Heinz Bachmann

EVEN LEARNING HAS TO BE LEARNED

learning theories and their application in classroom

Teacher “Lämpel” in the book “Max & Moritz”

by Wilhelm Busch (1832 – 1908)

About this publication

The following document is the result of an assignment to write a series of short texts about learning theories and their application in teaching for the Training Institute for Technical Instruction in Nepal, dating back to 2001. Later on, the texts were translated into German and published in form of a **book for teachers without a pedagogical background and for their learners** (Bachmann, H. [2003]. *Auch Lernen will gelernt sein*. Aarau: Sauerländer). The present edition was up-dated the last time in 2019.

Preface

Learning, unlearning, relearning – lifelong learning is a must today. New technologies, globalisation and the restructuring hereby involved have irrevocably and, in some cases, dramatically changed labour markets and jobs. The change is far from complete, and in most occupational fields the demands are constantly increasing. Those who don't learn new things and don't go along with them will fall behind. Only those who continue to learn permanently remain fit for the job market and will also have opportunities in the future.

The order of the day is "learning". But where can learning be learned? The insight that learning must be learned, i.e. that it is a basic competence to cope with future challenges, has not yet gained the necessary acceptance in higher education institutions. "Our students know how to learn," is still heard all too often at universities, and the view that only the weaker students need to learn is widespread. Even in the training of higher education teachers, the teaching of learning does not yet play the role it should in today's environment. Learning becomes teachable only when more and more authors take up the subject and its many sub-areas, and if various fragments from the numerous disciplines are brought together to form a whole.

This book by Heinz Bachmann helps to make learning teachable. The psychologist and experienced teacher skilfully bridges the gap between theory and practice. His work impresses with its brevity and conciseness. The author first explains the most important learning theories and illustrates them with illuminating examples. The remaining chapters are dedicated to learning practice; in addition to efficient and effective strategies, creativity and dealing with stress are also included. Each chapter concludes with a summary and a self-evaluation checklist.

The book suggests rethinking learning and teaching of learning. It helps to change perspectives and to better understand learners.

Heinz Bachmann's book is not only useful in the training of prospective higher education teachers. It can also inspire experienced teachers and lecturers and serve as a methodological toolbox for teaching learning.

I wish the book the success it deserves – and you, dear reader, great success in your own learning and teaching!

Dr. Verena Steiner, Zurich 2003
Part-time lecturer for study skills at the Swiss Federal Institute of Technology Zurich, ETH
Author of the book *Explorative Learning*

About the author

Heinz Bachmann was a natural science teacher for 15 years at secondary school level in the Canton of Zurich, Switzerland. He also taught in Africa, Latin America and Asia from kindergarten up to secondary school level as well as in high school and colleges. After completing a second degree in psychology at the University of Zurich where he also did his PhD he worked as teaching advisor and school psychologist. Later, he switched to development co-operation. He currently works as an academic advisor at the Centre for Teaching and Learning in Higher Education at the Zurich University of Teacher Education. Additionally, he is employed as a part-time lecturer for intercultural communication at the University of Liechtenstein.

In his work, he focuses on: Higher education teaching, learning, change management, education research, and intercultural communication.

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Content

Introduction

"Nothing is constant but change," says an old proverb. In a rapidly changing society, people have to keep learning on a continuous basis to deal with new information and technology at work. There is a need for lifelong learning. Understanding the foundations of learning can help us to cope with this challenge. **Foundations of learning encompasses basic study skills and knowledge about the most important theories of learning.**

Why teach study skills?

Unsuccessful learners typically use ineffective study skills. Many teachers expect learners to acquire study skills (see figure 1) on their own. Research, however, indicates that this does not work. Study skills must be taught. **We have to learn how to learn!**

Furthermore, research tells us that study skills are best learned when they are integrated with domain specific content in the courses learners are currently taking. That means **every teacher must help learners to apply study skills in their classes.**

Why study theories of learning?

To be an effective teacher you must understand how people learn. Teaching and learning are interrelated. **The word *teach* is defined as** "**to help to learn by telling or showing**" (Collins English Dictionary, 1991). Every teacher has his/her **personal theory or beliefs about learning** that serves as a guide for learning and teaching. These theories are constructed from past experiences. They consist of a set of beliefs and hypotheses that serve to guide our actions. Unfortunately, we cannot personally experience all the knowledge we need to succeed in teaching.

Fortunately, we can rely on the experience of others. Researchers have established the effectiveness of many principles that aid teaching and improve learning.

Learning defined

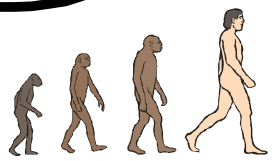
We use the term *learning* when people become capable of doing something different from what they could do earlier. The term "capable" is important because people often acquire skills and knowledge without overtly demonstrating them at the time learning occurs. Another criterion is that learning occurs through practice or experience. Processes of human maturation also produce changes in behavior but are not regarded as learning. For example, the ability of a baby to crawl is more a process of maturation than of learning. A modern definition of learning would be: ***Learning is a relatively persistent change in behavior, or in the capacity to behave in a given fashion, due to experience.***

Historical roots

The roots of contemporary learning theories extend far into the past (see figure 1). Many of the problems addressed and questions asked by modern researchers are not really new but rather reflect a universal desire for people to understand themselves and the world around them. Each culture has its own great scholars, people with outstanding ideas and great wisdom. For example, Buddha or Confucius to mention only two eastern philosophers. For western cultures Plato and Aristotle are well known examples. It has frequently been said that almost all modern ideas about learning are a refinement of the thoughts of the Greek philosophers Plato and Aristotle. **Plato** (427 – 347 B.C.) believed that rational thinking is the key to learning (*rationalism)*. Memory and how we think is central for learning. This position is recognizable in current psychological learning theories that fall under the heading **cognitivism**. **Aristotle** (384 – 322 B.C.) however, emphasized experience as the true source of learning (*empiricism*). His ideas about associative learning can be found in current psychological learning theories that fall under the heading **behaviorism**. Most of the scientific research on learning has been conducted in the field of psychology primarily during the last 100 years. But research done in biology also contributed to insights in the process of learning. **Charles Darwin** (1809 – 1892) stated that all creatures are subject to evolutionary processes. Animals and human beings are biologically equipped to survive in their environment by adapting to its demands. Learning is regarded as a survival strategy that allows us to adapt to a changing environment (**functionalism***)*. For Darwin there was no sharp boundary between higher and lower animals. Therefore, researchers were justified in using data from experiments with animals to derive models for human learning. At present, biology serves again as an important source for new insights in learning. A branch of biology called **neuroscience** studies the structure and chemistry of our brain and tries to link physical processes with mental processes.

Conclusion

Learning has taken place when people are capable of doing something different from what they could do earlier. The roots of contemporary learning theories extend far into the past. Nevertheless, most knowledge about learning was gained during the past 100 years in the domain of psychology. Every teacher is not only a subject matter specialist but also an expert in learning. Basic study skills must be taught to all learners and must be applied in all subject's areas. Teaching is guided by a personal theory of learning. The more complete this personal theory of learning is the more the teacher is able to help learners acquire new knowledge, skills, and attitudes.



foundations of learning

18/08/00 - v10

philosophy/religion

- rationalism
  - *Plato*
  - "see cognitivism"
- empiricism
  - *Aristotle*
  - "see behaviorism"
- confucianism
  - *Confucius*
- buddhism
  - *Buddha*

psychology

behaviorism

- classical conditioning
  - *Pavlov*
  - *Watson*
- operant conditioning
  - *Skinner*

cognitivism

- Gestalt psychology — *Wertheimer*
- developmental theory — *Piaget*
- discovery learning — *Bruner*
- meaningful reception learning — *Ausubel*
- social cognitive learning — *Bandura*
- constructivism — *Glasersfeld*
- metacognition — *Flavell*
- learned helplessness — *Seligman*
- learning styles — *Kolb*

study skills

- take notes
- use mind mapping
- use mnemonics
- be creative
- manage stress
- conduct timely reviews
- use effective reading strategies
- organize your learning

biology

functionalism

- theory of evolution / survival of the fittest — *Darwin*

neuroscience

- change in brain structure
  - *Hebb*
  - *Rosenzweig*
- right/left brain — *Sperry*
- reinforcement center in the brain — *Olds&Milner*

Apply Principles of Classical Conditioning

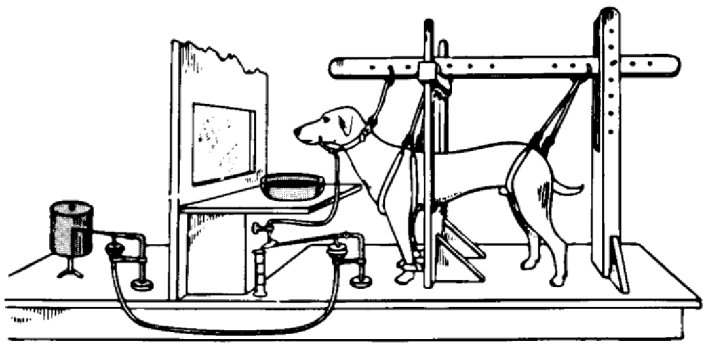


Figure 1 Pavlov's apparatus for studying conditioning

Introduction

During the early years of the twentieth century there was an emphasis on observable behaviour as the unit of study for psychology. The school of psychology that became known as **behaviourism** argued that psychologists should study behaviour only, avoiding analysis of subjective interpretation of mental processes. Behaviourists believe that the **environment** is the determining influence in shaping the character and destiny of each person. Hereditary factors are held to be of little consequence. According to this theory, it is possible to form people into almost any required character by a process of conditioning.

Conditioning

The new-born baby is fed and nursed by his/her mother. She is the one who satisfies all the baby's early needs. Quickly she comes to associate her with the satisfaction of these needs and even the sound of her voice may be enough to settle him/her when she cries. The child is **learning through association.** Our minds naturally link events that we have experienced together. Learning by association, or conditioning as it is called, is a useful method for learning attitudes and habits. It is also the basis of propaganda and advertising slogans that try to make us associate the whites washing with a particular brand of soap powder, or the fastest car with a particular make.

Ivan Pavlov

Associative learning is often called **classical conditioning** because it is based on famous, classic experiments. Ivan Pavlov (1849-1936), a Russian scientist, specialised in research on the physiology of digestion. This earned him a Nobel Prize in 1904. As part of his research on digestion, Pavlov set out to measure the degree to which dogs salivated while eating. A dog was given a measured amount of food and the resulting saliva was collected on the underside of the dog's mouth (see Figure 1). One day Pavlov noticed that the dog began to salivate at the sight of food or even the individual who brought it. Pavlov decided to study this phenomenon systematically. He set up a carefully controlled situation in which a bell was sounded just before the dog was presented with a small amount of food. After several pairings of bell and food, the bell alone aroused salivation. Pavlov called the food an **unconditioned stimulus** (abbreviated **UCS**) because it naturally causes salivation in hungry organisms. He called the salivation an **unconditioned response (UCR)** since it was a naturally occurring response. The new stimulus (the bell) he called a **conditioned stimulus (CS)** because it was a previously neutral stimulus that did not cause salivation. The response to the bell was labelled a **conditioned response (CR).**

The complete sequence of events Pavlov studied can be diagrammed as follows:

Phase	Stimulus	Response
1	UCS (food)	UCR (salivation)
2	CS (bell), then UCS (food)	UCR (salivation)
3	CS (bell)	CR (salivation)

John B. Watson

John Broadus Watson (1878 - 1958), an American psychologist, generally is considered to be the founder of modern behaviourism. He was a follower of Pavlov's research and used conditioning as the basis for his views of learning. He demonstrated the power of conditioning in humans in his famous **Little Albert** experiment. Albert, an 11-month-old baby, showed no fear of white rats. During conditioning, a hammer was struck against a steel bar behind Albert as he reached out for the rat. By hearing the loud noise (UCS) the baby jumped violently and started to cry. This reaction of fear was the unconditioned response (UCR). The rat (CS) and the loud noise (UCS) were paired several times, after which the rat was presented alone. The instant the rat was shown the baby began to show fear (CR).

Application in training

- Conditioned stimuli are things the trainee has learned to like or dislike. For example, grades. A slip of paper with an "A" or an "F" written on it has no meaning to a person who has never learned the meaning of the grade. Yet learners work hard to gain "A's" and avoid "F's". Plan for ungraded activities. Instead of linking good grades with positive feelings make use of the natural, unconditioned stimulus-response reaction between success and joy.

Mastery learning doesn't need any conditioning. The success (mastering a skill) is naturally linked with positive feelings.

- Classical conditioning explains why test failure can cause anxiety. Early in life, failure may be a neutral event. Often it becomes associated with disapproval from parents and teachers, which can serve as a UCS and cause anxiety. Other things associated with the situation also can become conditioned stimuli. It is not unusual for learners to experience anxiety when they walk into a room where they will take a test or when a teacher passes out a test. Don't scold a learner for bad test results. Analyse with him or her the mistakes made and support the person with ideas how to improve next time.
- If a learner misbehaves in a training situation we are often tempted to regulate his/her behaviour by punishing him/her. Doing this can have a very negative side effect. The punishment might stop his/her misbehaviour for the moment but at the same time associates negative feelings not only with the behaviour but also with the person of the teacher, the topic, or the training. As a result he or she starts to dislike learning in general. To avoid this, it's better to show the person another way to behave rather then just punishing him or her. This side effect is especially known in corporal punishment.
- Another well-known phenomenon is the learner who doesn't want to participate in any activity because he/she wants to avoid failure. Failure, initially a neutral stimulus, can become a conditioned stimulus if the teacher criticises failure every time it occurs. Critic (UCS) causes negative feelings (UCR). Failure (CS) is paired with critic and can after some repetition cause negative feelings (CR). To avoid these negative feelings a learner might decide to stop participating and learning. No learning means no failure, means no negative feelings. Because of this avoidance behaviour the person misses also an opportunity to gain a different experience. In a vicious circle learning is blocked. Knowing this mechanism we, as teachers, should positively support learners rather than criticise them. Stress to your learners, by words or deeds that it is ok to fail as long as we can learn something from the failure.
- If a learner experiences many failures and few successes he/she starts to believe that his endeavours are pointless. He/she associates learning with helplessness. Whatever effort he/she takes it doesn't show any positive result. There is no point in making an effort. Because of this attitude success becomes even less likely. Again we are in a vicious circle. Excessive demands result in frustrations that are associated with learning. As a teacher we have to provide learners with many situations where they can experience success.

Summarising the above findings we, as teachers have to plan, that trainees have many opportunities to experience success. Corrections should be positively formulated and not come in the form of negative statements. Failure should be regarded as a challenge to learn something new and not as something negative. A positive attitude towards our learners is essential for their learning.

Summary

Classical conditioning is the learning of "relations between events". An association between two stimuli is formed. Some associations are easier to form than others because of the biological preparedness of the organism. Animals have the potential to do harm. Humans are biologically prepared to suspect them and therefore learn with relative ease to fear or avoid them. Sometimes one encounter is enough to condition a stimulus with a response, other times repeated certain pairing is necessary.

Performance Guide
Apply Principles of Classical Conditioning

Did the teacher

1. use mastery learning concepts?
2. plan for ungraded activities?
3. communicate "it is okay to fail"?
4. regulate behaviour with reward when possible?
5. provide positive, developmental feedback?
6. plan for "success" experiences for all learners?
7. maintain a positive attitude?

Any "NO" means there is room to improve!

Principles of Operant Conditioning

Introduction

Operant conditioning is a behavioristic learning theory formulated by the American psychologist B.F. Skinner (1904 – 1990). B.F. Skinner is regarded as one of the most influential American psychologists of the twentieth century. His ideas are applied in school learning and discipline, upbringing of children, and vocational training. Behavior principles are commonly applied to enhance learning and produce desirable behavior. In operant conditioning, **a voluntary response is strengthened when it is reinforced.**

Limitations

Operant conditioning is regularly criticized because of:

- lack of concern of mental processes;
- insufficient description of complex behavior;
- overemphasis on external control as opposed to personal responsibility;
- disregard of intrinsic (self-) motivation.

The basic operant model of conditioning

In operant conditioning, the most fundamental elements are the stimulus situation, the response, and the consequences.

S^D → R → S^R

A discriminative stimulus (S^D) triggers a response (R) , which is followed by a reinforcing stimulus (S^R). For example, the teacher asks a question (S^D), calls on a learner volunteer who gives the correct answer (R), and praises the learner (S^R).

The discriminative stimulus is not always taken into account. This has something to do with the fact that in many everyday situations several stimuli opperate simultaniously, making it impossible to know precisely what triggered a particular behavior. For example, we may go for tea because we are thirsty or/and because we want to meet friends.

