Promoting Student Metacognition: Sample self-questions to promote student metacognition about learning

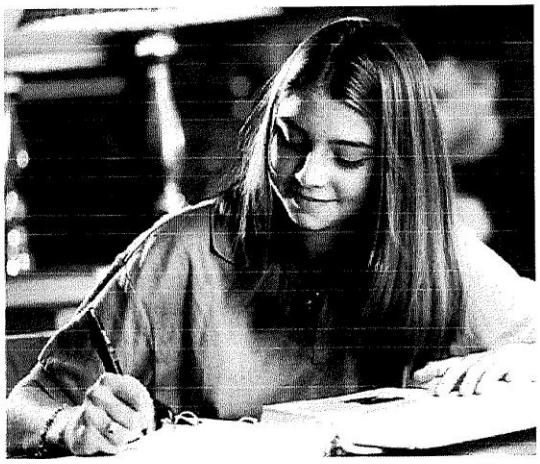
Activity	Planning/Predicting	Monitoring/Adapting	Evaluating
Class session	• What are the goals of the class session going to be? • What do I already know about this topic? • How could I best prepare for the class session? • Where should I sit and what should I be doing (or not doing) to best support my learning during class? • What questions do I already have about this topic that I want to find out more about?	• What insights am I having as I experience this class session? What confusions? • What questions are arising for me during the class session? Am I writing them down somewhere? • Do I find this interesting? Why or why not? How could I make this material personally relevant? • Can I distinguish important information from details? If not, how will I figure this out?	• What was today's class session about? • What did I hear today that is in conflict with my prior understanding? • How did the ideas of today's class session relate to previous class sessions? • What do I need to actively go and do now to get my questions answered and my confusions clarified? • What did I find most interesting about class today?
Active-learning task and/or homework assignment	• What is the instructor's goal in assigning this task? • What are all the things I need to do to successfully accomplish this task? • What resources do I need to complete the task? How will I make sure I have them? • How much time do I need to complete the task? • If I have done something like this before, how could I do a better job this time?	• What strategies am I using that are working well or not working well to help me learn? • What other resources could I be using to complete this task? What action should I take to get these? • What is most challenging for me about this task? Most confusing? • What could I do differently mid-assignment to address these challenges and confusions?	• To what extent did I successfully accomplish the goals of the task? • To what extent did I use resources available to me? • If I were the instructor, what would I identify as strengths of my work and flaws in my work? • When I do an assignment or task like this again, what do I want to remember to do differently? What worked well for me that I should use next time?
Textbook Reading Assignment	• What questions am I reading to answer? What do I need to get out of this reading? Do I have learning goals that reflect a range of thinking levels? • What clues are available in the textbook to direct my attention to the most important aspects of the reading? • When's the best time for me to complete this reading in relation to other course assignments?	• How can I best record and organize the information I need to learn? • What is most challenging for me about this reading assignment? Most confusing? What can I do to clarify my confusion? • What am I reading that I can connect to previous knowledge? • Is my attention wandering? What do I need to do to get it back on track?	• How can I best summarize the main points of the reading? • What have I learned? • Is this what I expected to learn? • Can I apply these ideas to a new situation? • Is there any gaps in my understanding? How can I fill in these gaps?

Activity	Planning/Predicting	Monitoring/Adapting	Evaluating
	• Is it too long to read in one sitting? How can I best break it into sections? • What's the best approach/system to use for this type of reading assignment (e.g., SQ4R, P2R, S-RUN, etc.)?		
Preparing for a Quiz or exam	• What strategies will I use to study (e.g., study groups, problem sets, evaluating text figures, challenging myself with practice quizzes, and/or going to office hours and review sessions)? • How much time do I plan on studying? Over what period of time and for how long each time I sit down do I need to study? • Which aspects of the course material should I spend more or less time on, based on my current understanding?	• To what extent am I being systematic in my studying of all the material for the exam? • To what extent am I taking advantage of all the learning supports available to me? • Am I struggling with my motivation to study? If so, do I remember why I am taking this course? • Which of my confusions have I clarified? How was I able to get them clarified? • Which confusions remain and how am I going to get them clarified?	• What about my exam preparation worked well that I should remember to do next time? • What did not work so well that I should not do next time or that I should change? • What questions did I not answer correctly? Why? How did my answer compare with the suggested correct answer? • What confusions do I have that I still need to clarify?
Overall course	• Why is it important to learn the material in this course? • How does success in this course relate to my career goals? • How am I going to actively monitor my learning in this course? • What do I most want to learn in this course? • What do I want to be able to do by the end of this course?	• In what ways is the teaching in this course supportive of my learning? How could I maximize this? • In what ways is the teaching in this course not supportive of my learning? How could I compensate for or change this? • How interested am I in this course? How confident am I in my learning? What could I do to increase my interest and confidence?	• What will I still remember 5 years from now that I learned in this course? • What advice would I give a friend about how to learn the most in this course? • If I were to teach this course, how would I change it? • What have I learned about how I learn in this course that I could use in my future courses? In my career?

