Successful Learning: Mindset and Metacognition

Prof Kevin M Passino

http://www.ece.osu.edu/~passino/

3/3/20
Outline:

1. Mindsets
2. Metacognition
3. Learning strategies
4. Examples
Mindset [1]:
1. You can grow your own intelligence!
2. You can learn how to learn effectively!
3. Everyone has a mix of two mindsets…

**Growth Mindset**
- “Failure is an opportunity to grow”
- “I can learn to do anything I want”
- “Challenges help me to grow”
- “My effort and attitude determine my abilities”
- “Feedback is constructive”
- “I am inspired by the success of others”
- “I like to try new things”

**Fixed Mindset**
- “Failure is the limit of my abilities”
- “I’m either good at it or I’m not”
- “My abilities are unchanging”
- “I don’t like to be challenged”
- “I can either do it or I can’t”
- “My potential is predetermined”
- “When I’m frustrated, I give up”
- “I like to try new things”

© Big Change
Adopt the growth mindset

Love the process of learning!

Growth vs. fixed mindsets in learning [1]
Repairing fixed mindset:
1. Acknowledge your fixed mindset (pieces)
2. Know fixed mindset triggers (challenges, dead ends, failures)
3. Assign a name to the fixed mindset (“Joe”)
4. Educate Joe with growth mindset ideas
5. Choose path, iterate

Nurturing a growth mindset:
1. Opportunities for learning and growth today? Me? Others?
2. Make a plan
3. What, where, and how can I act on my plan?
4. How to maintain and continue growth?
5. Repeat
Metacognition =
“thinking about your own thinking” [Flavell]

Metacognition and learning =
“thinking about your own learning”

Awareness you are problem-solving
Judge your approach and learning level, adjust
As if you have a brain inside your brain!
Academic success stories (many others + evidence per scientific studies) [3]:

Travis: LSU student, test scores:
47, 52, 82, 86

Dana: LSU student, test scores:
80, 54, 91, 97, 90

Learn “metacognitive learning” in the university, use it for life!
Career success requires life-long learning:

- Industry: Automotive, aerospace,..
- Government: Labs, think tanks,…
- Academia:
  - BS, MS, PhD, Professor
  - Law, Medicine, Business,…

Your ability to learn will greatly impact your life-long career success—*use your second brain!*
Desired Outcomes [3]:
1. Analyze your current learning strategies
2. What changes needed to get an A?
3. Concrete strategies for this semester
4. Use these strategies, as needed, in your whole career + learn more strategies
Learning Mindset: Effort, Goals [3,1]

• What is the difference between studying and learning?

• Which task would you work harder
  1. Get an A on an exam.
  2. Teach the material to the class.

What is your mode of operation:
(i) study mode, or (ii) learning mode?

Stay in learning mode, study as if you had to teach it!
Approach from a growth mindset

Remembering
- Retrieving, recognizing, and recalling relevant knowledge from long-term memory.

Understanding
- Constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining.

Applying
- Carrying out or using a procedure through executing, or implementing.

Analyzing
- Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure.

Evaluating
- Making judgments based on criteria and standards through checking and critiquing.

Creating
- Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing.

Bloom's Taxonomy [3]

Approach from a growth mindset
Characteristics [3]:

- Levels of thinking while learning.
- Levels build on each other.
- Must learn lower levels to get to higher ones.

How to move up the hierarchy?
Use the “study cycle”…
Actively and continuously engage in learning the material!

**Preview before class** – Skim the chapter, note headings and boldface words, review summaries and chapter objectives, and come up with questions you’d like the lecture to answer for you.

**Attend class** – GO TO CLASS! Answer and ask questions and take meaningful notes.

**Review after class** – As soon after class as possible, read notes, fill in gaps and note any questions.

**Study** – Repetition is the key. Ask questions such as ‘why’, ‘how’, and ‘what if’.
- Intense Study Sessions* - 3-5 short study sessions per day
- Weekend Review – Read notes and material from the week to make connections

**Assess your Learning** – Periodically perform reality checks
- Am I using study methods that are effective?
- Do I understand the material enough to teach it to others?

Approach from a growth mindset

Maintain a calendar: study sessions, assignments, tests
*Intense Study Sessions [3]  

1. **Set a Goal** (1-2 min)  
   - Decide what you want to accomplish in your study session

2. **Study with Focus** (30-50 min)  
   - Interact with material: organize, concept map, summarize, process, re-read, fill-in notes, solve, reflect,…

3. **Reward Yourself** (10-15 min)  
   - Take a break: call a friend, play a short game, get a snack

4. **Review** (5 min)  
   - Go over what you just studied

**Start assignments the day they are assigned.**  

Actively engage!
1. Assess prior knowledge, fill in gaps
2. Always ask “why,” “how,” and “what if” questions.
3. Organize knowledge (e.g., textbook + lecture).
4. Learn component skills + integration
5. Use study cycle/intense study sessions.
6. Seek higher levels of the Bloom Taxonomy.
7. Test understanding by giving mini-lectures on concepts (fake audience?). Work in study groups?
8. Solve problems without looking at an example or solution. Put together a mock exam?
9. Spend time every day on the class, use textbook
10. Goal: 100% mastery
Metacognitive Strategy: “Active reading” [3]

1. Preview: Read title, section headings
2. Re-preview: Read abstract, conclusions
3. Activate: Write down questions the reading can answer
4. Activate: Paraphrase as you read (write!)
5. Activate: Equations, figures, diagrams: Slow down! Requires analysis/Matlab?
Metacognitive strategy: Concept maps [2] Facilitate the development of higher order thinking skills [3]:

Example: Chapter map
Metacognitive strategy: [2,3]

Compare and Contrast: Find deep knowledge

Concept #1

Concept #2

How are they similar?

How are they different?

Other learning strategies are in [1,2].
**General Metacognition for Learning** [2]

- Assess the task at hand, taking into consideration the task’s goals and constraints.
- Evaluate their own knowledge and skills, identifying strengths and weaknesses.

(Adapted from Lovett, 2008)
• Plan their approach in a way that accounts for the current situation.
• Apply various strategies to enact their plan, monitoring their progress along the way.
• Reflect on the degree to which their current approach is working so that they can adjust and restart the cycle as needed.

Can apply this approach to any learning task!
Example Task: Solution to an Engineering Assignment

- Task details, constraints, goals
- Prior knowledge? Required time/effort?
- Approach: Math, Matlab, graphics, words, use of other literature.
- Learning goal: Be able to teach it to the class.
Example Task: Mathematical Paper

1. Use the active reading strategy.
2. Read slow and careful, re-read.
3. Do simple examples, sketches, math of your own, Matlab simulation.
4. Explore other literature (references).
5. Learning goal: Be able to teach it to a group of graduate students.

Approach from a growth mindset
Example Task: Humanitarian Engineering

1. Assess task, goals, constraints: Social, technical
2. Evaluate own knowledge, skills: Need help?
3. Plan an approach: But, be flexible
4. Apply various strategies, monitor
5. Reflect, adjust approach when needed

Approach from a growth mindset
Final Remarks:

• Ideas are useful to improve your success?
• Want to change your mindset?
• New metacognitive strategy to use first?
• Start now, or you probably will not!
References:

