces vibration in the **basilar membrane**. This vibration in turn causes the **organ of Corti,** which rests on it, to rise and fall. When the organ of Corti moves upward, the hair cells that project from it brush against the **tectorial membrane** located above it.

The hair cells are the auditory receptors where transduction occurs. Contact with the tectorial membrane causes them to bend; when they bend, they depolarize. Sufficient depolarization of the auditory receptors causes the neurons that synapse with them to fire. The axons of these neurons come together before they leave the cochlea to form the auditory nerve, which transmits auditory information to higher brain centers. From the cochlea, the auditory nerve travels to the medulla, where some fibers cross to the opposite hemisphere. The remaining fibers do not cross. The next stop is the thalamus.

Ultimately the information reaches the temporal lobe of the cortex for processing. At present there are two theories to explain how we hear different tones or pitches. The older **Place Theory**, proposed by Herman von Helmholtz in 1863, says that hair cells located at different places on the organ of Corti transmit information about different pitches. For example, bending hair cells located near the oval window results in the perception of higher frequencies, whereas bending hair cells farther away results in the perception of lower frequencies. The place theory to be correct, the basilar membrane has to

vibrate in an uneven manner, which is exactly what happens with frequencies above 1,000 Hz. This uneven vibration, known as a *traveling wave,* is caused by the differential thickness of the basilar membrane. The basilar membrane is thinnest near the oval window and becomes progressively thicker.

What about frequencies below 1,000 Hz? Here the **Frequency Theory** of Ernest Rutherford applies. In 1886, Rutherford suggested that we perceive pitch according to how rapidly the basilar membrane vibrates. The faster the vibration, the higher the pitch, and vice versa. The frequency theory works fine with frequencies up to 100 Hz; typically, however, neurons do not fire more than 100 times per second. How do you get from 100 to 1,000 Hz, where the place theory begins? The *volley principle* (Rose et al., 1967) suggests a likely possibility. According to this view, at frequencies above 100 Hz auditory neurons do not all fire at once; instead they fire in rotation or in volleys. For example, for a 300 Hz tone, one group would fire at 100 Hz, to be followed by a second group that also fired at the next 100 Hz interval, and then by a third group that fired at the next 100 Hz interval. The activation of these three groups of neurons would tell the nervous system that you had heard a tone of 300 Hz. Certainly the ability to discriminate among various pitches is an important attribute. Equally important is our ability to locate sound in space. Think of how confusing our world would be if we could not tell where sounds were coming from. Driving would be a nightmare, we could not tell which people were talking to us unless we saw their lips moving, and it would be impossible to find a lost child by hearing a call for help.

Two mechanisms help us locate the source of a sound. The first is blockage of certain sounds by the head. Because the head partially blocks sound waves coming from the opposite side of the body, those sounds are a bit weaker and are perceived as farther away. For example, if someone on your right side is talking to you, the sounds of his or her speech enter your right ear unblocked. Your head, however, partially blocks these sounds before they enter your left ear. In this way the sounds entering your right ear are a bit stronger than those entering your left ear and you are aware that the person is on your right. Similarly, your pinnas (outer ears) help block sounds coming from directly behind you.

The second mechanism is time delay in neural processing. The brain processes the difference in time when a sound enters one ear and when it enters the other ear to enable you to locate sounds in space. If a sound is presented on your right, it enters your right ear first, and then enters the left ear. Even though the time difference may be only a few milliseconds, it is enough time for your brain to process and help you locate objects in space.

Defining Learning

Most psychologists define **learning** as a relatively permanent change in behavior or the potential to make a response that occurs as a result of some experience (Hergenhahn &Olson, 2001; Mazur, 1998). This definition distinguishes learned behaviors from those that occur automatically in response to external events, like shivering in a cold wind or sweating when it is hot. By including the concept of experience in the definition of learning, we distinguish between learned behaviors and behaviors that become possible as our physical capabilities develop--- that is, *maturation.* For example, when you were

6 months old it is unlikely that you were able to walk. Around your first birthday (or shortly after), the ability to walk emerged. Did it occur as a result of learning? As we will see, the answer is no. When you were 2 years old, you did not have the strength to lift a 5 pound weight. By the time you were 10, however, lifting 5 pounds was easy. You did not have to learn anything to be able to walk or pick up the 5-pund weight. As a result of the process of maturation, your muscles and nerves had developed to the point that you were able to walk and to lift weight. Let's take a look at this question: why would Linda's improved driving ability in Chicago is considered an example of learning? Unless Linda was very young at the time she began big-city driving, we can rule out maturation as a cause for the change in her behavior.