The Skinner Box

At the beginning, Skinner conducted animal studies using an apparatus now named after him – the Skinner Box. A Skinner Box is a small container with a lever inside. Outside the box is a hopper with food pellets that are dropped into the box when the lever is pressed under **certain conditions**. A hungry rat is placed in the box, and when – in the course of exploring its new environment – it presses the lever, it is rewarded with food. Food is supplied only when the lever is pushed and in addition another condition is fulfilled, for example, a light is flashing. The rat learns in this way to press the lever in the presence of a flashing light. Without the flashing light present, pressing the lever has no effect. At the beginning, the rat **generalizes** and presses the lever whether the light is flashing or not. Eventually, after selective reinforcement is repeated often enough, the rat **discriminates** and presses the bar more frequently when the light is flashing. If reinforcement is stopped, over time **extinction** occurs, the lever is not pressed anymore. With such kind of experiments Skinner explained how animals and **people learn new behavior as a result of the consequences that follow a behavior**.

Basic processes in operant learning

Reinforcement

When a consequence (stimulus) serves to increase the rate of a response, it is called a reinforcer. For example, when a teacher who works overtime (response) is given additional money (reinforcer) to his /her normal salary, he/she is likely to repeat this performance; she/he learns to work overtime. Skinner called reinforcers that increase behavior subsequent to their presentation **positive.** Remember, something is added (+) to a situation. Money, grades, praise, smiles, candy, spare time all are positive reinforcers. Reinforcers that increase behavior if removed are called **negative** or aversive reinforcers. Remember, something is taken away (subtracted, -). When class tests, assignments, criticism, serve to increase behavior if removed they are called negative reinforcers. For example, if learners increase their participation in a session and the teacher subsequently cancels a scheduled test, the cancelled test would be called a negative reinforcer. Whether positive or negative, **reinforcers always increase the rate of a response.** Some events do not produce a consequence or do not change response rate. Therefore they are considered neutral stimuli in Skinner's terminology.

Punishment

Punishment reduces undesirable behavior being repeated. An aversive stimulus is presented to decrease the rate of response. A slap in the face, scolding, ridiculing, or making a learner write one hundred times "I will not argue with my teacher" are all examples of punishment. Punishment is quite different from negative reinforcement.

In punishment you add a stimulus and you decrease a behavior. In negative reinforcement you take a stimulus away and you increase a behavior. Skinner was very critical about punishment because of its side effects:

- Punishment reduces the occurrence of behavior but does not eliminate it. A teacher might stop a misbehavior in the classroom with the result that the misbehavior is shown again in class with another teacher.

- Any behavior that allows avoidance of punishment will be reinforced. Lying, for example, is likely to increase when it makes possible the avoidance of punishment.
- Punishment does not show the desired behavior. The attention is on what the individual did wrong, rather than what should be done to correct it.
- Punishment produces guilt, fear, anger, aggression that interfere with learning.

Extinction

A response is weakened when it is ignored. Learners who raise their hands in a session but get no attention may stop raising their hands. Extinction is an alternative to punishment. Misbehavior will tend to extinguish if it is not reinforced. Therefore a possible reaction of the teacher is to ignore minor misbehavior.

Generalization

Generalization is a tendency for a conditioned response to be triggered by a stimulus similar to the original one. The auto mechanic who has learned to change the spark plugs in a Toyota should be able to do the same job in a Ford. Whether or not generalization is desirable depends very much on the circumstances (see discrimination).

Discrimination

Discrimination is the ability to distinguish between similar stimuli. Discrimination is the complementary process to generalization. It involves learning to notice the unique aspect of seemingly similar situations and to respond differently to each situation.

For our safety in traffic, it's important that all drivers distinguish between green and red traffic lights and respond adequately.

Reinforcement schedule

In the real world, reinforcement rarely is provided continuously. Reinforcement that occurs sporadically is referred to as intermittent (some but not all responses are reinforced). Counter to common sense, researchers discovered that in many cases an intermittent schedule is more effective than a continuous schedule. A famous example is the player at the slot machine in a gambling hall. Since payoff is variable, he/she knows that the more times he/she pulls the handle, the greater the chance of being rewarded. Consequently, she/he sits at a machine constantly feeding it coins, ignoring her/his occasional small winnings. This type of schedule is called **variable ratio**. Reinforcement is supplied after different number of responses that correspond to a predetermined average. This leads to a high and steady rate of response and limits extinction. If every response is reinforced such a schedule is called **continuous.** A continuous schedule is particularly effective in the early stages of learning when you want the learner to experience success. When a new skill is learned learners should receive feedback after each response concerning the accuracy of their work. Continuous reinforcement helps to ensure that incorrect responses are not learned.

Shaping

A preselected behavior is learned through a series of successive approximations. Many of the behaviors human beings learn are acquired gradually. Giving an injection for example, requires different behaviors like collecting the necessary material, disinfecting the skin with alcohol, choosing the right size of needle and so on. The key to success is to take one step at the time. The person must become aware that each step in the sequence is essential. To shape behavior, you have to stick to the following sequence:

- Identify what the learner can do now.
- Identify the desired (terminal) behavior.
- Identify potential reinforcers.
- Break the terminal behavior into small steps to be mastered sequentially.
- Guide the learner from the entry behavior to the terminal behavior by successively reinforcing each approximation to the terminal behavior.
- Three factors can hamper shaping:
- Too much positive reinforcement for early, crude responses reduce the learner's willingness to attempt a more complex behavior.
- Making the steps in a sequence too large decreases the likelihood of an appropriate response.
- Delayed reinforcement of the terminal behavior allows unrelated behavior to occur.

Skinner believed that shaping allows the production of complex behavior that were not likely to occur naturally in their final form.

Conclusion

Operant conditioning is a behavioristic learning theory. People learn a new behavior as a result of the consequences that follow that behavior. If the consequences are positive (reinforcement) a behavior is repeated. If the consequences are negative (punishment) a behavior is decreased. At the beginning of a learning process a new behavior should be reinforced continuously. Once mastered intermittent reinforcement is more effective. If a performance is not reinforced now and then it isn't exhibited anymore (extinction).

Apply Principles of Operant Conditioning

Introduction

Operant conditioning is a theory of learning formulated by the American behaviorist B.F. Skinner (1904 -1990). This theory has made a profound impact on learning and teaching all over the world. Skinner's theory explains how people **learn new behaviors as a result of the consequences that follow a response**. The idea of reward (reinforcement) provides the foundation for operant conditioning. A response (behavior) that is followed by a reinforcer is strengthened, and therefore more likely to occur again.

For more details, please, refer to the skill card "Principles of Operant Conditioning".

Guidelines

- **Emphasize positive reinforcement to learn a behavior.** Instead of using threats or punishment in learning situations, reward learners whenever possible.
- **Reinforcement must be provided in a clear and consistent manner.** As a teacher you should avoid giving your learners inconsistent messages about a specific behavior. Insisting in wearing goggles when working on the lathe machine one week, allowing trainees not to wear them next week, does not show them what is right or wrong. Desirable behavior must be clearly indicated through a consistent set of rules and clearly stated consequences.
- **Be specific.** Specify the behavior you want to see and reward learners who demonstrate it.
- **Identify stimuli (rewards) that can serve as reinforcers.** If a certain consequence is perceived as neutral, negative or positive depends very much on the time, the situation and the person. For a good learner, grades might be rewarding. For a learner with difficulties grades are very often not rewarding and therefore don't increase learning.
- **Proceed from a continuous to an intermittent (some but not all responses are reinforced) reinforcement schedule.** When a new skill is learned, learners should receive feedback after each response concerning the accuracy of their work. Continuous reinforcement helps to ensure that incorrect responses are not learned. Once a skill is mastered you can shift to an occasional reinforcement.

Give feedback

The most important element in operant conditioning is reinforcement: the impact of consequences on behavior. As a teacher, give feedback **frequently, specifically**, and **quickly.** This is particularly important when the material is complex and the learner is unsure of the correctness of his or her response.

- Call attention to the errors as quickly as possible and point out the correct response.
- Use question-and answer session after an assignment.
- To overcome the problem that you can't respond to every learner all the time, have learners team up and give each other feedback.
- Hand back and discuss all tests. Keep the time between the exam and the handing back as short as possible.

Design training

Teaching should be structured, following a simple-to-complex planned sequence leading to a terminal observable behavior. When designing instructional training, the following elements (amongst others) have to be kept in mind: *terminal behavior , initial behavior, sequence*.

Terminal behavior

Other terms used are learning objective, learning outcome, or terminal performance objective (TPO). Before beginning teaching Skinner insisted that the terminal behavior the learner has to acquire must be specified clearly, There should be a description of exactly **what a learner is able to do after the training**, under what **condition**, and up to what **standard**. For example, bake a bread (what) on a charcoal fire (condition) within one hour (standard).

Initial behavior

Before starting to plan a training, identify what the learner can do at present. For example, when assigned the task to " bake bread", has the learner experience in baking a cake? Does he/she know how to use a mixer? Does he/she know what baking powder is?

Sequencing

For teaching, not only is the terminal behavior important, it is also necessary to identify the sequence of responses leading to the terminal behavior. The steps must be of appropriate size, and they must be arranged in an effective sequence. In order to bake bread, you first have to collect the necessary material and ingredients. You then have to use a scale to weigh flour. In a next step you mix the ingredients and knead the dough. In between you must light the charcoal fire so that it emits maximum heat when you have finished the dough. A pot full of sand has to be placed on the fire. Finally you can bake your bread by placing it in the hot sand.

Implement training

Individualize teaching

Individuals differ in their aptitudes and rates of learning, in their interests and goals, and in their learning styles and personal behavior. Individualized teaching meets the learning needs of each learner in a unique way and thus enhances the chance of successful learning. Learners are asked to make choices and reach decisions and are held responsible for the consequences of those decisions.

As a teacher you have to:

- analyze learners' academic abilities, occupational strengths, learning styles, major goals and interests, and self-discipline;
- develop an individual learning plan with objectives and activities for (and with) the learner;
- organize the learning facilities and teaching materials for individual learning;
- guide learners through the learning process;
- identify and diagnose individual learning problems and help them to solve those problems;
- evaluate learners performance on an individual basis.

Revise your teaching regularly

Skinner referred to his model of learning as the experimental analysis of behavior. A continuous analysis and evaluation of instructional processes is necessary to check if your teaching is effective. Not only should reinforcers be reviewed frequently to determine whether they still increase desired behaviors, but the organization and sequence of content to be presented should be examined periodically to determine whether learners are progressing toward the terminal objective.

Write contingency contracts

The contract is a written agreement between the learner and the teacher. The learner agrees to behave in a common agreed upon way, and the teacher agrees to provide reinforcement as accepted by both parties. The desired behavior is specified in observable and measurable terms. The reinforcement is clearly stated (see Figure1). Contracts can be signed by a whole group as well as by a single learner. As with most contracts, provisions can be made for renegotiating the terms. A written contingency contract enhances the **commitment of a learner** to behave as expected. The learner has a clear understanding of the desired outcome and the provided consequences.

For a grade A,

Manju Shrestha

will write a one page summary on the article about operant conditioning within one week with no errors in language or grammar.

Signed: ***learner***

teacher

Figure1 Contingency contract

Conclusion

The learning theory of operant conditioning is based on the observation that people learn new behavior as a result of the consequences that follows that behavior. Principles of operant conditioning can be applied in many areas, for example, in training design, in individualizing teaching, and in providing good feedback.

Performance Guide
Apply Principles of Operant Conditioning

Did the teacher…		
Design a learning unit by:	**YES**	**NO**
1. defining the terminal behaviour?	____	____
2. identifying the initial behaviour?	____	____
3. sequencing the steps leading to the TPO?	____	____
Give feedback:		
1. frequently?	____	____
2. specifically?	____	____
3. quickly?	____	____
To individualise teaching:		
1. analyse the learners abilities?	____	____
2. develop an individual training plan?	____	____
3. organise the learning facilities?	____	____
4. evaluate learner performance individually?	____	____
To write a contingency contract:		
1. come to an agreement with the learner?	____	____
2. specify the behaviour in observable and measurable terms?	____	____
3. state the reinforcement clearly?	____	____

Any “NO” means you can improve your teaching.

Figure 1 Example of Gestalt Principle, figure/ground

Introduction

During the last decades cognitive psychology (**cognitivism**) was the predominant perspective in research on learning. Cognitive psychologists examine how individuals process information internally (mentally). Processes like attention, perception, memorizing, thinking, problem solving, motivation, and creativity are the center of focus. In contrast to behaviorists, who emphasize the roles of environmental conditions (stimuli) and overt behaviors (responses) in learning, cognitivists study mental processes that are not directly observable.

Purpose

Many assumptions underlying cognitivsm are radically different from behaviorism. Because people possess abilities that are unique to the human race (e.g. language, consciousness) learning in humans is regarded as different from learning in animals. Learning involves an internal, mental change, but not necessarily the external behavior change that behaviorists propose. Cognitive processes (thoughts, beliefs) mediate the relationship between stimulus and response. Learning is a process of relating new information to previously learned information.

Cognitive theories

1. Gestalt psychology

In the early 1920's German psychologists like Wertheimer, Koehler and Kofka started to explore human perception. **Wertheimer** observed that when two lights blink on and off sequentially at a particular rate they often appear to be only one light moving quickly back and forth. The fact that an individual "sees" motion when observing stationary objects led Wertheimer to the conclusion that **perception may be different from reality**. He assumed from this and other experiments, that the organism structures and organizes experience. For example, in Figure 1 you can see a vase or two faces depending on the mental organization of the perception. Existing cognitive structures (memories of past experiences) influence the manner in which information is perceived and interpreted. Learned perceptions create templates (expectations) through which a learner filters new information. These templates set up constraints that either facilitate or interfere with the learning process. In this theory **the learner is regarded as actively participating in the learning process with a personal history of learning that is important for future learning**.

2. Piaget's developmental theory

The Swiss biologist Jean Piaget (1896 - 1980) is regarded as one of the most influential researchers in the field of cognitive psychology. Although Piaget's theory dates from the 1920s many of his ideas can be found in contemporary cognitive theories of learning.

- According to Piaget our knowledge is structured and organized. He uses the term **schema** (plural **schemata**). A schema is a schematic representation of organized knowledge. In another definition, a schema is described as a mental unit that represents a class of similar actions or thoughts. For example, an infant might have a schema for grasping and use it for grabbing everything from bottles to rubber ducks.
- For learning to occur, an individual must be able to **assimilate** (integrate) new information into existing cognitive structures or to **accommodate** (modify) existing cognitive structures. For example, a penguin doesn't look like a bird at first sight. But taking the criteria for an animal being a bird into consideration (e.g. laying eggs) you start do see the penguin as a bird (assimilation). On the other hand if you thought that metal couldn't float on water you have to change your mind after having seen an iron ship on a lake (accommodation).
- Cognitive development from childhood to adulthood progresses through distinct stages. The thought processes at each stage are qualitatively different from those at other stages. Each stage provides the foundation for the next step. A commonly used example to illustrate this finding is *the conservation of liquid problem* (see Figure 2).

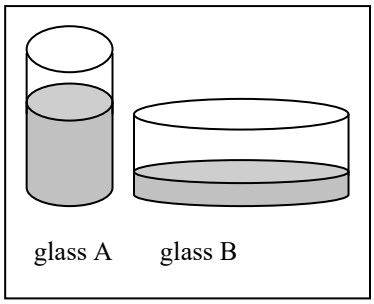


Figure 2 The conservation of liquid problem

Imagine two glasses: Glass A is thin and tall and filled with water. If you pour the content of glass A into an empty glass B which is short and fat the water level will be lower in glass B. A five year old will tell you that in glass B there is now less liquid than originally in glass A. The child's thinking at this age is more ruled by perception than logical thinking: the water levels in the glasses are different so the content must be different.

3. Constructivism

Researchers like Heinz von Foerster, Ernst von Glasersfeld, or Paul Watzlawick state that learners construct their own reality. By reflecting on their experiences, people construct their own understanding of the world they live in. Each individual generates his/her own rules and mental models, which he/she uses to make sense of his/her expe-

riences. There are several guiding principles of constructivism:

- Learning is a search for meaning.
- Meaning requires understanding wholes as well as parts; and parts must be understood in the context of wholes.
- The purpose of learning is for an individual to construct his or her own meaning, not just to memorize the "right" answers.
- To truly understand material, **learners must rediscover for themselves the basic principles**.