- Inspired by Ertmer and Newby (1996), Schraw (1998), and Coutinho (2007)
  Adapted from: http://www.lifescied.org/content/11/2/113/T3.expansion.html

Creating Study Guides

THE PURPOSE OF STUDY GUIDES is to organize lecture notes and text book material so that you can increase your comprehension and memory of large amounts of information. Preparing study guides that are visual is even more effective, as the visual organization helps you see related concepts and make meaningful connections with the material, thus acquiring the higher levels of learning expected by many of your professors.



STUDY GUIDES AND LEARNING LEVELS

Preparing for tests often involves more than knowing facts, figures, formulas, and definitions. Many professors expect you to demonstrate critical thinking, which involves more than rote memorization. Therefore, you must organize and process course materials so that you can increase your comprehension and ability to think critically.

Examples of Learning Levels

Review the following examples of test questions from a sociology class. The first question only requires that you recall a definition, which you can do well through rote memorization techniques, such as flash cards. The remaining questions require you to make connections or conclusions that may not have been directly presented by your professor or your text book.

Question 1: A group of relatives by marriage constitutes
a) a conjugal family b) an extended family c) a nuclear family d) none of the above

Question 2: Describe the similarities and differences of these societal forms: matriarchal, neolocal, and patriarchal societies...

Question 3: Illustrate the economic flow and functions of a neolocal society.

To correctly answer test questions like those in the example, you must create study guides that will help you:

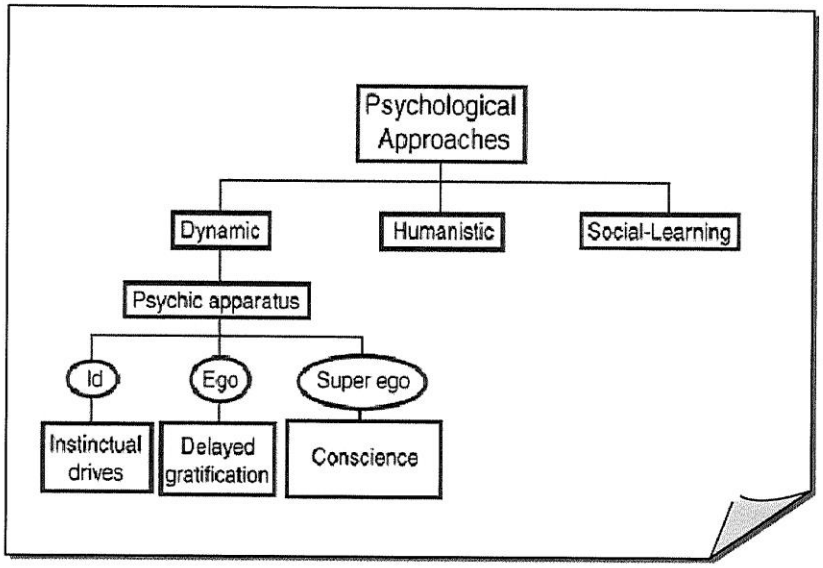
- **condense** course material into smaller amounts of information that are easier to remember.
- **Visualize**, understand, and demonstrate relationships among concepts and ideas.
- **create** examples and apply information to "real world" situations.

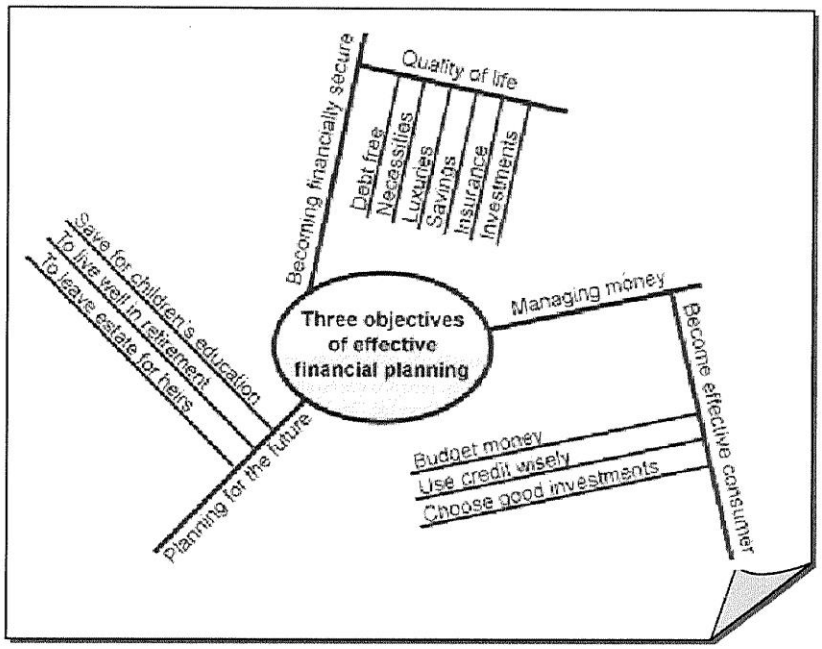
COMMON TYPES OF STUDY GUIDES

Within this Idea Sheet are examples of common types of study guides or "visual organizers". These study guides can be adapted based on your personal learning style and the information you need to organize. Experiment with these, as well as using other study guide formats that you have found to be effective. Remember, the purpose for study guides is to organize information so that you can demonstrate your knowledge at the critical thinking level your professor expects.

1. Concept map and branching diagram

Many students benefit when information is presented visually. Concept maps and branching diagrams allow you to organize information spatially versus in a linear outline format. However, you still organize information from the general to the specific. You can then add details and examples that help you apply the information. Concept maps and branching diagrams are useful for classes in any subject area.





2. Comparison chart

A comparison chart allows you to organize information visually so that you can see relationships among categories or characteristics. It is a very effective format when you need to be able to understand the differences or similarities among facts, theories, theorists, processes, etc.

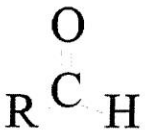
HOW TO CREATE A COMPARISON CHART

Information you are comparing	Characteristics you are comparing		
	Transmission	Vaccine	Symptoms
Hepatitis A			
Hepatitis A			
Hepatitis A			

EXAMPLE (from Psychology class)

Type of memory	Information stored	Capacity	Duration of info.	Format
sensory	temporary; senses	high	<1 sec. (vision) few seconds (hearing)	literal
short-term	brief; info. currently being used	limited	<20 seconds	auditory & verbal
long-term	relatively permanent	unlimited (?)	long or perm. (?)	semantic

EXAMPLE (from a Chemistry class)

Name of organic compound	Functional group	Structure
1. Alkane		
2.		
3.		

3. Concept card

Concept cards are "flash cards on steroids", and you create them using index cards that are 3x5 or larger.

On the **FRONT OF THE CARD**, you write the:

1. key idea or concept you want to learn
2. organizing term or phrase (upper right-hand corner). This is the category or term that allows you to see how your key ideas or concepts are organized.
3. source of the information (textbook page, date of lecture, etc.)

Digestive System (stomach)
organizing term

Gastric Juice
concept

Chapter 22 – p. 491
where info. is in textbook

On the **BACK OF THE CARD**, you write what is most important to know and learn about the concept, in your own words. To ensure you do more than just memorize the information, include examples, summaries, and synthesis of main points as well as definitions. Include diagrams, time lines, or other visuals that will help you understand the information at the level your professor expects.