Likewise, the change in Linda's driving behavior is not an automatic response, like shivering in a cold wind or blinking when a puff of air is directed toward your eyes. Rather, the repeated experience of rush-hour city driving has brought about a change in her behavior.

Psychologists study color vision in animals such as Ruby the elephant. Ruby's painting also provides us with a good example of learning. Initially, the sound of the word "paint" had no meaning, and Ruby made no response to it. After the word was associated (paired) with one of her favorite activities, Ruby began to squeal when her trainer said "paint". Ruby had learned that this word signaled the opportunity to engage in an enjoyable activity. The elephant's response is an example of a relatively permanent change in behavior that occurs as a result of experience; she has *learned.*

There are three basic types of learning, *classical (or respondent) conditioning and operant (or instrumental) conditioning.* The third basic type of learning is *observational* learning or modeling. Keep in mind that the word ***conditioning*** refers to the fact that the learner forms an association, usually between a stimulus and a response or between two stimuli.

Classical Conditioning

A psychology class is participating in an unusual demonstration. The instructor passes a can of powdered lemonade mix around the room; each student puts a spoonful of the powder on a sheet of paper. Once all students have their own lemonade powder, they are instructed to wet one of their fingers. When the instructor says "now," each student puts a small amount of lemonade powder on his or her tongue with the moistened finger. The effect of putting lemonade powder on the tongue is predictable: The mouth puckers, and saliva begins to flow. The instructor has the students repeat this procedure several times during the class period until all the lemonade powder is gone. Before the class period ends, the instructor says "now" without warning. The student's mouths pucker, and saliva flows. What is the purpose of this class demonstration?

This demonstration is an example of *classical conditioning*, which has become so closely associated with the Russian scientist Ivan Pavloc (1849-1936) that it is often called *Pavlovian conditioning.* Pavlov was a physiologist whose work was so well respected that he received a Nobel Prize in Medicine in 1904 for his research on digestion.

Although Pavlov conducted much of his research with dogs, examples of classical conditioning can be found in many human behaviors. **Classical conditioning** is a form of learning that occurs when two

stimuli—a neutral stimulus and an unconditioned stimulus—that are "paired" (presented together) become associated with each other. For example, the sight of McDonald's golden arches and the smell and taste of a juicy burger have occurred together, and as a result many people associate the golden arches with tasty fast food.

Basic Elements of Classical Conditioning

We have said that the procedure for establishing classical conditioning is to present two events called *stimuli*so and that the pairing of these two events causes a human participant or animal to make an association between them. At the start of conditioning, the first event, which in a laboratory setting may be presentation of a light or a tone, is neutral---that is, not currently associated with the response to be established? What was the neutral stimulus in the lemonade example at the start of this section? Keep reading and you will find out. When this **neutral stimulus (NS)** is presented, the participant may notice that it is there, but it does not cause any particular reaction. By presenting the second event, called an **unconditioned stimulus (UCS),** after the NS however, we transform the NS into a **conditioned stimulus (CS).** The NS becomes a CS because it is repeatedly paired with a UCS. This pairing eventually causes the participant to establish an association between the two events; the CS comes to *predict* the occurrence of the UCS. In the lemonade powder example the work "now" was the NAS it became a CS after it was paired with the lemonade powder.

Cognitive and Social Perspectives on Learning

The door to the garages was ajar and Mary became frightened; she was afraid that someone might be trying to rob the house. Trembling, she peeked into the garage to discover that her 3-year old son was in the driver's seat, fiddling with the car key. Suddenly the engine started to run and Mary made a dash to the car to prevent an accident. At a family gathering several weeks after this event, Mary was discussing what had happened; family members seemed quite surprised that a 3-year-old could start the car. One of Mary's cousins, Sally, is a psychology major who had some ideas concerning what happened that day. *How would psychologists explain how this 3-year-old managed to start the car?*

We encountered contingency theory and blocking in our study of classical conditioning. These processes suggest that classical conditioning is not a simple mechanical process; rather, mental activity or thought processes (cognition) are involved to some degree. The relation of cognition to basic learning processes, such as insight learning and latent learning, has been studied for many decades.