4. Bruner's theory of discovery learning

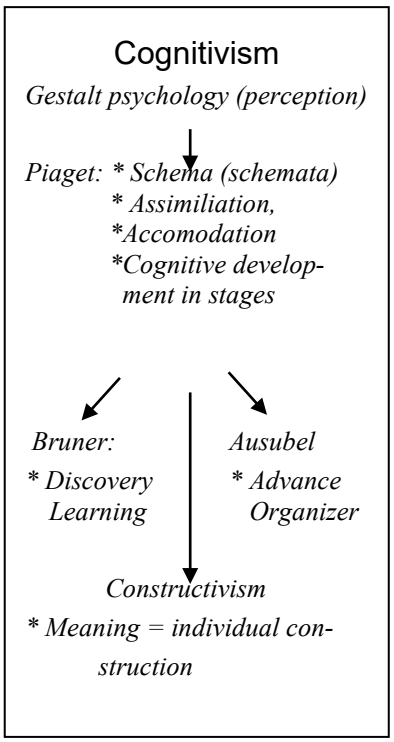
Jerome Bruner, an American psychologist, is known for his ideas about discovery learning. Learning becomes more meaningful when learners explore their learning environment rather than listen passively to teachers. Discovery learning involves formulating and testing hypotheses instead of simply reading or listening to teacher presentations. Learners move from studying specific examples to formulating general rules, concepts and principles (**inductive learning**). To make discovery learning effective the teacher has to plan and organize the learning opportunities for his/her learners to discovery to happen.

Without that guidance it would take a learner a very long time to discover the things the teacher wants to teach to his/her learners. For example, a biology teacher might use guided discovery to help trainees to learn animal groups such as mammals, birds, and reptiles. Rather than providing the basic animal groups with names and examples, the teacher can ask learners to provide the names of types of animals. Then the learner can try to classify the animals by looking for similarities and differences. At the end, the discovered results can be verified by comparison with the scientific classification.

5. Ausubel's theory of meaningful reception learning

David Ausubel stresses the importance of linking new information to existing knowledge. To foster meaningful learning rather than rote learning, Ausubel recommends **advance organizers** (see Figure 3).

Figure 3 Advance organizer for this Concept Card



Advance organizers are introductory materials that provide an organizing structure to help students relate new information to existing knowledge. Advance organizers are broad statements presented at the outset of lessons. Usually they are relatively brief passages written in familiar terms often with schematic diagrams and illustrations.

In contrast to Bruner, Ausubel favors meaningful reception learning over discovery learning. Presenting new information to learners in an organized, meaningful way is as effective as discovery learning but much more efficient in his opinion. The teacher should present general ideas, concepts and theories initially, followed by specific examples (**deductive learning**).

There is no indication from research that one method (deductive versus inductive learning; see Figure 4) is superior to the other. A good teacher should use deductive and inductive learning to suit learners with different learning styles.

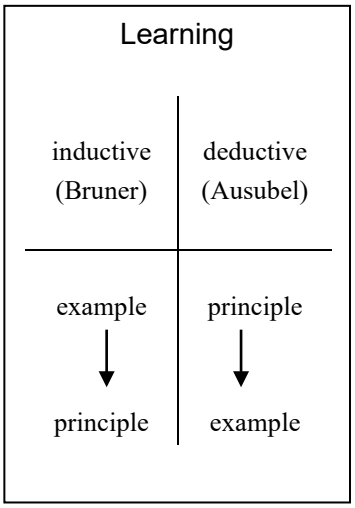


Figure 4 Inductive learning versus deductive learning

Conclusion

Most contemporary learning theories are subsumed under the heading cognitivism. All these theories have a common focus on mental processes like thinking, problem solving, and memory processes. They stress the difference between human and animal learning. Past experiences (thoughts and believes) influence present learning. As a teacher you have to organize learning in a way that allows the learner to related new information to already existing knowledge.

Apply Principles of Cognitivism – Metacognition

Introduction

Metacognition is often simply defined as **thinking about one's own thinking**. It is an awareness of one's own understanding and learning. It includes knowledge about what you know or what you don't know in a subject area and **self-control over the learning process**.

Metacognition enables you to be a successful learner. Research into metacognition suggests that learners need to become aware of the processes of their learning as distinct from the content of learning to improve their learning outcome.

Purpose

Very often learners follow instructions and perform tasks without questioning why they are doing what they are doing. They seldom ask themselves about their own learning strategies or evaluate the efficiency of their performance. Some learners have virtually no idea what they should do when they are confronted with a more complex learning task. They are unable to explain their learning strategies. There is, however, much evidence that those learners who perform well on complex tasks and are flexible in problem solving are those who can consciously apply their learning skills - those who have metacognitive skills.

To support learners to become effective thinkers, teachers must help them developing metacognitive or self-monitoring skills.

The concept of metacognition

The concept of metacognition was introduced by Flavell (1979) in the field of cognitive psychology. He distinguished two components:

- metacognitive knowledge
- metacognitive regulation.

Metacognition can be defined as a person's knowledge about his or her own thinking processes and the ability to control these processes by organizing, monitoring, and modifying them as a function of the learning outcome.

Metacognitive knowledge

Metacognitive knowledge refers to general knowledge about how human beings learn and process information (foundations of learning!). It also includes knowledge of one's own learning processes. For example, you may be aware that it will take more time for you to read and comprehend a science text than it would for you to read and comprehend a novel.

Metacognitive regulation

Metacognitive regulation refers to the monitoring and regulation of one's own thinking and learning. Regulation processes include goal setting, frequent checking of the learning progress, reassessing, and evaluation.

Skills of metacognition

Metacognitive skills are many. Metacognition has to do with study skills and learning how to learn. Metacognitive skills include:

- Ability to set realistic goals
- Ability to manage time
- Ability to effective sequence learning tasks
- Ability to determine prerequisites required to learn
- Ability to decide whether you need to ask someone for help
- Ability to scan rapidly to make decisions about what is important
- Ability to organize learning tasks into manageable portions
- Ability to reorganize new information
- Ability to integrate new knowledge with old knowledge
- Ability to monitor and to control your motivation
- Ability to use learning resources.

Applying metacognition in learning

There are basically three steps to take:

1. Develop a plan of action
2. Monitor the plan
3. Evaluate the plan

Develop a plan of action

Ask yourself:

- What do I know about this subject or issue?
- Do I know what I need to know?
- What should I do first?
- Do I know where I can go to get the necessary information?
- How much time will I need to learn this?
- How can I spot an error if I make one?

Monitor the plan

Ask yourself:

- Did I understand what I just heard, read or saw?
- Am I on the right track?
- What information is important to remember?
- How should I proceed?

- Should I move in a different direction?
- Should I adjust the pace of learning depending on the difficulties?
- What do I need to do if I do not understand?

Evaluate the plan

Ask yourself:

- Do I need to go back through the task to fill in any gaps in my understanding?
- How well did I do?
- What could I have done differently?
- How might I apply this line of thinking to other problems?

Strategies for developing metacognitive behavior

Make conscious decisions about your learning:

- At the beginning of a specific learning task, write down what you already know about the topic. Then write what you want to learn about the topic.
- Formulate questions you would like to have answered. Predict what the answer could be before you start learning. Check your prediction with the outcome at the end.
- Think aloud. Paired problem-solving is a useful strategy for this. Talk to a partner describing your thinking process whilst solving a problem. Your partner listens and asks questions to help you clarify your thinking.
- Use a thinking journal. Keep a diary where you reflect upon your learning. Write how you deal with difficulties. Diagnose your strengths and weaknesses as a learner. Note conditions under which you learn best.
- Make plans for learning activities including time estimations, organizing materials, and scheduling processes necessary to complete an activity.

The self-directed learner

Self-directed learners actively participate in their own learning. Rather than relying on others, they themselves take charge of their learning. They decide:

- What they want to learn
- How they want to learn
- When they want to learn.

Metacognition helps you to become a self-directed learner.

In a rapidly changing world, lifelong learning becomes essential. Learning how to learn might be the most important skills in coping with future challenges.

Conclusion

Metacognition is defined as thinking about one's own thinking. It is an awareness of one's own understanding and learning. Effective learning can be greatly enhanced when learners not only are aware of the content but also about the process of learning.

It is your obligation as a teacher to create an awareness in your learners of how they learn.

Performance Guide

Apply Principles of Cognitivism – Metacognition

Do you:

Before starting a learning task:

1.	Write down what you already know about the topic?	Y	N
2.	Formulate questions you would like to have answered?	Y	N
3.	Predict answers to your questions?	Y	N
4.	Sequence learning tasks in manageable portions?	Y	N
5.	Estimate the needed time?	Y	N
6.	Plan learning resources?	Y	N

During the learning process:

7.	Check your understanding of what you have heard, read or saw?	Y	N
8.	Think what information is important to remember?	Y	N
9.	Ask yourself if you are still on the right track?	Y	N

After the learning process:

10.	Identify gaps in understanding?	Y	N
11.	Go through the task again to fill in those gaps?	Y	N
12.	Diagnose your strength and weaknesses as a learner?	Y	N
13.	Use a learning journal?	Y	N

Any "No" means you can improve your metacognitive skills!

Introduction

Modeling is part of the **social cognitive learning theory**. This theory emphasizes the fact that human **learning occurs in a social context**. People learn from each other by watching one another performing certain skills, knowledge and attitudes. Children imitate their parents, learners observe and learn from their teachers, people watch and copy models from television and other media. For example, they dress according to the latest fashion or wear their hair in a style as their friends do. Modeling is important in teaching because it can be used to learn complex behavior in relatively short time in a way which can't be explained by behavioristic theories.

Albert Bandura (1925 -)

Born in Canada and working at the Standford University in the United States, Bandura has become the most prominent researcher regarding social learning. He is famous for his classic experiments on modeling. In one case a child was seated at a table and encouraged to play with a toy. The model was nearby at another table and played aggressively with a doll. The model kicked, punched and hit the doll for several minutes. Next day, the child was allowed to play with an attractive toy but only for a short time. This was done with the intention to mildly upset the child. The child was then brought to a neighboring room containing a variety of toys including the doll. Children who did not observe the model but otherwise went through the same process displayed little aggression. By contrast, the child who has seen the model the previous day started to treat the doll and other toys in a similar way the model did: kicking, hitting, punching. The child obviously learned from the model without being told to do so or being reinforced for the behavior. In addition, it learned a behavior that was demonstrated some time earlier.

Principles

- Most learning takes place through watching the behavior of other individuals.
- Learning and performance are not the same. Learning may or may not result in a behavior change. For example, a person might be able to change a flat tire after having seen a demonstration of how to do it. Then instead of doing it by him-/herself the person goes to see a mechanic to avoid getting dirty hands.
- Cognitive (mental) processes like attention, retention (memory), expectations, and motivation play an important role in learning. If a learner doesn't pay attention to his/her teacher's demonstration, or can't memorize the necessary steps to be taken, he or she won't be able to perform as expected.
- The perception that a model gets a reward (reinforcement) for a certain behavior can be stimulating enough for an observer to perform the same behavior. This kind of reinforcement is called **vicarious reinforcement.**

Processes

1. Attention

Attention plays a critical role in learning. If you plan to demonstrate the correct way to perform some skill or procedure, first make sure you have the attention of everyone in the class. Attention is influenced by the **expectations of reinforcement.** People pay more attention to another's behavior when they believe they will be reinforced for modeling that behavior. It is crucial, that a learner pays attention to the relevant aspects of the model or his/her behavior. The pimple on the teacher's face is not important but the way he/she holds a tool is!

2. Retention

Once we have noticed a model's behavior, we must store that information in memory. This storing can be in the form of an image or in verbal form. As a teacher you can help your learners memorize material by giving them tips on how to organize information; to relate it to already existing knowledge; and how to use mnemonics. Mental review of information also serves a key role in the retention of knowledge. For example, athletes are known for mentally exercising critical steps of a skill in addition to overt practice.

3. Motor reproduction

Many simple actions may be learned by simply observing them. Complex skills, however, are learned through a combination of modeling, guided practice, and correct feedback. When an individual lacks the ability to reproduce an observed behavior, perhaps because of lack of strength or disability, this step obviously cannot happen.

4. Motivation

An individual must want to demonstrate what has been learned. Learners model behaviors only when they are motivated to do so. Individuals do not learn all the knowledge, skills and attitudes they observe. People perform actions they believe will result in rewarding outcomes and avoid acting in ways they believe will result in negative conse-

quences. Motivation is critical in observational learning. Teachers can promote motivation by making learning interesting, relating material to learners' interests, and stressing the value of learning for the individual.

Characteristics of effective models

When we think of modeling, we most frequently think of a live model; an actual person showing a particular behavior. However, we also learn by observing models in a film, book, or other media. Persons who are most likely to serve as models have one or more of the following characteristics:

- **Competence**: When models compete for attention, people are more likely to attend to the competent, confident model. For example, a learner trying to learn how to construct a brick wall is more likely to model the technique of a successful worker than the behavior of a teacher who does not even know how to mix cement.
- **Prestige, power**: Individuals who have high status, respect, and power are more likely to be modeled. Teachers can make use of this by inviting resource persons to their class who are widely respected. In addition, multiple models increase the probability that observers meet a model that particularly fits them.
- **Physical attractiveness**: Models are usually physically attractive. As a teacher you should be therefore well-groomed when going to class.
- **Perceived similarity**: Observing others similar to oneself succeed raises observers' **self-efficacy** (judgments of one's own capabilities to produce actions) and motivates them to try the task, too. Learners believe that if peers can succeed, they can succeed as well. A teacher can make use of this by assigning successful learners to help their peers. For learners with difficulties, peers who had difficulties themselves and overcame them are more helpful then a brilliant colleague who never fails. Select low-achieving learners who have mastered a skill to demonstrate the skill to other low-achieving learners.

What about situations where a model preaches one set of moral values and practice another? Research is very clear about this. Observers are more likely to imitate what the model does than what the model says.

Telling your learners that being on time is important and coming personally always late, they learn from your being late.

Conclusion

Much human learning occurs in a social environment. People learn from each other by watching one another. While observing other people, mental processes like attention, memory, expectation, and motivation play an important role. Characteristics of a good model are competence, prestige, physical attractiveness, and perceived similarity between the model and the observer.

Performance Guide

Learn through Modelling

Did the teacher…

	Yes	No
To get attention:		
1. Raise expectations?	___	___
2. Show learners the relevance of the material taught for their performance on the job?	___	___
3. Impress learners by his/her competence?	___	___
4. Be enthusiastic?	___	___
To enhance retention:		
1. Direct the learners' attention to critical steps?	___	___
2. Ask learners to mentally rehearse critical steps?	___	___
3. Organise the information presented?	___	___
4. Use mnemonics and visuals?	___	___
To allow motor reproduction:		
1. Take the learner's ability into account?	___	___
2. Demonstrate the skill?	___	___
3. Give guided practice?	___	___
4. Provide feedback to learners?	___	___
To motivate learners:		
1. Design interesting learning arrangements?	___	___
2. Stress the gained values of learning for the the individual?	___	___
3. Use peer tutoring?	___	___

Any "No" means you can improve your teaching!

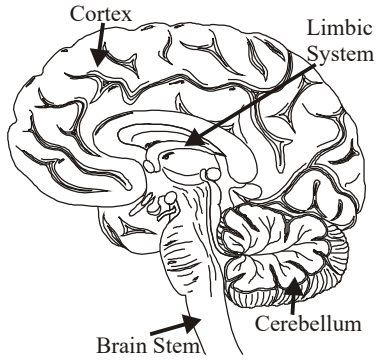


Figure 1 Anatomy of the brain

Introduction

For centuries, learning has been a topic in philosophy and religion. At the beginning of the 20th century, learning became a domain of scientists. Researchers started to examine the processes of learning with a focus on objectively observable behavior (**behaviorism**). Later on, mental activities like thinking, problem solving, or memory were in the center of attention (**cognitivism).** Now, at the end of the 20th century **neuroscience** gives us a new and exciting insight into learning. Neuroscience studies the nervous system and the biology of the brain. Neuroscience links our observations about cognitive behavior with actual physical processes in our brain.

Purpose

Learning changes the brain. New technologies allow us to analyze the brain while learners are performing different tasks. The electroencephalogram (EEG) measures the electrical activities of our brain and shows us which areas of the brain are involved in problem solving. Magnetic Resonance Imaging (MRI) machines provide high-quality images of brain tissue. Every 50 milliseconds a picture can be captured. That speed makes it possible to measure the sequence of thinking across areas of the brain. These and other techniques help us to verify existing theories of learning and provide new insight into learning.

