Some Important Ideas About Learning

That all point to the need for students to actively participate in the learning process.
How People Learn

A Study Commissioned by the
US National Academies of
Science and Engineering

Committee on Developments in
the Science of Learning
&
Committee on Learning Research
& Educational Practice

National Academy Press
Washington DC
2000

This book is available online:
http://newton.nap.edu/html/howpeople1/
“How People Learn”

Describes a synthesis of recent research by
cognitive psychologists
developmental researchers
social psychologists
cognitive psychologists
anthropologists
neuroscientists
and educators

and leads to
three significant findings.
Finding 1

“Students come to the classroom with preconceptions about how the world works. If their initial understanding is not engaged they may fail to grasp the new concepts and information that are taught, or they may learn them for the purpose of a test but revert to their preconceptions outside the classroom.”

Initial Conditions of Learning

Cold, Hard fact:
Your teachers may not know your preconceptions.

Some teachers may try to find out, but others may not.

That means you must work to sort out differences between how you think the world works and what is proposed in your classes.

If you do not take responsibility for this you may miss out on essential learning.
Finding 2
To develop competence in an area of inquiry, students must:

(a) have a deep foundation of factual knowledge,

(b) understand facts and ideas in a context of a conceptual framework, and

(c) organize knowledge in ways that facilitate retrieval and application.

A Thought Experiment

Each of us has several areas of expertise - a sport, a hobby, music, history, science, hang gliding, surfing, scuba diving, etc.

Think of one area of your expertise and list the types of **factual information and skills** you need to be an expert there,

In pairs, discuss this knowledge and **how you organize it in your head**.
Example

Sailing boat racing

Weather (wind, waves, tide, current, ...)

Sail setting (fore sail, main sail, other sail, ...)

Course (location of next mark, wind direction, tide direction, ...)

Competition (location of other boats, relative position, ...)

...
Chess Expertise

Experts develop patterns of meaningful information.

Experts versus Novices

Experts acquire new information and organize it differently from novices.

Experts may transfer (teach) information but not the context or organization of information. That takes place in the student’s own mind.
To become experts ... students should think about how they learn and how they organize information.

The process of “study” is largely about organizing information so that it can be accessed and used efficiently.
Transformation of Students

The most powerful learning occurs when we move away from inert knowledge and towards flexible thinking.

Adapted from John Bransford and the “Center for Learning in Formal and Informal Environments”. 
Finding 3

A metacognitive approach to instruction can help students learn to take control of their own learning by defining learning goals and monitoring their progress in achieving them.

The Habits of Mind provide us with the dispositions needed for skillful thinking and a language with which to develop the ability to think and talk about our thinking – metacognition.
Habits of Mind

• are dispositions to behaving intelligently when faced with a problem where the "solution" is not known.

• One list of 16 "habits" has been developed by Arthur Costa and Bena Kallick.

• Because they describe behaviors they provide a good basis for discussing thinking.
Habits of Mind developed by Arthur Costa and Bena Kallick.

**Personal Traits**
- Persisting
- Managing impulsivity
- Striving for accuracy
- Finding humor

**Acquiring Information**
- Gathering data through all senses
- Listening with understanding and empathy
- Questioning and posing problems
- Thinking interdependently

**Thinking Tools**
- Thinking flexibly
- Thinking and communicating with clarity and precision
- Applying past knowledge to new situations
- Remaining open to continuous learning

**Personal Responses to Thought**
- Creating, imagining, innovating
- Responding with wonderment and awe
- Thinking about thinking (metacognition)
- Taking responsible risks
First Order Thinking
Processing Ideas

1. Treating facts or ideas as independent entities
   accumulating facts, generating new ideas

2. Simple analysis of collections of facts or ideas
   classify, sequence
   analogy/metaphor, compare/contrast
   parts/whole reasoning

3. More complex analysis
   inference
   causal reasoning
   generalization, prediction
   analogical reasoning
   deduction
   conditional (if ... then)
   categorical (some ... all)

4. Complex cognitive tasks (systematic thinking)
   decision making
   problem solving
   assumptions, order of magnitude estimates
   planning
   modeling and simulation
Second Order Thinking
Evaluating Ideas

1. Assessing the reasonableness of ideas
   assessing the reliability of information
   accuracy of observation
   reliability of sources

2. Evaluating the utility of ideas

3. Testing conclusions with reality
   uncovering and evaluating
   assumptions
   hypothesis and testing
   identifying reasons and conclusions

4. Reformulating ideas based upon assessment

5. Evaluation of the human element
   consensus
   personal feelings
Third Order Thinking
Metacognition

1. Being **aware** of the kind of thinking you are doing

2. Knowing the thinking **strategy** you are using.

3. **Evaluating** the effectiveness of your thinking.

4. **Planning** how you will do the same kind of thinking the next time it is needed.
"Education is what you have left when you have forgotten everything you learned in school."

- Albert Einstein, 1936
The Brain

The brain is a collection of about 10 billion interconnected neurons.
How the Brain Changes

• Synaptic connections occur in two ways
  – Overproduction and loss (during the growth process).
  – Addition of new synapses – throughout life as a result of the effort to learn.

• Physical changes occur with exercise
  – exercise increases the number of blood vessels supplying the brain

Mens sana in corpore sano
Times to Remember

Sensory Memory
(1 - 2 seconds)

Working Memory
(≈ 18 seconds without attention)

Long Term Memory
(permanent, more or less)

sight
sound
feel
taste
smell

90%

Attention
Rehearsal
Refresh
Perhaps the most significant discovery about the brain made in the last 30 years is that it is not the immutable organ it was thought to be.

You can train your brain to become a more skillful thinker.

It is important for you as a student to be aware of these new viewpoints and techniques because:

1) you can improve the processes of your own learning and thinking,

2) skillful learning and thinking makes your knowledge more useful and transportable,

3) they can initiate a lifelong process of continual development and improvement.