The Role of Cognition

Two of the most compelling examples of how cognitive factors are involved in learning are: insight learning and latent learning. We will discuss these next.

Insight Learning

The importance of cognition to operant conditioning can be seen in the process known as insight learning. **Insight learning** is a form of operant conditioning in which we restructure our perceptual stimuli (we see things in a different way), make an instrumental (operant response, and generalize this behavior to other situations. In short, it is not blind, trial-and-error learning that develops gradually but a type of learning that occurs suddenly and relies on cognitive processes. It is the "aha!" experience we have when we suddenly solve a problem.

Research by the Gestalt psychologist Wolfgang Kohler (1927) exemplifies insight learning. Using chimpanzees as his test animals, Kohler gave them the following problem. A bunch of bananas was suspended out of reach of the chimps. To reach the bananas, the chimps had to stack three boxes on top of one another and then put together the pieces of a jointed pole to form a single, longer pole. After several unsuccessful attempts at jumping and trying to reach the bananas, Kohler's star pupil, Sultan, appeared to survey the situation (mentally rearrange the stimulus elements that were present) and solve the problem in the prescribed manner. Kohler believed that Sultan had achieved insight into the correct solution of the problem.

Consider the solution of a particularly difficult math problem. You struggle and struggle to solve the problem, without success. In frustration you set the problem aside and turn to another assignment. All of a sudden you understand what is required to work the math problem successfully; you've had an "aha!" experience. How you perceive the situation has changed; insight has occurred. Once this problem has been solved, you are able to solve others like it. Similarly, one of the authors of this book works on word puzzles; the daily newspaper carries two of them almost every day.

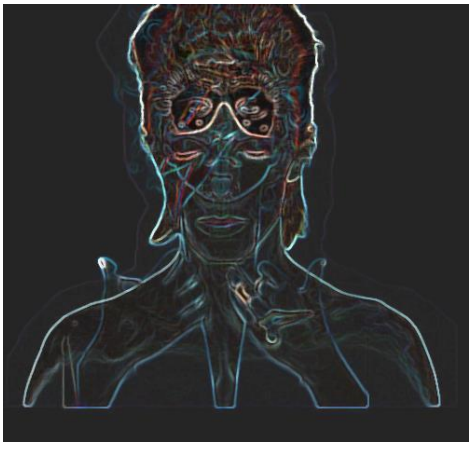
Sometimes he struggles to rearrange the mixed up letters to form words, and, some times the answers appear almost instantly. Quite often (especially after he takes a brief break from the puzzle), the answer seems to occur quickly, as insight has been achieved. Thus cognitive processes are important in helping us to adapt to our environment. As we shall see, other organisms----even rats----- may use cognitive processes as they go about their daily activities.

Latent Learning

Psychologist Edward C. Tolman presented persuasive evidence for the use of cognitive processes in basic learning in his study of maze learning by rats (Tolman & Honzik, 1930). Tolman is associated most often with his study of **latent learning,** which occurs when learning has taken place but is not demonstrated. In one of Tolman's most famous studies, three groups of rats learned a complex maze that had many choices and dead ends. One group of rats was always reinforced with food for successfully completing the maze.

These animals gradually made fewer and fewer errors until after 11 days of training, their performance was nearly perfect. A second group was never reinforced; the rats continued to make numerous errors. The third (latent-learning group of animals did not receive reinforcement for the first 10 days of training. On the 11thday, reinforcement was provided. The behavior of these animals on the 12th day is of crucial importance. IF learning occurs in a gradual, trial-and-error manner, the rat's performance on the 12th day should not have differed much from their performance on the 11th day. If, however, the rats used cognitive processes to learn to navigate the maze, they would exhibit dramatic behavior changes. In fact, on the 12th day these rats solved the maze as quickly as the rats that had been continually reinforced. How did these rats learn so quickly? Tolman argued that by wandering through the maze for 10 days before the introduction of reinforcement, these animals had formed a cognitive map of the maze. In other words, they had learned to solve the maze, but this knowledge had remained latent (unused) until reinforcement was introduced on the 11th day. Then, on the 12th day, these rats demonstrated that they knew how to get to the location of the reinforcement. Their latent learning had manifested itself. The implications of this finding are clear: It is possible to learn a behavior, yet that learning is not directly observed.