Changes in the brain

Donald Olding Hebb (1904-1985), a Canadian, was one of the first psychologists who made neurophysiological explanations of learning. In 1949, Hebb designed an experiment with rats to investigate the **effects of different kinds of rearing conditions on intellectual development.** Two groups of rats were involved: One was reared in cages in Hebb's laboratory; his two daughters reared the other in an enriched environment in Hebb's house. The rats of his daughters could move around freely and play with the children. In contrast, the rats in the laboratory were kept in empty cages in a boring environment. After a couple of weeks the two groups were compared. Hebb found that the performance of the rats raised by his daughters on maze problems was consistently superior to that of the rats reared in the laboratory. Hebb explained that the difference in performance between the two groups was due to a change in the brain structure. He assumed that in the brains of the enriched rats, nerve cells changed their structure. But in those days he couldn't prove this hypothesis. Rosenzweig (1984), an American researcher, conducted similar experiments. He made the same observation: Enriched rats were found to be quicker learners than impoverished rats. At the end of his experiments he examined the brain of all rats. The brain of a typical enriched rat has a thicker and heavier cortex (the grey matter in the brain), a richer blood supply, and higher protein content. In addition, there are differences in the structure of brain cells: Enriched rats have nerve cells (neurons) with larger cell bodies and with more dendrites (see figure 2). Dendrites are branch-like extensions that grow outward from the cell body. Through dendrites, a neuron receives information from other neurons. These changes mean the brain cells communicate better with one another. In summary, our brain undergoes consistent modification when learning occurs. The richer our learning environment is the more our brain grows! Key factors for the growth of our brain are:

- **Nutrition.** Drink a lot of water**,** eat balanced meals high in fiber and vegetables, use vitamins.
- **Physical exercise.** Involve yourself in sports, play an instrument.
- **Challenging tasks.** Engage in problem solving and critical thinking.
- **Variety of tasks.** Engage in games, real world problems, practice, theory, language, art, science, and mathematics.
- **Supporting, positive attitude of social environment.** Seek feedback and encouragement. Think positively.

The bigger the variety, the bigger the chance that an individual can develop his/her different talents. The more you know the easier it is for your brain to make new connections. This enhances understanding, makes learning more meaningful and fun!

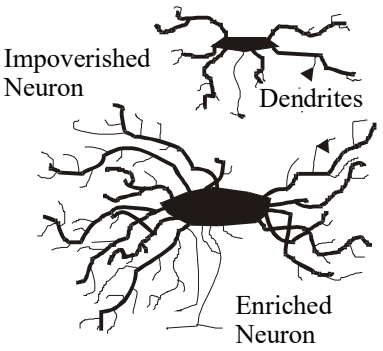


Figure 2 Enriched environment changes the structure of brain cells

Right / left brain

A human brain consists of two halves: the **left and the right hemisphere** (see figure 3).

The two halves of the brain are connected by a large mass of fibers called the corpus callosum. **Roger W. Sperry** (1913-1994) received the Nobel Prize for his studies on how information between the two hemispheres is exchanged. Sperry began his research with studies on cats. In an operation, he cut through the corpus callosum. He found that this prevented transfer of information from one hemisphere to the other. The two halves

of the split brain appeared to learn independently and actually behaved like two different brains. Based on these research findings, it appeared that the right and left hemispheres of the brain perform different functions. The left hemisphere of a human brain is largely responsible for speech, analytical reasoning, and logical, linear sequencing. The right hemisphere is largely responsible for holistic, spatial perceptions and orientation, music perception, nonverbal communication and intuition. However, recent research and examples of overlap (e.g. speech) lead to the position that both hemispheres are interconnected and simultaneously involved in most complex human functioning. Crossovers and links between the right and left hemisphere are happening continuously. It is therefore unwise to speak simplistically of left-brain or right-brain thinking. Traditional learning methods have a left-brain bias which favor those with learning preferences in that area. **To make full use of our brain it is important to include intuition, feeling, sensing, and imagination, in addition to the traditional skills of analysis, reason, and sequential problem solving.**

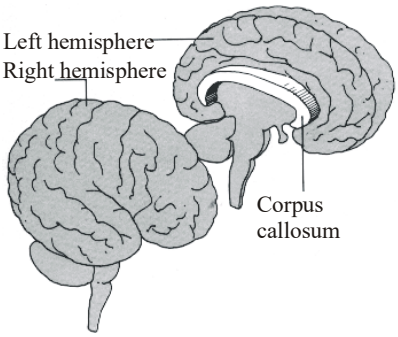


Figure 3 The two hemispheres of the brain

Reinforcement centers in the brain

Olds and Milner who worked together with Hebb implanted electrodes in the brain of rats.

An animal with an electrode implanted in a brain area called the limbic system (see figure 1) could be trained to run a maze. Learning occurred when that area of the brain was stimulated with a mild electrical current after the animal had performed the appropriate response. The limbic system is called the reinforcement center because when it is stimulated, the animal tends to repeat what it was doing before the stimulation. Since this discovery of reinforcement centers in rats, reinforcement centers have been found in humans as well. When a human being's reinforcement center is stimulated, the person sometimes reports erotic sensations and thoughts or simple feelings of pleasure. Findings like these explain why people not always need to be reinforced externally for learning a certain behavior. Reinforcement can also come from the brain itself. Part of the limbic system is also responsible for our emotions. **Emotions** like fear, anger, surprise, disgust, sadness, or joy have been found to **play an important role in learning.** Emotions chemically stimulate the brain which helps us recall things better. It's common for learners to remember a field trip, or a hands-on science experiment far longer than most lectures.

As a teacher you should engage emotions at every chance you get. Use music, games, drama, or storytelling to engage emotions.

Conclusion

Neuroscience links our observation about cognitive behavior with actual physical processes in our brain. Researchers have found that learning changes the brain. Learning leads to nerve cells with larger cell bodies and more dendrites. The brain consists of two hemispheres. Each hemisphere controls to a certain extent a different kind of thinking (logical versus intuitive). To make full use of our brain, it is important to use both hemispheres. That means including intuition, feeling, sensing, and imagination, in addition to skills of analysis, reason, and sequential problem solving. An area in our brain called the limbic system is the center of our emotions. Emotions are essential for learning. In summary, learning engages both hemispheres of the brain, involves emotions and finally, leads to real changes in the structure of our brain.

Performance Guide

Apply Findings of Neuroscience

Does the teacher	**YES**	**NO**
1. engage his/her learners in problem solving, critical thinking, analysis, and reasoning?	___	___
2. engage intuition, feeling, sensing, and imagination of learners?	___	___
3. use music, drama, or storytelling to engage emotions of learners?	___	___
4. vary tasks: games, real world problems, theory, practice, hands-on experiences?	___	___
5. include physical exercises in his/her teaching?	___	___
6. provide encouragement and feedback?	___	___

Any "NO" means you can improve your learning environment!

Apply Principles of Motivational Theories

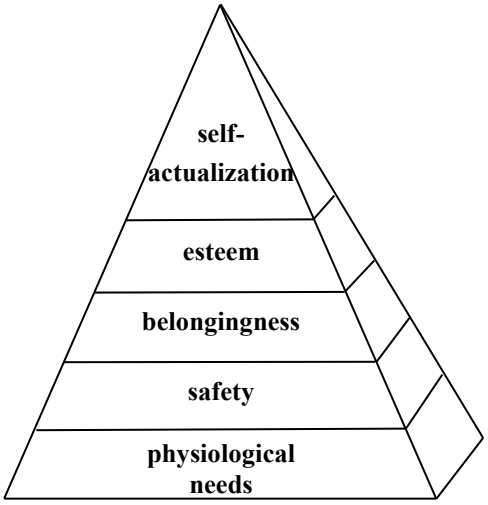


Figure 1 Maslow's Pyramid of Needs

Introduction

Lack of interest within the classroom often leads to a vicious cycle. A dull presentation by the teacher causes learners to show that they are bored and restless. The lack of response from learners causes the teacher to lose confidence and enthusiasm, and to assume that nothing can be done to arouse learners' interest. Understanding motives that activate and direct learner behavior will help teachers to design and conduct more effective instruction. **Motivation can be defined as arousing and sustaining interest in learning**. Motivation is affected by:

- The nature of the learning task.
- The characteristics of the individual learner.
- The classroom atmosphere.
- The personality of the teacher and his/her teaching style.

Scope of theories of motivation

Explanations of why individuals do what they do have been a central aspect of psychology from its earliest days. Behaviorists stress the importance of reinforcement in learning. Learners are motivated to complete a task by being promised a reward of some kind (for example grades).

Cognitivists are interested how motivation is influenced by the way learners perceive things. A task that is perceived as important and attainable is highly motivating.

Neuropsychologists look how changes in brain waves, hormones and neurochemicals affect motivation. For example, reduced motivation early in the morning can be the result of feelings of depression triggered by a high level of corticoid in the blood.

There is no one theory of motivation that explains all relevant phenomena satisfactory. Therefore, this Skill Card concentrates on those theories that are most useful for learning in an instructional setting.

Maslow's theory of growth motivation

The American psychologist Abraham Maslow (1954) postulated that human behavior is motivated by specific needs. For example, if you are hungry you are motivated to look for food in the fridge. Not all of our needs have the same importance. Maslow therefore attempted to prioritize needs in form of a pyramid (see Figure 1). On the lowest level we have *physiological needs* like a need for food, water, oxygen, movement etc. On a next level there are *safety needs* like a need for security, orderliness, or avoidance of risks. Even higher up are needs of acceptance, group membership, and affection; Maslow calls them *needs of belongingness*. On the level of *esteem* we find for example a need for respect and status. On the highest level (*self-actualization*) people try to maximize their own potentials. They are ready to explore their limits, strive to become autonomous and are open to change.

Implications for learning

Learners who come to a training and are still hungry can not be expected to be ready for learning. A learner who is rejected by his/her peers may not respond to the learning task. The task of a teacher is therefore to see that learners are physically comfortable, feel safe and relaxed, have a sense of belonging, and experience self-esteem. The following steps can help:

- Have regular breaks.
- Ensure clear classroom rules and enforce them.
- Take an interest in your learners and show them that they belong in your classroom.
- Promote team spirit by organizing social events.
- Show your learners respect; use an appropriate language.

People whose lower needs are not met, make often bad choices. For example, an insecure learner may choose to attend a particular college more on the basis of how close it is to home than on the quality of its academic programs. According to Maslow, human beings have two sets of forces within them. One set clings to safety and tends to look for the familiar, hanging on to the past. The other set of forces is based on confidence and looks for new challenges. A learner who feels safe, loved and respected is ready to choose the unknown, and is ready to learn.

Intrinsic vs. extrinsic motivation

The theory of operant conditioning states that a behavior is repeated if it is followed by a reward. A student who has written a good test might be rewarded with some money by his father. Such a reward is called an **extrinsic motivation** because it comes from outside of the student. Extrinsic rewards have potential negative side-effects:

- Learners become dependent on the teacher.
- Learners might feel manipulated and therefore resist

learning.

- Extrinsic rewards may undermine intrinsic motivation. Learners view learning as a mean to an end – the earning of reward. They are no longer interested in increasing their competence or master some new skill.

Research suggests that extrinsic motivation (praise and reward) can be effective if it is not overused.

Intrinsic motivation comes from inside of the learner. The pleasure of mastering a new skill, the discovery of a principle in physics, is a reward in itself. Satisfaction is derived from merely being engaged in a certain activity. Under ideal circumstances learners are intrinsically motivated. They learn a topic for its own sake. Intrinsic motivation can be fostered by:

- Offering choices in assignments.
- Delegating responsibility to the learner.
- Letting learner participate in goal setting.
- Setting challenging but attainable goals - success is stimulating!

Learned helplessness

The psychologist Rotter (1966) differentiated between two categories of people:

- Those who believe that outcomes occur independently of how they behave (***external locus of control***) and
- Those that outcomes depend on their behavior (***internal locus of control***).

Learned helplessness results from perceived independence between response and outcomes (external locus of control). Seligman (1975) demonstrated in a famous experiment the concept of learned helplessness. Dogs were given inescapable electrical shocks. Later on they were moved to another location where they could avoid shocks by jumping a hurdle. The prior inescapable shocks conditioned the dogs; they made little attempt to escape in the new setting but rather passively endured the shock. They learned that any effort to escape was useless and therefore became passive. In contrast, dogs not previously exposed to shocks easily learned to escape.

Implication for learning

Learned helplessness applies to many learners with learning problems. Learners who often fail begin to doubt their learning capabilities and view success as uncontrollable (external locus of control). As a result they minimize effort and persistence in their learning that leads to further failure. They enter in a vicious cycle of negative beliefs, reduced effort, and renewed failure. Eventually, learners interpret their successes as externally caused. The task was easy, they were lucky, the teacher helped them. Failure on the other hand is attributed internally to low ability.

In such a situation the teacher can help by:

- Setting clear, realistic, attainable goals.
- Giving encouraging feedback.
- Avoiding negative judgment.
- Play down comparisons between learners; urge self-improvement.
- Being positive; believing in the learner's ability to succeed.

Conclusion

Arousing and sustaining interest – motivation – is central in learning. Maslow's pyramid of needs gives an inside in prerequisites of conditions favorable for learning; learners who feel safe, loved and respected are ready to learn. Intrinsically motivated people learn for the sake of learning; they don't need extrinsic motivation – rewards – from others. Seligman's concept of learned helplessness shows how a learner can enter in a viscous cycle of negative beliefs, reduced effort and failure.

Understanding and applying these principles of motivation helps a teacher to create an environment that allows learners to achieve.

Performance Guide

Apply Principles of Motivational Theories

Did the teacher:

Create a good classroom atmosphere?

1.	Ensure and enforce classroom rules?	Y N
2.	Take an interest in his/her learners?	Y N
3.	Promote a team spirit?	Y N
4.	Show respect to his/her learners?	Y N

Promote intrinsic motivation?

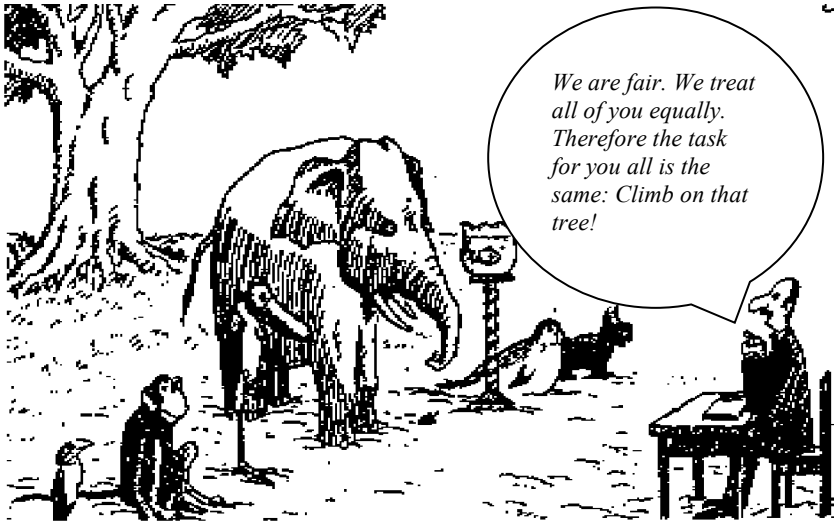
5.	Offer choices in assignments?	Y N
6.	Delegate responsibilities?	Y N
7.	Set challenging but attainable goals?	Y N
8.	Let learners participate in goal setting?	Y N

Help learners with learning problems?

9.	Give encouraging feedback?	Y N
10.	Avoid negative judgment?	Y N
11.	Play down comparison between learners?	Y N
12.	Believe learners can succeed?	Y N

Any "NO" means you can improve motivation in your classroom.

Overview of Learning Styles



Introduction

We know that people are not all alike. Individuals perceive and process information in very different ways. Think about what you do when you have to learn something new. You probably approach the task in a similar way each time. Over time, you have developed **a pattern of behavior that you use for new learning**. **This pattern in called your learning style.** The learning styles theory suggests that how much an individual learns in a training situation has a lot to do with his or her learning style and less with being smart or not. Essential to quality learning is an awareness in the learner of his/her preferred way of learning. For example, do you prefer listening to a lecture or learning by doing? Do you work quickly or deliberately? The learning style focuses on **how you learn** best.

Purpose

Knowing your learning style helps you to learn more effectively. Knowing about different learning styles allows you to develop skills in weaker styles. The fact that a learner may have a preferred learning style does not mean that he/she connot function in others. In fact, the learner who has the flexibility to change from one style to another to fit the requirements of the situation is the most successful one.

Advantages

- Increased awareness for learning activities which match or mismatch your learning style.
- Profile of strength and weaknesses in your learning.
- Heightened awareness that as a teacher, you tend to favor learners whose learning styles are similar to your own.

Limitations

- Many styles have only been vaguely operationalized.
- The concept is contested by many researchers.
- It is impractical to meet each possible learning style in a training.

Different concepts

There are different approaches to individual learning styles. Many of the proposed concepts offered by researchers are overlapping. Some researchers focus on the speed of learning. **Impulsive learners** work fast to get an answer. They are more easily frustrated and more distractible. They are also more likely to take risks than **reflective learners** who work more slowly to avoid errors. Other researchers emphasize the importance of the sensory channel or pathway through which individuals receive information. They distinguish between visual learners, auditory learners and kinesthetic learners.

Visual learners

Visual learners prefer written information, notes, diagrams and pictures. They have a problem if information is not in written form. To understand and store information they like to take detailed notes. This is why some visual learners will take notes even when they have printed course notes in front of them.

Auditory learners

Auditory learners depend heavily on the spoken word. Often information written down will have little meaning for them until it has been heard. It may help them to read written information out loud.

Kinesthetic learners

Kinesthetic learners learn through touch and movement. They prefer to learn new skills by imitation and practice.

Kolb's learning cycle

David Kolb states that when we learn we go through a cycle. For example, we have an experience, think about it, draw a conclusion, and plan on this conclusion the next steps.

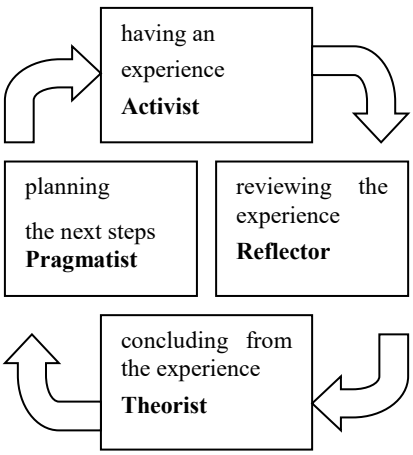


Figure 1 Kolb's learning cycle adapted by Honey&Mumford

A teacher training institute might decide to send future teachers first to a school to assist an experienced teacher there.

The teacher candidates gain some experience before they begin their formal studies at the teachers' training institute. Their experiences are followed by personal reflections. They are told to write a diary during their stay at the school. The training institute then will provide a theory input before the teacher candidates will plan their first sessions.

It's quite possible that a training institute chooses another approach. First, a theory input is given before a student is allowed to plan and teach a session. Both strategies are valid and each has its own advantages and disadvantages. A learner can start anywhere on the cycle because each stage feeds into the next. Most people, however, develop preferences which give them a liking for certain stages over others.

Kolb also identified two separate dynamics of learning: **perception** and **processing**. *Concrete perceivers* absorb information through direct experience, by doing, acting, sensing, and feeling. *Abstract perceivers* take in information through analysis, observation, and thinking. Once information is perceived it must be processed. *Active processors* are people who make sense of an experience by immediately using the new information. *Reflective processors* make sense of an experience by thinking about it. **Traditional schooling tends to favor abstract perceiving and reflective processing.**

Honey's & Mumford's four types of learner

Peter Honey and Alan Mumford have, based on Kolb's research, identified four different types of learners:

- Reflectors
- Theorists
- Pragmatists
- Activists

Depending on their preferences, people tend to favor always the same starting point in a learning cycle. Some people like first to watch and think before they act – they are called *reflectors*. Others prefer first to integrate new information in a logical framework – they are called *theorists*. *Pragmatists* are people who are more interested in the application side of learning than anything else. Does it work, where can I use it are questions they ask. *Activists* are those people who are enthusiastic about new experiences. Their philosophy is "lets try anything once". Honey&Mumford describe the four types of learners in detail:

Activists

Activists involve themselves fully and without bias in new experiences. They are open-minded, not skeptical, and this tends to make them enthusiastic about anything new. They tend to act first and consider the consequences afterwards. Their days are filled with activity. They tackle problems by brainstorming. As soon as the excitement from one activity has died down they are busy looking for the next. They are bored with implementation and longer term consolidation.

Reflectors

Reflectors like to stand back and think about experiences and observe them from many different perspectives. They collect data and prefer to think about it thoroughly. They tend to postpone definitive conclusions for as long as possible. Their philosophy is to be cautious. They prefer to take a back seat in discussions. They tend to adopt a low profile and have a slightly distant and tolerant air about them. When they act it is part of a wide picture which includes the past as well as the present and other observations as well as their own.

Theorists

Theorists adapt and integrate observations into complex but logically sound theories. They think problems through in a step by step, logical way. They tend to be perfectionists. They like to analyze and synthesize. They are keen on basic assumptions, principles, theories, models, and systems thinking. If it's logical it is good. Questions they frequently ask are; "Does it make sense?" "How does this fit with that?" They prefer to maximize certainty and feel uncomfortable with subjective judgements and anything flippant.

Pragmatists

Pragmatists are keen on trying out ideas, theories and techniques to see if they work in practice. They search for new ideas and experiment with applications. They are the sort of people who return from courses being exited to try out in practice the newly learnt things. They like to get on with things and act quickly and confident on ideas that attract them. They tend to be impatient with lengthy and open-ended discussions. They are practical people who like solving problems.

Conclusion

Knowing your preferred learning style helps you to optimize your learning strategies. It also provides you with information about your strengths and weaknesses in your learning. Certain tasks favor a specific learning style. As a learner you should try to match your learning style with the requirements of the task at hand.

As a teacher you should be aware that not all learners benefit equally from your chosen teaching approach. Each individual has his or her own unique learning strengths and weaknesses. It is vital for you to deliberately use a variety of methods to reach as many learners as possible.

Introduction

Learning is an ongoing process that continues throughout your life. If you want to develop certain specific skills, advance in your career, improve your performance on the job or at school, you have to take charge of your learning. A personal learning plan will help you to outline your learning needs and tell you how and when you are going to meet them.

Advantages of having a plan

Having a plan helps you to:

- Reduce stress because you know what is expected of you and when
- Manage limited resources (for example, time)
- Stay focused
- Set priorities
- Control your procrastination.

Set goals

Goal setting is the process of identifying specific aims and the means how to reach them.

The goal pyramid

One way to visualize your goals is to use a pyramid.

1. On the top of the pyramid write your long-range goals. Look five to ten years into the future. What type of work do you want to be doing then? How do you expect your life to look like? In addition to specific career goals, include long-range personal goals such as marriage, home ownership, travel, community involvement etc.
2. Below the long-range goals list mid-range goals. Mid-range goals are steps that will help you to realize your long-term goals. You should accomplish them within one to four years. For example, if your long-range goal is to have a job abroad, learning languages would be a mid-range goal.
3. On the base of the pyramid you note short-term goals. These are even smaller steps that can be completed in a relatively short time (less than a year). Short-term goals support your mid-range goals. For example, in order to master a new language, a goal could be to know by heart 1000 new words in the foreign language after one year.

The goal pyramid helps you to stay focused in your learning. Review your goals periodically. You may eventually decide on a different career or on a different path leading there. The process of creating a goal pyramid helps you to see the interrelationship of your goals and can motivate you to accomplish short-term goals that are less stimulating to learn.

SMART goal setting

Formulate goals clearly. Be **SMART**! That means your goals should be ***S**pecific, **M**easurable, **A**ttractive, **R**ealistic,* and have a ***T**ime* horizon.

- **Specific:** If your objective is to improve your writing skills you are not specific enough. Specific would be: I am able to write one page with less than 5 writing mistakes.
- **Measurable:** Specific goals always have criteria to check them. In the example above I can count the mistakes to see if I have achieved my goal. Another criterion could be the time needed to write one page.
- **Attractive:** Goals should be important and rewarding. Goals should motivate me in my learning. For example, my goal may be to obtain a driving license for cars after 10 hours of practice with my driving instructor. The reward achieving the goal is saved money for expensive lessons and the prospect of being able to drive alone in the near future.
- **Realistic:** If you set goals unrealistically high, chances are you will not achieve them. Failure produces frustration, anxiety and results in a low self-esteem. All these factors reduce your capability to learn effectively. Having goals too big can also scare you away from starting.

  Take past learning experiences into consideration when you set your goals. What are your strengths? What are your limitations? For example, think of the time that was necessary for you to pass the driving test for getting your driving license for the motorbike? If it took you 40 hours, the estimated 10 hours for getting the license for your car is far too low.
- **Time horizon:** When will you do your first step? When will you reach your goal? Time frames create a slight pressure on you and remind you when to start your learning.

Manage your time

We often concentrate on things we are able to do or like doing at the expense of things that we find difficult. Timetables help you to stay on track and to do what you should do.

The yearly planner

The yearly planner deals with your long-range goals. Use a calendar that allows you with one glance to see long-range goals and due dates.

The weekly work list

The weekly work list is an overview of the time and resources needed to complete each assignment by its due date. The list is a table with the following headings:

- Assignment
- Due date
- Resources needed
- Estimated time needed
- Actual time needed

Differences between estimated and actual times can be expected. An assessment of the differences helps you to show you your strength and weaknesses in learning. Were there any distractions during learning? Was the assignment more difficult than expected? What can you do to reduce the difference between actual and estimated time? Questions like this can help you in the long run to improve your learning strategies.

After you finished an assignment, cross it off and experience the pleasure and relief that accompanies a task well done.

The daily do-list

A daily do-list is a small piece of paper or a space in your agenda that tells you what to accomplish during the day. Plan your day each morning or the night before.

To control your time effectively you have to set priorities. You must constantly ask yourself: How important is this activity in reaching my short-term and long-term goals? To use the daily do-list, either write the tasks in the order of their priority or use a "star rating" system to mark priorities. Put the do-list in your pocket and check it every half an hour until you have finished it.

After each task finished cross it off.

Reward yourself for task completion. Have a short break, eat a snack, give yourself a pat on the back etc. Self-reinforcement has a powerful effect on developing a "do it now" attitude.

Control your learning environment

Set aside a fixed place for learning and nothing but learning. It should be reasonably quiet and relatively free of distractions like TV, telephone, and people. **Make learning** – or at least part of your learning – **habitual**. **Behaviors that become a habit are a lot easier to perform.** When you sit down at your working place your attention automatically will be focused on learning because the room has been associated with learning.

A good study area has the following:

- Good lighting
- Sufficient ventilation
- A comfortable chair
- A desk large enough to spread out your materials

Try also to be habitual with your learning time. Find out your peaks of efficiency. An activity log can help you to do this.

The activity log

The activity log helps you to monitor the way in which you spend your time. Note down things as you do them throughout the whole day. Every time you change activities, whether reading, making coffee, dealing with colleagues, gossiping etc. note the time of the change. It's also worth noting how you feel. Are you alert, energetic, tired, bored? Once you have logged your time for several days, analyze the data. You will see the times of the day when you are energetic or flat. Schedule important learning tasks respectively. You may also realize how much time you spent on unproductive activities. This can be a start to change your habits and to become more effective and efficient in your learning.

Conclusion

Learning is an ongoing process that continues throughout your life. To meet your learning goals a personal learning plan can help. Identifying learning gaps, setting specific, measurable, realistic goals and managing time effectively is all part of the planning process. A conducive physical learning environment and most important, a positive learning attitude are essential for learning.

Performance Guide

Organize your Learning

Did the learner:

Develop a personal learning plan:

1.	Identify learning deficiencies?	Y	N
2.	Set goals (that are **s**pecific, **m**easurable, **a**ttractive, **r**ealistic, **t**ime bound)?	Y	N
3.	Visualize your goals with a pyramid?	Y	N

Manage his/her time:

4.	Prepare a weekly schedule (with planned assignments, due dates, resources needed, estimated time needed, actual time needed)?	Y	N
5.	Write every day a do-list?	Y	N
6.	Note an activity log periodically?	Y	N
7.	Schedule habitual learning sessions?	Y	N

Control the learning environment:

8.	Set aside a fixed study place (with good lighting, ventilation, a comfortable chair, a spacious desk)	Y	N

Any NO represents a way to organize your learning.

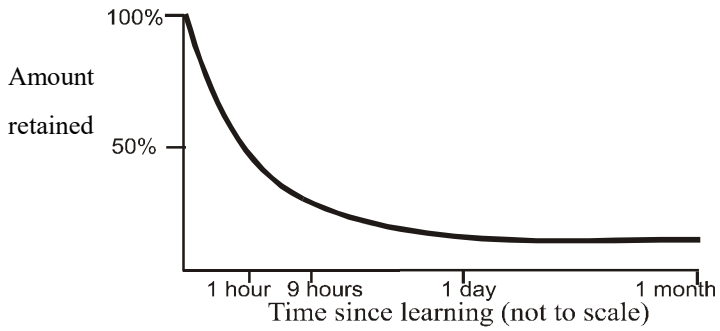


Figure 1 Curve of forgetting after Ebbinghaus

Introduction

Reviewing is a repetition of information you want to learn. Thoughtful repetition strengthens learning and increases what you remember. Proper reviewing or revision does not mean a blind repetition of information, but means a planned series of **specific times for looking at information** already understood.

Purpose

No matter how you learn something, if you do not use it occasionally you are likely to forget it unless you review it. One of the surest ways to make learning stick is to include time for reviewing what has been learned. Material that has been reviewed is likely to be retained five times as much as material that has not. That's because reviewing allows you to reconsider the information and find different or more meaningful ways to store it in the brain.

Curve of forgetting

The first experimental investigations of memory were carried out by Hermann Ebbinghaus in Germany from 1879 to 1885. His findings are summarized in the curve of forgetting (see figure1). Information learned and stored in memory shows a rapid initial decrease in memory followed by a gradual tailing off over the following days and nights. Most forgetting occurs immediately after learning. One hour afterwards more than half of the original has been forgotten. Nine hours later about 60% of the original has been lost, and one moth afterwards 80% has gone. The more meaning, organization, and association there is in the material, the less steep is the curve. Combined with periodic reviews, the rate of forgetting can be greatly reduced.

Advantages

Periodic reviewing:

- stimulates understanding of a subject area;
- integrates new information in previous learned knowledge;
- helps the brain remember new material;
- saves time and effort. Most forgetting occurs immediately after learning. If you wait too long you must start from zero again.

Review strategies

Review strategies are techniques for repeating the material mentally, aloud, or in writing. They include:

- mentally **repeating** material you have learned.
- **reciting** information aloud.
- **writing** notes in your own words about material you have learned.
- **overlearning**. This means continued repetition of information mastered previously.
- **self-questioning**. Ask questions to demonstrate that you understand the material or can analyze and apply it to other topics.

1. ***Overlearning***

The continuous repetition of already mastered material is called overlearning. For example, soldiers are drilled to take apart and reassemble their guns again and again until they can perform this task in a dreamlike state. Material learned this way persists better in the memory. This is especially true of material that must be remembered in a stressful situation (exam!). Overlearning has been shown to be effective in improving retrieval speed. It can also give you more confidence that you really do know the material.

2. ***Self-questioning***

Researcher Alison King (1992) developed a list of questions that might help you to review your studies.

1. What is the main idea of …?
2. How would you use … to…?
3. What is the difference …?
4. How are … and … similar?
5. Explain why …?
6. Explain how …?
7. What do you think would happen if …?
8. How does … affect …?
9. What is a new example of …?
10. What are the strengths and weaknesses of …?
11. What is the best … and why?
12. How is … related to … that we studied earlier?

Review at spaced intervals

In order to make sure you do not forget, reviews should be done at the correct time and intervals (see Figure 2.)

1. First review

Because most forgetting occurs immediately after learning the first review should occur as soon as possible. The best times to review are: during study, by reciting after each major section, and immediately after studying. If you don't have time immediately afterwards, find a 10- to 15-minute period before day's end. The first review is crucial because it is an opportunity to edit, organize, and reflect on the material while it is still fresh in your mind. As you review, reflect on the material's relevance to past classes and its personal significance for you.

2. Second review

The second period of review should be about twenty-four hours later and should take only two to three minutes. This makes maximum use of the consolidation which occurs during sleep. The second review refreshes your memory, strengthens comprehension, and facilitates the integration of major ideas and facts.

3. Third review

The third review should be about one week later, again for two to three minutes. This will stabilize the memory for a much longer period.

4. Fourth and fifth review

There should be another review after about one month, again for two to three minutes, and a final review after six months. After this final review most material will be permanently recorded in memory.

The effect of such a review procedure is to reduce greatly the rate of forgetting. The procedure makes sure that your review takes place just before the memory of what you want to remember starts to drop.