Observational Learning



As the previous discussion suggests, our behavior and the behavior of other animals is not just mechanically stamped in or out. There is a degree of cognitive activity or processing of information that is involved when we learn. Consider the following example. Imagine that you have given permission for your 6-year-old son and 8-year-old daughter to participate in a psychological experiment at the local university. During the experiment each child watches an adult play with a large inflatable doll that can double as a punching bag. Because the doll's base contains sand, the doll bounces back when it is punched and then is ready for more punches.

The adult gives the doll a merciless beating; then each child is given an opportunity to play with the doll. Control participants, who had not observed the adult model, behaved less aggressively. Because the children made no responses while they were watching, the researchers concluded that simply observing the behavior and reinforcement (or punishment) of another participant could result in learning. (Bandura, 1977). Such learning is termed **Observational Learning** or modeling. Because the observation of other people is a central factor in this form of learning, this approach is often called social learning theory.

While a great deal of concern has been raised concerning the possible effects of learning violence from television, a more recent concern focuses on video games, which can be highly violent. Researchers Craig Anderson and Karen Dill (2000) found that playing violent games was positively correlated with aggressive behavior and delinquency in children. The cautions we raised concerning correlation evidence. In a second study, the researchers found that exposing a random sample of children to a graphically violent video game had a direct and immediate impact on their aggressive thoughts and behavior.

What's more, a review of the literature on the effects of video game violence led researchers (Anderson & Bushman, 2001) to the following conclusions:

The results clearly support the hypothesis that exposure to violent video games poses a public-health threat to children and youth, including college age individuals. Exposure is positively associated with heightened levels of aggression in young adults and children, in experimental and non-experimental designs, and in males and females. Exposure is negatively associated with pro-social behavior.

If you stop to think about it, observational learning is the main way we learn about our culture and its customs and traditions. Let's return to the story that opened this section. Observational learning is most likely how Mary's 3-year-old son learned to start the car. He has most likely observed his mother and father put the key in the ignition and turn it hundreds if not thousands of times.

One key to observational learning appears to be that the participant identifies with the person being observed. If we put ourselves in the other person's place for a moment, we are better able to imagine the effects of the reinforcement or punishment. This phenomenon is called *vicarious reinforcement or vicarious punishment*.

Observational learning is a widespread phenomenon, it is even found among a number of animals. For example, rats that observed the extinction behavior of other rats subsequently stopped responding more rapidly than rats that did not observe extinction performance (Heyes, Jaldow, & Dawson, 1993). In another experiment, monkeys reared in a laboratory didn't fear snakes. After watching another group of monkeys react fearfully to snakes, however, the non-fearful monkeys developed a pronounced fear of snakes.

Summary

Attempts to influence behavior through observational learning occur every day. Turn on the television and you are bombarded with commercials, which are nothing more than a form of observational learning. If you drive this kind of car, wear these clothes, use this brand of perfume, shower with this soap, use this shampoo, and eat this kind of breakfast, you will be rich, famous, powerful, sexy, and so forth, just like models in the commercials. According to the social learning theory proposed by Bandra (1986), for observational learning to be effective, the following conditions must be present:

1. You must pay attention to what the other person is doing and what happens to him or her.
2. You probably will not make the modeled response immediately, so you need to store a memory of the situation you have observed. For example, catchy advertising jungles that run through our heads continuously help us remember a particular commercial and its message.
3. You must be able to repeat or reproduce the behavior you observed. It might be wonderful to dream of owning a Porsche, but most of us will never be able to reproduce the behaviors needed to obtain one, regardless of how often we watch the commercial.
4. Your motivational state must be appropriate to the behavior you have learned through observation. Watching numerous commercials of people drinking a particular soft drink will not normally cause you to purchase one if you are not thirsty.
5. You must pay attention to discriminative stimuli. Sometimes we do not choose the best time and place to imitate someone else's behavior. For example, it would not be wise for teenagers to model some of their peers' behaviors at the dinner table.