Interference

As more and more memories are accumulated, particularly those with similar associations, or of similar meaning, it becomes harder to distinguish between different materials - in other words, the memories interfere with one another. Information you have learned in the past may block the recall of something you have learned recently. For example, when children start learning a second language and find themselves unable to remember the word they want because the equivalent in the first language keeps coming to mind. Likewise, information you have learned recently may interfere with your memory of something you learned in the past. Learners, for example, after cramming for an examination, find the facts they learned the night before keep coming back when they try to recall those learned earlier in the week.

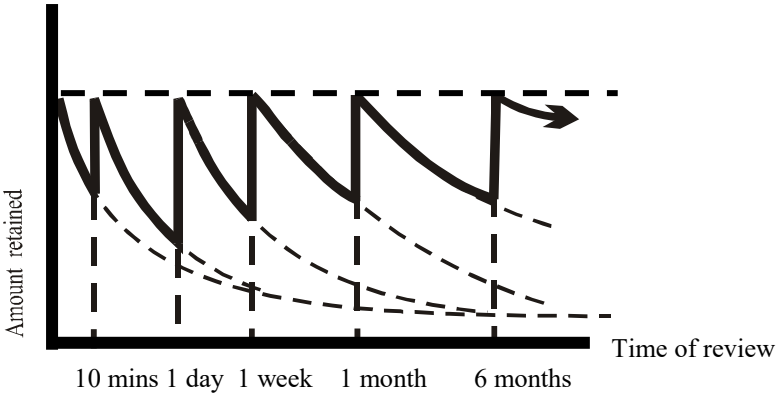


Figure 2 Review at spaced intervals (not to scale)

Reducing interference

Strategies to reduce interference:

- Learn the material thoroughly.
- Make material meaningful.
- Avoid studying two similar subjects close together. For example, if you've spent several hours studying German, you should not study another foreign language immediately afterwards.
- The context in which you learn something affects your ability to remember it. If you have two very similar subjects to study, it's best not to study them in the same location. This will tend to cause interference. Studying French in your bedroom and Spanish in the dining room will help you keep the two separate.

Conclusion

Repetition is one of the most fundamental and powerful principles of learning and remembering. Reviewing is an organized series of repetitions. It makes sure that the repetition takes place just before the memory of what you want to remember starts to drop. As a result the remembering of material learned can be greatly enhanced.

Performance Guide
Conduct Timely Reviews

Did you ….	**YES**	**NO**
1. review new material immediately after studying?	___	___
2. gradually increase intervals between reviews (1 day, 1 week, 1 month, 6 months)?	___	___
Did you during the review…		
1. recite information aloud?	___	___
2. reword the newly learned material?	___	___
3. use self-questioning?	___	___
Did you avoid interference by…		
1. learning the material thoroughly?	___	___
2. making material meaningful?	___	___
3. avoid studying two similar subjects close together?	___	___
4. avoid studying similar subjects at the same location?	___	___

Any "No" means you can improve your remembering skills.

Use Mnemonics

Introduction

Mnemonics (pronounce "ne MON ik") are methods for improving memory. Mnemonics are devices that facilitate **learning** and **recall** of information. The word is derived from *Mnemosyne,* the name of the ancient Greek goddess of memory. A mnemonic is essentially any technique that helps people remember things better. It can be tying a knot in a handkerchief, a rhyme, a visual image, or any other aid.

Purpose

Some teachers believe, when they assign many things to be memorized, they are improving the learner's memory. There is no evidence that it does. Remembering is a learned skill. Improving memory is like developing any other skill. You must work at it by learning the appropriate techniques and by practicing them.

Mnemonics are effective. Yet people in general rarely use mnemonics. Teachers can help learners by showing them how to develop effective mnemonics on their own.

Advantages

- Mnemonics improve your memory substantially.
- Mnemonic techniques make remembering fun.

Limitations

- Mnemonics are less useful for understanding and remembering complex ideas.
- The time required to create new mnemonics can be considerable.

Why do they work?

Mnemonic techniques use the basic principles of learning:

- *Meaningfulness*. Mnemonic techniques help make material meaningful.
- *Organization*. Mnemonics provide a context in which apparently unrelated items can be organized.
- *Association*. Mnemonics help the learner relate new material to information already stored in long-term memory.
- *Visualization*. Mnemonics use images. Images are better remembered than words.
- *Attention*. Mnemonics foster attention because they tend to be more interesting and fun than rote learning.

Different techniques

1. External retrieval cues

One problem people regularly face is that they often forget to retrieve important information at the appropriate time. E.g., suppose you should attend a meeting at 2 p.m. When you need to remember to retrieve, an external retrieval cue can be helpful. The classic example is the string around the finger: the string is tied in a spot impossible to overlook and serves as a reminder that something needs to be remembered, e.g. your meeting at 2 o'clock.

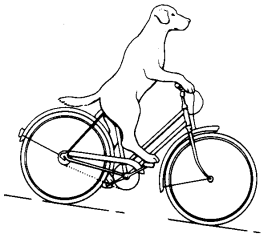
2. Story system

Storytelling is a powerful memory tool. It helps us organize thoughts. Suppose you were given a list with the following items*: paper, tire, doctor, rose, ball*. You form a story based on the items you want to remember: The *paper*boy rolled a *tire* down the sidewalk, and it hit the *doctor* coming to make a house call; it knocked him into a

Rose bush, where he picked up a *ball* and threw it at the boy. For recalling the items proceed through the story, picking the key words out as you come to them.

3. Visual imagery

Visualizing is the ability to see a picture in your mind - to see it quite clearly, with color, shape, and form. The richness of our imagination allows us to visualize not just the picture of something, but also how it smells, what it feels like, and how it sounds. Because visual association plays a central role in most mnemonics, it is useful to have some guidelines. The two items you are associating should be pictured as interacting in some way with each other, rather than as merely sitting next to each other. For example, if you were associating the words *dog* and *bicycle* it would be better to picture a dog cycling than to picture a dog standing by a bicycle. People who are not accustomed to visualizing may find that it helps at first if they close their eyes when trying to see the mental picture. It helps to see the picture in action (the dog is cycling, not just holding the



bicycle). Exaggerate: See items exaggerated in size or number. Being able to visualize well can greatly improve your memory skill.

4. Acronym and acrostic

The acronym is also called first-letter mnemonic. You take the first letter from each of a set of items to be learned and make up a word. For example, the writing rule *keep it short and simple* can be memorized with the acronym KISS. An acrostic is a sentence where the first letter of each word is a cue to an idea you need to remember. To learn and remember the nine planets, the sentence "My very elderly mother just served us nine pizzas" works quite well. The nine planets listed outward from the sun are: *Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto*.

5. Rhyming-peg system

A standard set of words (peg words) is learned, and items to be remembered are linked to the pegs with visual imagery. The system got its name from the fact that peg words act as mental pegs or hooks on which a person "hangs" the information that needs to be remembered. Numbers from zero to ten are associated with rhymes.

0 is a hero	1 is a gun
2 is a shoe	3 is a tree
4 is a door	5 is a hive
6 are sticks	7 is heaven
8 is a gate	9 is a vine
10 is a hen	

In order to use this system, you must first memorize the words that rhyme with numbers zero through ten. Then, as you say each rhyme, visualize the item that the peg word represents. Once you have formed a link between the numbers and the words that rhyme with them, you have constructed your pegs. If you want to remember a list, all you have to do is link each item with a peg - the first with a hero, the second with a gun, the third with a shoe, and so on. To remember the list, call up the pegs and the mental images that are linked to the pegs will be re called automatically.

Peg words can help you remember lists of items or errands. They can help you organize all of your daily activities. The Peg system can also be used for memorizing number codes such as telephone numbers, Social Security numbers, etc. Long strings of numbers can be converted into phrases, complete with concrete imagery. For the number 230152, you picture a *shoe* (2) hanging from a *tree* (3) and a *hero* (0) with a *gun* (1) shooting at the *hive* (5) in the *shoe* (2).

6. Keyword method

This method facilitates foreign language vocabulary. The technique involves two steps. First, isolate some part of the foreign word that, when spoken, sounds like a real English word. This is the keyword. Second, form an interacting visual image between the keyword and the English translation of the foreign word. For example, the Spanish word for duck is *pato* (pronounced pot-o), which could be represented by the sound-alike keyword pot. Second, picture a duck wearing a pot on its head. To recall the meaning of the Spanish word *pato* you first retrieve the keyword *pot*, and then the stored image that links it to duck.

7. Loci method

The method of loci (pronounced *low-sigh* and meaning "places") has been developed by Greek orators to help them remember speeches. Places serve as memory aid. These orators would think about a familiar route that they walked frequently and about landmarks along the way - perhaps a bridge, a large tree, and a brothel, in that order. Then, when planning a speech, they would translate each key point into some sort of concrete, observable object and form a visual image of each successive key point located at each landmark. Let's say that an orator's first three points in his speech were the frequent traffic jams near the forum, the importance of a mass transit system in downtown Athena, and the consequent necessity for a tax increase. He might store images such as these: (1) numerous horses entangled in a traffic jam on the bridge (first landmark), (2) a gigantic, 30-person chariot crashing into the tree (second landmark), and (3) several prostitutes pitching coins at a tax collector from the upstairs window of the brothel (third landmark). To recall his speech, the orator simply would retrace his steps through each location, retrieving each image from where it was originally placed, and decode each image into a spoken message.

Conclusion

Mnemonics facilitate remembering. Teachers should identify and present mnemonic aids to their learners. In addition they should supply information about mnemonics, how they work, and how they can aid learning. Learners who understand the nature and value of mnemonics may be encouraged to develop their own in the future.

Performance Guide

Use Mnemonics

Does the teacher....

1. Visualise the material to be remembered?
2. Link new material to existing knowledge?
3. Organise the material in a meaningful way?
4. Use mnemonics in class regularly?
5. Explain to his learners how mnemonics work?

Any "NO" means you can improve your and your learners' memory skills!

Take Notes

Introduction

Taking notes is the process of selecting and recording information contained in a spoken or written message. Taking concise, clear notes is first and foremost the practice of discrimination – developing your ability to separate the essential from the superfluous, the key ideas from all the rest.

Purpose

- Taking notes compensates for deficiency in our memory. On the average, we forget about 50% of what we learn within a day. Notes serve as an external storage device for our memory, like a computer disk.
- Note-taking forces the listener to pay attention to the message.
- By involving our motor sense (the muscles used in writing) we enhance the permanency of learning.
- When we take notes, we organize and translate the speaker's message into our thoughts and words. This strengthens memory.
- Many jobs involve meetings and briefings where accurate notes must compensate for an imperfect memory.

Note-taking is a skill

Note-taking takes practice, which involves effort. Try to listen and to write at the same time. It can be done!

Things which make note-taking difficult are:

- Spoken language is more complex than written.
- Speaker's organization of the message is not immediately apparent.
- Spoken language is quickly gone.

Before taking notes

Materials

- Plan to write all your notes on the same sized paper (A4). It looks neater so you are more likely to use the notes at a later date. Never write notes on odd scraps of paper.
- Use only one side of the paper (you then can lay your notes out to get an overview).
- Label the course, name of lecturer, date, and topic at the top of the first page.
- Use a ring binder. It permits you to add handouts and reorganize the pages as needed.
- Have at least two pens ready (one as a reserve).

Mental preparation

- Anticipate what is to come. Use the course title for this.
- Ask yourself questions: What has happened in the class to date? What do I already know about the topic? What do I want to learn?

While taking notes

Be selective

- Avoid taking notes mechanically.
- Don't write down information you already know.
- Look for cues that enable you to recognize key ideas. Cues are:
  - Advance organizers
  - Repeated remarks
  - Examples
  - Visual aids
  - Summaries
- Be alert for speaker's emphasis through:
  - Tone
  - Gesture
- Take notes when you hear words and phrases, such as
  - It's important, critical...
  - The cause, motive….
  - The consequences, results…
  - But, nevertheless…
  - Everyone believes…
- Copy everything down from the board.
- Note especially those ideas which conflict with our own picture of the world. We tend to remember things which support our existing concepts, and forget those things with which we disagree.

Develop your shorthand skills

- Learn the meaning of key Latin abbreviations used in textbooks (e.g. for *for example*, i.e. for *that is*, vs. for *versus*…).
- Use only the first one or two syllables of a word (for example, *illus* for *illustration, rel* for *relevant*).
- Omit prepositions (in, by, to…) and articles (a, an, the…).
- Omit vowels (*pnt* for *point*, *bk* for *book*).
- Substitute symbols for words (= for *equal*, > or < for *greater* or *less than*). Use arrows to symbolize change and movement.
- Most important, keep a master list of your abbreviations in your ring binder so that you don't forget what they mean!

Leave plenty of white space

As you take notes, leave plenty of white space for editing after class.

After taking notes

Edit your notes

- Finish incomplete thoughts.
- Rewrite illegible words.
- Fill in gaps as you remember points heard but not recorded.
- Arrange with another learner to compare notes.
- Use asterisks to mark important statements.
- Write a brief summary of the session.

Review

Research indicates that recording lecture notes but not reviewing them is as ineffective as just listening to a lecture without taking notes!

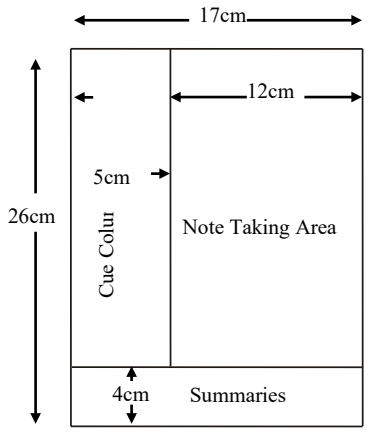
- Rehearse and reflect on the material while it is still fresh in your mind. Thoughtful repetition of the information strengthens learning and increases what you remember.
- Add your personal notes and mark them as such (e.g.□).
- Formulate several test questions based on the material.

The Cornell note-taking format

Note Taking Area: Record lecture as fully and as meaningfully as possible.

Cue Column: As you are taking notes, keep cue column empty. As soon as possible after the lecture, reduce your notes to concise jottings as clues for Reciting, Reviewing, and Reflecting.

Summaries: Sum up each page of your notes in a sentence or two.



The 5 R's of note-taking

The Cornell format provides a perfect opportunity for applying the 5 R's of note-taking.

- **Record**. During the lecture, record in the main column as many meaningful facts and ideas as you can.
- **Reduce**. As soon after as possible, summarize these facts and ideas in the Cue Column. Summarizing clarifies meanings and relationships and reinforces memory.
- **Recite**. Cover the Note Taking Area, using only your writing in the Cue Column, say over the facts and ideas of the lecture as fully as you can in your own words. Then, verify what you have said.
- **Reflect**. Draw out opinions from your notes and use them as a starting point for your own reflections. Reflection will help prevent ideas from being soon forgotten.
- **Review**. Spend 10 minutes every week in quick review, and you will retain most of what you have learned.

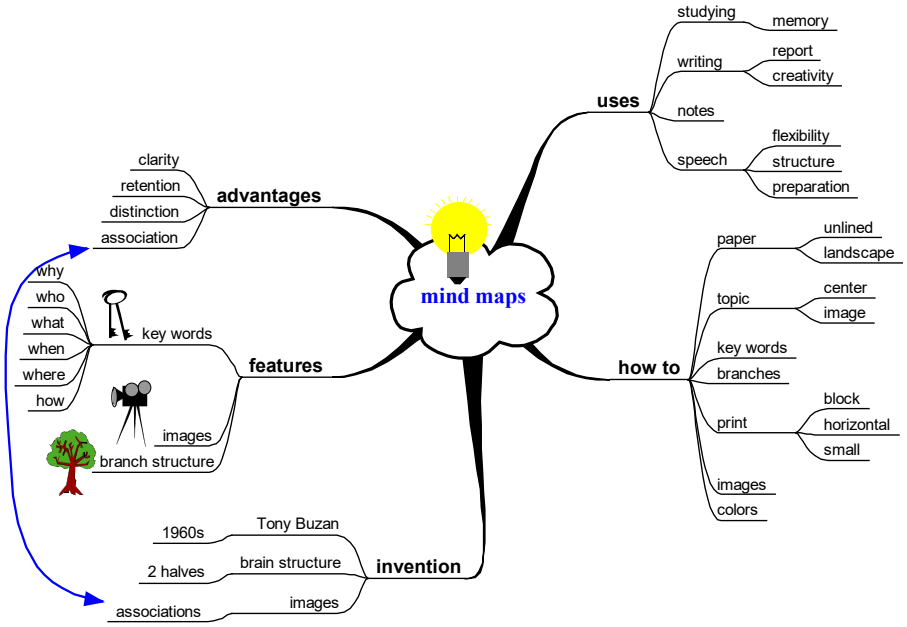
Conclusion

In summary, taking notes is the process of selecting and recording information from a large body of knowledge. Selecting is enhanced by seeking cues from the teacher's organization and communication pattern. Recording is facilitated through preparing, choosing the appropriate format, using shortcuts, and conducting timely reviews.

Performance Guide
Take Notes

Do you...	**YES**	**NO**
1. bring plenty of A4 size paper and at least two pens to your class?	____	____
2. write topic and date on the top of the page?	____	____
3. anticipate what is to come in a session?	____	____
4. record selectively paying attention to cues?	____	____
5. use abbreviations in your writing?	____	____
6. leave plenty of white space?	____	____
7. edit your notes after the session?	____	____
8. review your notes timely?	____	____

Any "NO" means you can improve your note-taking skills!



Introduction

Mind maps were developed in the late 60s of the 20th century by Tony Buzan as a way of helping students make notes. A mind map consists of a central word or concept. Around the central word you draw the 5 to 10 main ideas that relate to that word. You then take each of those words and again draw the 5 to 10 main ideas that relate to each of those words. In this way an exponential number of related ideas can quickly be produced. Mind maps diagram the structure of ideas in an associative manner. Mind mapping supports the thinking process through the graphic and the visualization of thoughts.

Uses

- **Note taking**. Whenever information is being taken in, mind maps help organize it into a form that is easily assimilated by the brain and easily remembered.
- **Creative or report writing**. A mind map lets you rapidly produce an almost infinite number of ideas, and at the same time organize them by placing each idea next to what it is related to. This makes it a very powerful tool for creative writing or report writing, where it is very important to get down all your ideas.
- **Studying**. Instead of simply reading a book on some topic, next time try making a mind map while you read. Just draw your central word and then begin reading. Every time you read some idea that strikes you as important or interesting, just add it onto your mind map in the appropriate place. The act of creating the mind map will greatly increase how much you absorb from the book. Then, if you ever want to review the topic, all you need to do is to look at the mind map. If you want to learn the information very solidly then try to redraw the mind map from memory a few times.
- **Giving a talk.** When giving a talk a set of notes in the form of a single mind map has several advantages over other memory aids. Only a single page is needed. As ideas are reduced to single words you will not be 'reading' your speech. If someone asks a question you can move instantly to the place on your mind map which relates to that question and then return to where you were without loosing yourself in a pile of cards or papers.

Features of the mind mapping technique

The fundamental concept in mind mapping is the idea of key words and the use of pictures. The reason why pictures are 'worth a thousand words' is that they make use of a massive range of brain skills: color, form, line, dimension, texture, visual rhythm and especially imagination. Pictures are therefore often more exciting than words, more precise and potent in triggering a wide range of associations, thereby enhancing creative thinking and memory. In mind mapping both halves of the brain are used. The left half is used for logical thinking and finding information material. The right half is used for the pictorial representation of the mind maps. This combination gives you more ideas and makes you more creative. You can remember the individual items more easily and more quickly.

Advantages

- The central or main idea is emphasized clearly.
- The relative significance of each idea becomes evident in a more meaningful way. The

most important ideas are near the center, and less important ones at the edges.

- The result is that the remembering process and repeating technique are faster and more effective.
- The nature of the structure makes it possible to retain new information easily and without the deletions and squeezed-in additions which affect clarity.
- The shape and contents of each mind map is clearly different from any other. This assists the remembering process.
- In the creative writing area, such as the preparation of essays and speeches, the mind map model makes it easier to link in new ideas.

How to mind map?

The key words in a mind map are the basic concepts and ordering ideas of a topic. A good way to find these key words is to ask:

- What are the most important seven categories in the area under consideration?
- What are the basic questions? Why? What? Where? Who? When? How? often serve remarkably well as major branches in a mind map.
- What are my specific objectives?
- What knowledge is required?

To develop a mind map the following steps have to be taken:

- **Use unlined paper at least A4 size**. Lined paper shuts down the right brain.
- **Turn the paper sideways** ('landscape' mode).
- **Write the topic in the center and circle it with a border**.
- **Use a central image**. Make the center a clear and strong visual image that depicts the general theme of the map.
- **Branch off the main ideas (key words) from this central image**. Further ideas can be branched off from those key words.
- **Use one key word or symbol per line**.
- **Put key words on line. Keep your printing upright**.
- **Print rather than write in script**. It makes them more readable and memorable. Lower case is more visually distinctive (and better remembered) than upper case.
- **Use images throughout your mind map**.
- **Use color to depict themes and associations**. Anything that stands out on the page will stand out in your mind.
- **Use arrows when you want to make connections within and across the branch pattern**.
- Don't get stuck in one area. If you dry up in one area go to another branch.
- If you run out of space, don't start a new sheet; paste more paper onto the map.
- Be creative, have fun.

Conclusion

Mind mapping is a powerful technique that helps you to develop, to structure and to memorise ideas. The central concepts of a mind map are images, key words, and branch structure. Mind mapping supports the thinking process through the graphic and the visualisation of thoughts. Both halves of the brain are used. This combination gives you more ideas, makes you more creative and helps you to organise your thoughts.

Performance Guide
Use Mind Mapping

Did the learner:	**YES**	**NO**
1. select unlined paper (A4 size or bigger)?	____	____
2. turn the paper sideways?	____	____
3. write the topic in the centre?	____	____
4. circle the topic with a border?	____	____
5. use a central image?	____	____
6. branch off the main ideas from the centre?	____	____
7. use key words?	____	____
8. use one key word per line only?	____	____
9. put key words on line?	____	____
10. write upright in print?	____	____
11. use images and colours?	____	____
12. use arrows to make connections?	____	____

To develop a good mind map, all items should be checked "YES."

Use Effective Reading Strategies

Introduction

Every serious learner has the same problem: how to get through the vast amount of reading material available for a specific topic. There is just not enough time to sit down and read everything line by line, word by word. It takes too long. It is necessary for you to acquire reading strategies that allow you to cope with the huge amount and the different types of reading material.

Types of reading material

There are different types of reading material. As a teacher you mainly have to deal with:

- Science articles.
- Magazins and newspapers.
- Texts you have to proofread.

You should not read all of them with the same strategy. For example, each type of reading has a different rate. An exciting novel is quicker to read than a text in physics. Texts also vary in how well they are written. As a consequence some are more difficult to read. If you just don't get it, may be it's because the author just doesn't know how to explain it. Maybe it's not your fault! Go to the library or the bookstore and find another book covering the same subject area that you can understand.

1. Reading magazines and newspapers

These tend to give very fragmented coverage of a subject, typically concentrating on the most interesting parts of a topic. Less interesting background information is ignored. The most effective way of dealing with magazines is to scan (see below) their contents table and turning then directly to interesting articles. If the articles are useful than they can be cut out and filed into a folder specifically covering that sort of information.

2. Reading science articles

Scientific information is often complex and assumes a high level of initial knowledge. It is often written in a complicated language. Before going into details, assess who it has been written for. Be prepared to spend quite some time to understand the message.

3. Proofreading

As a teacher you sometimes have to write instructional material that should have as little mistakes as possible. Before you distribute a text go through the following steps:

- Read very slowly.
- Read out loud, if possible.
- Read one word at a time.
- Mark each read word with a pencil dot.
- Double check for errors you know you tend to make.

Remember that it is twice as hard to detect mistakes in your own work as in someone else's

Reading strategies

The most common approach to study a text is a linear one. The reader opens the book at page one and reads the book through to the end. This might seem the obvious approach, but it is very inefficient. It is a waste of time if you go over material that is already familiar to you. Time is also wasted when the material covers information that is irrelevant to the study in question. Therefore, you should plan your reading assignments and make use of the following strategies:

1. Know what you want to know

The most important thing before you start to read is to know what you want to know after having read the text? Once you know this you can look at the title, the introduction and the table of contents of a book. Is it going to move you towards the goal or not?

2. Know how deeply to study

Where you only need a shallow knowledge of a subject, you can skim (see below) the text . Only when you need detailed knowledge of a subject it is worth studying the text thoroughly.

3. Understand the meaning of information

Understanding occurs by relating new ideas to information you already understand. A good way to do this is to make a quick mind map (see skill card "use mind mapping") of your current knowledge before you start to read. If the material you are reading is totally new, it is often advisable to go first to a reference book, such as an encyclopedia. This will give you an introductory overview of any new subject.

4. Skim

To skim is to read quickly and superficially. Skimming involves searching for the main ideas by reading headings, the first and last paragraph, summaries, words in italics, or bold letters. Skimming provides you with a logical framework with the main ideas. This framework allows you to fit in details later when you start to read more intensive. The framework also enhances your capacity to remember.

4. Scan

To scan is to identify specific facts or ideas. Scanning involves running your eyes down the page looking for specific facts. For example, when you run your eyes down a list of exam results to find your own score. Your eyes move quickly down the page until they focus on your name which you then read more closely to find out exactly what your scores are.

5. Read actively

When you are reading it is often useful to highlight and annotate the text as you go on:

- Read a section first, then highlight it selectively.
- Circle special vocabulary.
- Mark examples that represent main ideas with an asterix.
- Place question marks in the margin next to information you find confusing.

If it's not your book, you should consider photocopying important pages and post it paper for personal notes. Stop periodically, think about the material you read, and summarize in your own words.

6. Develop your own vocabulary

When you locate a new term, look it up in the glossary of the book or in a dictionary. It is a good idea to keep a glossary of your own. Record the terms on one side of a blank business card and their definition on the other side. The business cards fit in every pocket and you can easily be carried around without bothering you. Whenever you have some spare time you can start to memorize the definitions – a very economical way to deal with new vocabulary.

The SQ3R method

Survey! Question! Read! Recall! Review!

If you have to study a text in depth apply the following steps:

1. Survey

Before you read, skim the document:

- Title
- Table of contents
- Introduction
- Heading
- Summaries

Try to anticipate what the author is going to say.

2. Question

Ask yourself, "What do I already know about this subject?" Use a mind map for this. Ask yourself, "what do I want to know from this text?" Write your questions on a piece of paper

3. Read

- Look for answers to your questions.
- Pay special attention to the underlined, italicized, bold printed words.
- Reread parts which are not clear.

4. Recall

- Read only a section at a time and then stop.
- Summarize in your own words what you have just read.
- Highlight important information.
- Write answers to your questions.

5. Review

- Look at your questions and answers.
- Look at the highlighted information.
- Mentally visualize and sketch a picture of the WHOLE.
- Develop a mind map of the text.

Note: More time should be spent on recall and review than on reading!

Conclusion

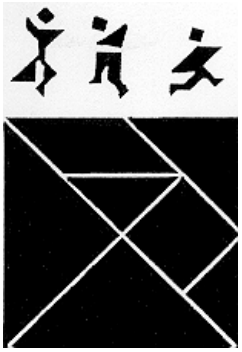
Every learner has the problem of how to cope with the fast-growing amount of reading material. Not every text requires the same reading strategy. Very often it's enough to skim through a document to get a general overview. If you look for a specific information scanning is sufficient. If you have to study a text in detail apply the SQ3R method: Survey, Question, Read, Recall, Review. Remember, the written text should provide you with answers to questions you had at the onset of the reading activity.

Performance Guide

Use Effective Reading Strategies

Do you ….	**YES**	**NO**
1. clearly state what you want to know?	___	___
2. skim a text first?	___	___
3. develop a mind map prior to reading to assess your knowledge?	___	___
4. write a vocabulary for unknown terms?	___	___
5. read actively by highlighting and annotating the text?	___	___
6. link new ideas to information already understood?	___	___
7. develop a mind map at the end that allows reviewing?	___	___

Any "No" means there is room to improve your reading skills.



Introduction

The root of the word "creativity" is “to create”. Create means to produce, or bring into existence something new. Other related words are originality, imagination, innovation. True creativity consists of:

- **SEEING what everyone else has seen,**
- **THINKING what no one else has thought, and**
- **DOING what no one else has dared!**

Purpose

Creativity is the ability to generate novel and useful ideas and *solutions to everyday problems* and challenges. It’s not something that is limited to fine art, writing, and musical composition. One can have creativity in the workshop as well as in the art room; in dressing a shop window as well as in advancing scientific theory and practice. Creativity is a powerful tool for every teacher to enhance the teaching and learning process.

Can you learn to be creative?

The ability to generate innovative ideas in our work is a potential ability that we all possess. The problem is that while we have this ability, our minds are optimized to think within existing patterns. We use the past experiences stored in our memory as a guide for how to proceed forward. For example, past experiences enable a good troubleshooter to quickly zero-in on a problem in a new piece of equipment based on an initial review of the situation. The troubleshooter has seen the pattern of failure before and therefore, has a good idea of the underlying breakdown. But, while this is great for doing the repetitive tasks of daily life, it is not optimal when we want <u>new</u> ideas, <u>new</u> solutions. Creative thinking skills involve using specific techniques to perceive things freshly and break free of the current patterns stored in memory.

Techniques to improve creative thinking skills

1. Break your routine

The more you are used to something, the less stimulating it is for your thinking. Try programming interruptions into your day. Change working hours; get to work a different way; listen to a different radio station; read some magazine or books you wouldn’t normally read; try a different recipe; watch a TV program or film you wouldn’t normally watch.

2. Change your perspective

To solve a problem successfully requires often a change in perspective. If you have an opinion and another person has an opposite point of view, visualize yourself in the other person’s shoes for a change. List all reasons why his/her opinion is valid; then list all the reasons why his/her opinion is invalid: and finally list all the irrelevant points.

3. Force an analogy

Select an object, look at different features of the object, and use these features to question your problem. For example, you have a product that is not selling. Picking up a wooden pencil helps you to explore the problem.

Pencil	Your product
Yellow	Maybe I could change the color
Wood	What about using a different material
Eraser	Maybe I should eliminate certain features
Gold Ring	Maybe I could make it look more expensive
Six Sides	Is the shape of my product as good as it could be?
Sharp Point	Maybe customers miss the “point” of my product – advertising could help

4. Ask “why” five times

Ask “Why” a problem is occurring and then “Why” four more times.

E.g. 1. Why has the machine stopped? (A fuse blew because of an overload) 2. Why was there an overload? (There wasn’t enough lubrication for the bearings) 3.Why wasn’t there enough lubrication? (The pump wasn’t pumping enough) 4. Why wasn’t lubricant being pumped? (The pump shaft was vibrating as a result of abrasion) 5. Why was there abrasion? (There was no filter, allowing chips of material into the pump)

Solution: Installation of a filter solves a future problem.

5. Make the problem worse

Change a positive statement into a negative one. E.g., if you are dealing with Customer Services issues, list all the ways you could make customer service bad. You will be pleasantly surprised at some of the ideas you will come up with.

6. Use unconscious problem solving

This method relies on the ability of the unconscious mind to continually process the information stored in memory. A practical application of this technique is to saturate yourself in the problem and then take a break. Write down the problem on a writing pad and leave it by your bedside. The next morning, take that pad and start writing down your ideas. Aim to write three full pages of anything that comes to mind. Explore your dreams.

7. Record your ideas immediately

Unless you make the effort to document your ideas, you'll lose many of them. There's absolutely no way to predict when a great idea is likely to pop into your mind. The only way to reduce the risk of losing ideas is to carry a notepad and a pen with you **all the time**. Catch an idea when it turns up and write it down on your pad. As you catch all these ideas, you should consider starting an *Idea Bank* where you can deposit your notes. The idea bank could be a file folder, shoe box or a desk drawer. Other material can be added to the bank such as press clippings, cartoons, quotes or helpful hints.

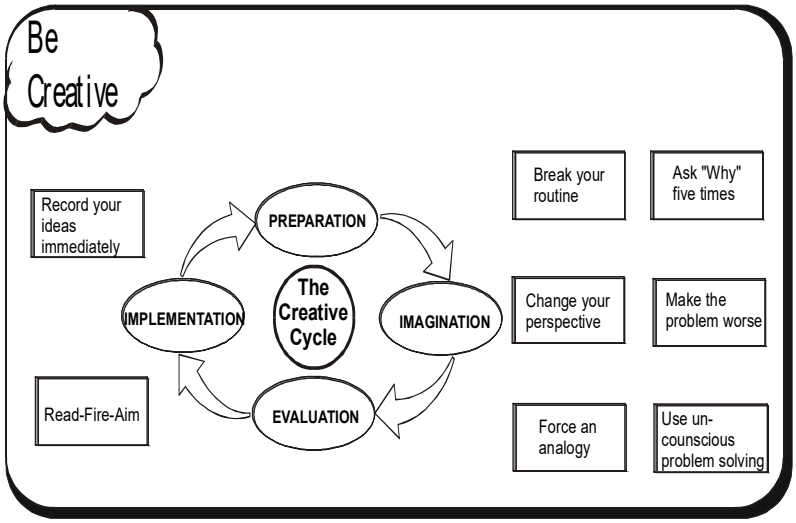
8. Ready-fire-aim

Don't assume the first solution to a problem is the best or only one. Admit in advance that you don't know all the answers and expect to be surprised. *Do it. Try it. Fix it*. Don't be afraid of failing with any given avenue of exploration. Even a negative result from on line of questioning can lead to a new idea or new possibility. A common barrier to creativity, the **"waiting for exactly the right answer" syndrome**, is locked into people's brains shortly after they start school.

The creative cycle

A creative act typically involves four stages:

- **Preparation stage**. Creative thinking begins with careful observation of the world coupled with thoughtful analysis of how things work and fail. In this stage we see and define a problem.
- In the **imagination stage**, we generate novel ideas to solve the problem by using creative thinking skills.
- In the **evaluation stage**, the ideas are put to test to verify if they satisfy the need.



- **Implementation stage**. **Ideas have no value until we put them into practice**. Every new idea that is put into practice changes the world we live in which re-starts the cycle of observation and analysis.

Conclusion

Creativity is the ability to generate novel and useful ideas and solutions to everyday problems and challenges. Generating innovative ideas in our work is a potential ability that we all possess. Very often dominant ideas polarize our perception of a problem. Creative thinking skills help obtaining a different perspective on a problem and therefore enable us to find a better solution.

Performance Guide
Be Creative

When faced with a problem do you:	**YES**	**NO**
1. state the problem clearly?	____	____
2. change your routine to create ideas?	____	____
3. change your perspective?	____	____
4. force an analogy for creating ideas?	____	____
5. ask "Why" five times?	____	____
6. think about how to make the problem worse?	____	____
7. allow your unconscious to "work on" the problem?	____	____
8. always keep a pencil/pad handy to record all of your new, creative ideas?	____	____
9. apply the strategy "Do it. Try it. Fix it"?	____	____

Any "NO" means you can improve your creative skills!

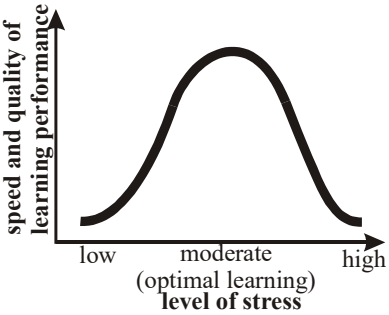


Figure 1. Impact of stress on learning performance

Introduction

Stress is a state of mental, emotional, and physical tension triggered by threats. Your ability to effectively handle the stress in your life is important for your learning. As in many other areas the golden rule holds true: Prevention is better than healing. That means it is important to know what you can do to avoid stress. Equally important are mastering skills to manage stress in situations where you can't avoid it. As a teacher not only are you under stress, you are also the source of stress in your learners.

Excess stress in the learning environment may be the single greatest contributor to impaired learning. There are many ways to cause stress in learners, for example, by assigning them a task they can't solve or by teaching them in an overcrowded classroom.

What is stress?

Stress is a very old survival strategy anchored in our genes. To a threatening situation we respond in either of two ways - it's **fight** or **flight**. The decision which reaction will take place is taken within parts of a second. It's an automatic reaction of the body with the advantage of happening fast but with the disadvantage that, in such a situation, thinking is hardly possible. In an emergency, prolonged evaluation may cost you your life. Whenever an emergency is sensed (e.g. a large vicious-looking dog confronts you) your nervous system swings into action. The heart pumps more blood to your brain and muscles and breathing becomes rapid and deeper. In short, you are prepared for increased physical action. Unfortunately, in our modern society it is often impossible to perform one of the two reactions. Because the energy the body prepares for fight or flight is not used, it is directed towards your own body. As a result the following signs can be observed if you are exposed too often to stress:

Physiological signs:

- tension of muscles
- headache, stomach-ache
- diarrhea, missing appetite
- vision problems, sweating
- cold feet and hands

Mental signs:

- inability to concentrate
- problems to think clearly
- memory lapses

Behavioral signs:

- nervousness, aggression
- increased consumption of alcohol, cigarettes, drugs
- unbalanced eating habits

If something is perceived as a threat or not has to do with your interpretation of reality and past experiences. Some people might consider a certain event as a threat while others just dismiss it. For example, a test can be regarded as a challenge or be perceived as a threat to your career depending on your past experiences in test situations.

Sources of stress

- **The physical learning environment** can be stressful and cause learner failure. Crowded conditions, poor heating, and even lighting can matter.
- **Social situations** can be a source of stress, too. Fear of a threatening teacher, fear of embarrassment, being a failure to peers. Classroom status or social hierarchies, all can and do change the brain's chemistry.
- **Life's mosquito bites.** The greatest source of stress in anyone's life are often the little things - life's mosquito bites. Individually they are irritating; in combination, their effect can be serious. A typical school day is filled with disappointments. Projects that don't work out, scores that are lower than usual, classmates who don't act the way you want, noise, damaged equipment, colleagues who forget their promises … Life's mosquito bites often do more damage than life's major threats precisely because these bites occur continuously. Unattended, the effects of these stressors (things that cause stress) combine.
- **The impact of your beliefs and thoughts.** Your own thoughts and beliefs can be major contributors to the stress in your life. Negative, pessimistic thinking, or unrealistic expectations can put you under a lot of pressure and cause stress.
- **Missing goals.** The absence of goals can be a major stressor. Your stress level is significantly increased if you lack goals. Goals make the unknown knowable! Goals provide direction and motivation.

Managing personal stress

- **Recognizing stressors.** The first step to handling stress effectively is recognizing what are the situations and people that are stressors for you. An important rule of stress management is to pay attention to the impact of the little stressors - life's mosquito bites.

- **Avoiding stressors.** Identifying stressors and taking steps to avoid them constitute a key method in reducing stress in your live. For example, you might leave for work an hour earlier to avoid rush hour. Planning is one way you can avoid stress.
- **Coping strategies**. Unfortunately, many stressors cannot be avoided. In these situations, coping (handle successfully a situation) strategies become necessary. We distinguish between coping strategies designed to regulate feelings of stress (**emotional focused**) and those aimed at redefining the problem causing the stress (**problem focused**). The use of **relaxation techniques** such as meditation is one example. Interrupting a stress reaction through physical movements, or purposeful, relaxed breathing, is another. While these strategies may be helpful in the short run, long-term resolution require focusing on the problem and altering one's perceptions of the situation and its value. One type of problem-focused strategy is to tell yourself that failing an exam is not the end of the world or say "I've failed, but I can learn from this". Another useful approach is to obtain social support by drawing on the experiences of others. Feeling of "Others have gotten through it, so can I" can help in putting the particular stressor in proper perspective. If we can view a stressor as more commonplace and less threatening than originally perceived, the body's response to it presence may be diminished.

Stress and learning

Stress is not always bad for learning. In fact, a certain degree of stress facilitates learning and performance. The inverted U curve in Figure 1 displays the relationship between efficiency of performance and level of stress. Moderate stress generally leads to the most efficient performance. A higher level of stress is helpful in simple tasks (e.g. reciting memorized information), but lower levels of stress are better for complex tasks, such as essay writing and problem solving. In short, for most learning conditions, low to moderate levels of stress are best. **High stress or threat has no place in a learning environment!**

Managing classroom stress

- Try to avoid using threats to regulate learning behavior.
- Don't embarrass learners.
- Reduce threats from other learners in class by setting up clear expectations about classroom behavior. Follow through and enforce classroom rules. Never tolerate learners threatening or hurting one another.
- Encourage the use of partners, work groups and teams. Change them regularly to ensure everyone has a chance to meet and work with others in a variety of leadership and support roles.
- Help learners set specific, realistic and measurable goals.
- In the classroom, stress can be released through peer support, games, and physical exercise.
- Provide enough fresh air, proper lighting , and adequate room temperature.

Conclusion

Stress is a natural phenomenon triggered by threats. Under stress you have a desire to fight or flight. If you can't react in either way your health is affected negatively and your ability to think and to learn is impaired. Recognizing and avoiding stressors is important for your learning and teaching. Physical exercise, purposeful breathing and relaxation techniques are helpful in managing stress successfully.

Performance Guide
Manage Stress

To manage personal stress do you...	**Yes**	**No**
1. Identify potential stressors in the environment?	___	___
2. Avoid stressors?	___	___
3. Do physical exercise to loosen up tension?	___	___
4. Apply relaxation techniques?	___	___
5. Alter your perception of a problem?	___	___
To manage classroom stress do you …		
1. Avoid using threats to regulate learning behavior?	___	___
2. Reduce threats from other learners by setting up clear rules about classroom behaviour?	___	___
3. Help learners set specific, realistic and measurable goals?	___	___
4. Apply games and physical exercise?	___	___
5. Provide adequate lighting and fresh air?	___	___

To mange stress successfully, all items should be checked" YES."

Summary of Research on Effective Classroom Learning & Teaching

Introduction

Teaching and learning are interrelated. **The word *teach* is defined as "to help to learn by telling or showing"** (Collins English Dictionary, 1991). Knowing the foundations of learning helps us to understand which teaching strategies will work.

What we know about teaching comes from two different areas:

- research, and
- clinical experience.

Clinical experience is that large body of knowledge written by teachers about what works best for them. The majority of what is known about teaching comes from clinical experiences passed on from teacher to teacher.

In 2008 the Australian researcher John Hattie published his groundbreaking study "*Visible Learning*". It is the result of 15 years of research and synthesizes over 50,000 studies. It presents the largest ever collection of evidence-based research into what actually works in classrooms to improve learning.

A professional teacher should continuously keep up to date with the literature from both research and clinical experience.

Hattie for higher education

The greatest variance in student achievement (about 50%) is a function of what the learner brings to the classroom. Students differ greatly in respect to their prior knowledge, their different motivations and purposes for learning and last but not least by their different talents and learning biographies. But already the second greatest source of variance is the quality of the teacher (around 25%). To be an effective teacher you have to see learning through the eyes of a student (Hattie, 2015, p. 89):

When academics walk into a teaching situation their fundamental question needs to be "how will I know my impact today". This leads to the tree subquestions – what do I mean by impact today and have I communicated this to my students, what is the magnitude of the impact I am seeking, and how many students can I teach such that they attain this magnitude on the impact I have clearly communicated.

Using his data, John Hattie identified the following qualities for teachers to have, which impact student learning the most (ordered here from 1 to 6 in order of importance):

1. Are **passionate** about helping their students to learn.
2. **Monitor** their impact on students' learning and adjust their approaches accordingly.
3. Are **clear** about what they want their students to learn.
4. Forge strong **relationships** with their students.
5. Adopt **evidence-based teaching** strategies (see Table 1).
6. Actively **seek to improve** their own teaching.

Hattie developed a way of synthesizing various influences in different meta-analyses according to their effect size (Cohen's d). Hattie found that the average effect size of all the interventions he studied was 0.40. Therefore, he decided to judge the success of influences relative to this 'hinge point', in order to find an answer to the question "What works best in teaching?" An impact factor over 0.4 is a strong indication for a successful teaching strategy.

The fundamental premise of Hattie's research is that when teachers focus on defining, evaluating, and understanding their impact on student achievement, it leads to improved student learning.

SOTL

SOTL is an acronym for **S**cholarship **o**f **T**eaching and **L**earning. It is defined as a systematic inquiry into student learning which advances the practice of teaching in higher education by making inquiry findings public. Building on this definition, Peter Felten, a professor at Elon University, identified 5 principles for good practice in SOTL: (1) inquiry focused on student learning, (2) grounded in context, (3) methodologically sound, (4) conducted in partnership with students, (5) appropriately public.

SOTL is an approach that helps teachers to develop their pedagogical expertise. Inquiry methods in SOTL include reflection and analysis, interviews and focus groups, questionnaires and surveys, course evaluations, classroom observations etc. Findings of these endeavors should be made public and are part of a teacher's accountability.

Bain for higher education

Another relevant long-term study for higher education teachers comes from Bain (*What the best college teachers do; 2004*). For decades he has evaluated the data from lecturers whose classes have achieved outstanding learning outcomes. His research findings can be summarized as follows (Bain 2004, p. 15 – 19):

- *Without exception, outstanding teachers know their subjects extremely well.*
- *They prepare their teaching assignment with questions about student learning objec-*

tives rather than about what the teacher will do.

- *They have high expectations regarding student performance.*
- *While methods vary, the best teachers often try to create what we have come to call a "natural critical learning environment". In that environment, people learn by confronting intriguing, beautiful, or important problems, authentic tasks that will challenge them to grapple with ideas, rethink their assumptions, and examine their mental models of* reality.
- *Highly effective teachers tend to reflect a strong trust in students. They usually believe that students want to learn, and they assume so until proven otherwise. They often discuss openly and enthusiastically their own sense of awe and curiosity about life. Above all, they tend to treat students with what can only be called simple decency.*
- *All the teachers we studied have some systematic program to assess their own efforts and to make appropriate changes. Furthermore, because they are checking their own efforts when they evaluate students, they avoid judging them on arbitrary standards.*

Future trends

Technological promises to change learning dramatically have a long history. But up to now learning is still a biological process and manifests itself at the level of synapses (see page 19). Therefore, learning needs time and repetition. Learning is restricted by biology and not by any kind of method as often misunderstood.

Maybe one day neuroenhancers, implanted computer chips, genetically modified humans or personalized learning histories will lead to a paradigm shift in learning.

Until then learning theories and their application in teaching are the point of reference for any teacher.

Conclusion

There is always room to improve!

Keeping up to date with research on effective teaching & learning and putting the research into practice is a lifelong job for every teacher. Evaluate the impact of your teaching on student achievement regularly by using a SOTL approach and share your findings with a wider community.

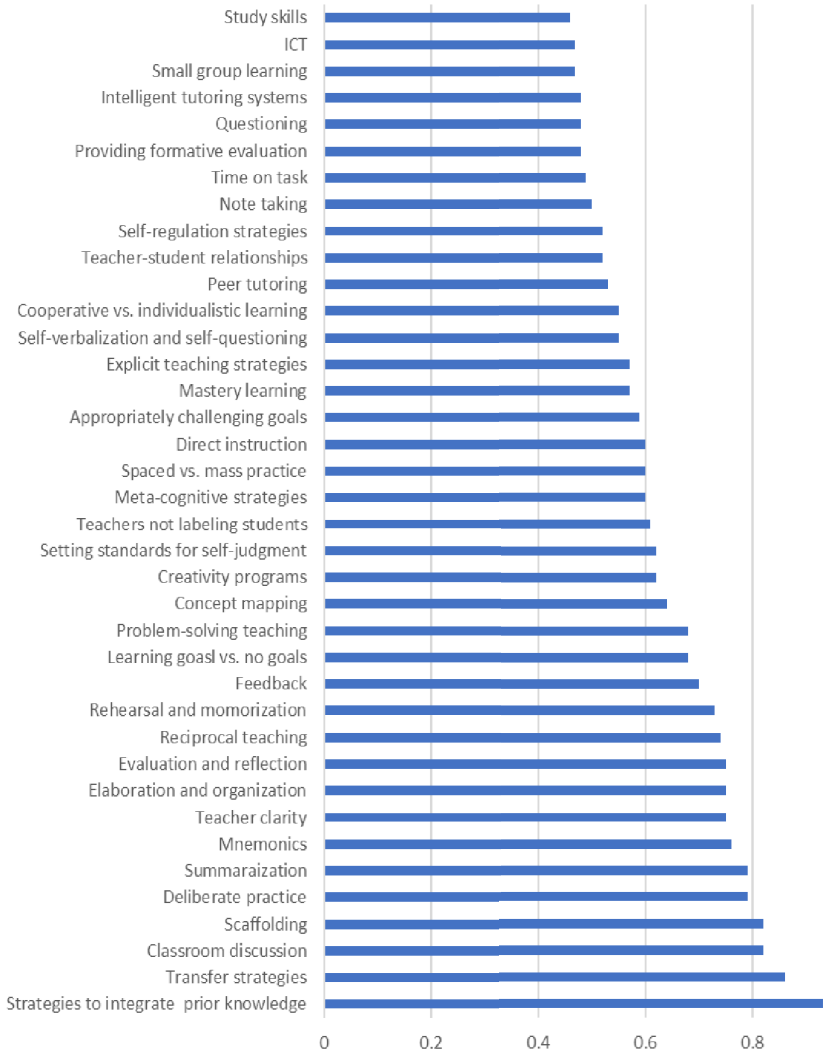


Table 1 Selection of factors related to student achievement after Hattie 2018 with Cohen's d effect size on the x-axis

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