Example 1: BACK OF CARD

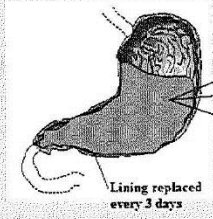
Gastric Juice: a digestive fluid that mixes with food and secreted by cells inside stomach

1. hydrochloric acid (concentrated)
2. pepsin (digestive enzyme for proteins)
3. mucus
   *protective coating keeps acid from destroying stomach
   *only released when food is in stomach

Every 3 days: stomach lining replaced

Example 2: BACK OF CARD

Gastric Juice: a digestive fluid that mixes with food and secreted by cells inside stomach



APM: acid, pepsin, mucous

Example 3:

FRONT

Concept, term, or problem

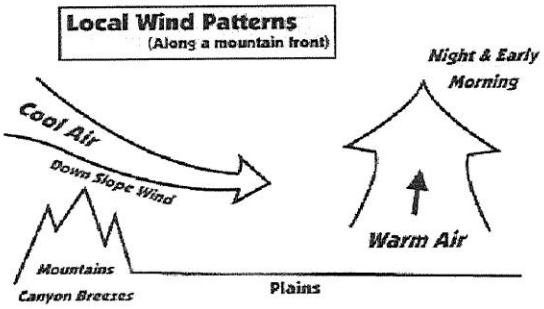
BACK

Essential characteristics,	Non-essential characteristics, your own words, definition
Examples, diagrams, applications	Non-examples, exceptions, cautions

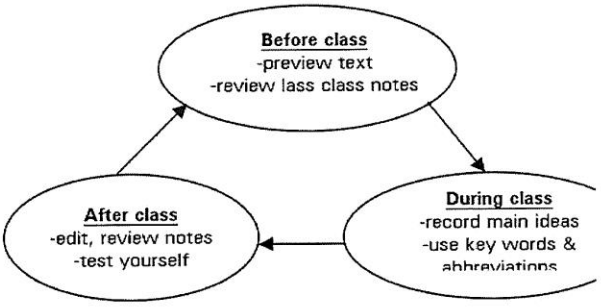
4. Diagram

Diagrams allow you to visually represent dynamic information such as a process, procedure, stages, and steps. For example, in a geology class, you could create a diagram to describe how rock layers are formed. In a political science class, a diagram can help you understand and learn the process for how a bill is passed into law.

Example 1: physical geography class



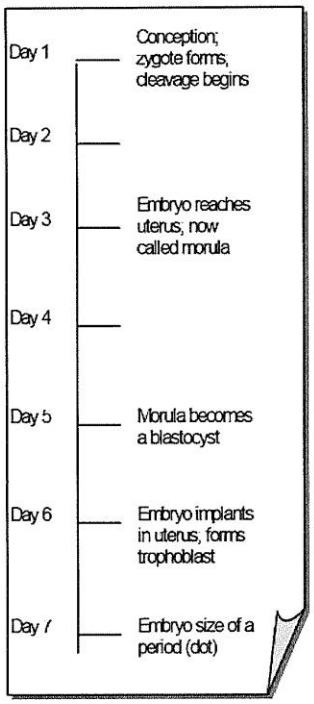
Example 2: note-taking cycle



5. Time Line

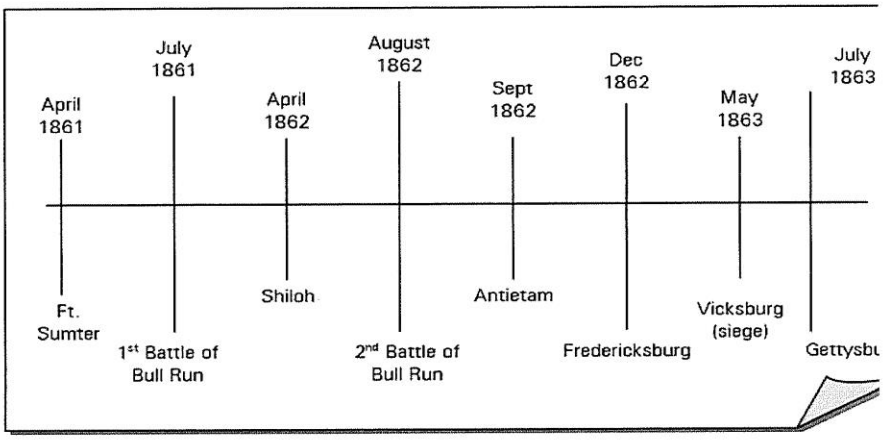
A time line allows you to organize information chronologically. You are able to review information that must be understood and remembered in sequence. Time lines would be effective for classes in which you are presented:

- historical developments: history, anthropology, political science, music, art
- biological developments: biology, anatomy, physiology
- human or other developments: psychology, biology, natural resources



Example 1: Development of an embryo

Example 2: Major Civil War Battles 1861-1863



ACTIVE STUDY TASKS

Preparation Strategies

- Develop study sheets
- Develop concept maps
- Make word cards
- Make question cards
- Make formula cards
- Make problem cards
- Make self-tests
- Do study guides
- Mark text material
- Do problems
- Outline
- Take notes
- Summarize

- Chart related material
- List steps in the process
- Predict essay questions
- Plan essay answers
- Write essay answers

- Answer questions at the end of chapter
- Prepare material for study group

Review Strategies

- Recite study sheets
- Replicate concept maps
- Recite word cards
- Recite question cards
- Practice writing formulas
- Work problems
- Take self-tests
- Practice study guide info aloud
- Take notes on marked text
- Redo "missed" problems
- Recite main points from outline
- Recite notes from recall cues
- Recite summaries aloud from memory
- Recreate chart from memory
- Recite steps from memory
- Answer essay questions
- Practice reciting main points
- Rewrite essay answers from memory
- Recite answers
-
- Explain material to group members

Assessing Your Metacognition

Metacognition is essential to successful learning because it enables individuals to better manage their cognitive skills and to determine weaknesses that can be corrected by constructing new cognitive skills. Almost anyone who can perform a skill is capable of metacognition – that is, thinking about how they perform that skill. Promoting metacognition begins with building an awareness that metacognition exists, differs from cognition, and increases academic success. The next step is to learn strategies, and more importantly, to construct explicit knowledge about when and where to use strategies. A flexible strategy repertoire can be used next to make careful regulatory decisions that enable individuals to plan, monitor, and evaluate their learning.

Recent research indicates that learners who are metacognitively aware are more strategic and perform better than unaware learners, allowing individuals to plan, sequence, and monitor their learning in a way that directly improves performance. Metacognition is separate from other cognitive constraints on learning such as aptitude and domain knowledge. There is strong support for the two-component model of metacognition which includes **knowledge** and **regulation** of cognition.

> *Reflective aspect of learning.* Knowledge about cognition corresponds to what students know about themselves, strategies, and conditions under which strategies are most useful. Declarative, procedural, and conditional knowledge can be thought of as the building blocks of conceptual knowledge.
>
> *Control aspect of learning.* Regulation of cognition corresponds to knowledge about the way students plan, implement strategies, monitor, correct comprehension errors, and evaluate their learning.

(See page 2 for detailed descriptions of the terminology related to reflective and control aspects of learning.)

A strong correlation between these factors suggests that knowledge and regulation may work in unison to help students become self-regulated learners.

If students are taught metacognitive awareness concerning the purpose and usefulness of a strategy as they are taught the strategy, they are more likely to generalize the strategy to new situations. The Metacognitive Awareness Inventory could be used to begin discussions by using these guiding questions:

Think about your own metacognitive processes. What kinds of strategies do you use to monitor and access your own learning?
Of the declarative, procedural, or conditional knowledge which are you more proficient? more inefficient?
Of planning, information management, monitoring, debugging, or evaluation strategies which are you more proficient? more inefficient?

Complete the attached Metacognitive Awareness Inventory to help you answer these questions.

Remember!
We engage in metacognitive activities every day - being aware of and monitoring our learning. Although related, cognition and metacognition differ: Cognitive skills are those needed to perform a task whereas metacognitive skills are necessary to understand how it was performed. Successful adult learners employ a range of metacognitive skills such as those described in the inventory.

TYPES OF COGNITION/KNOWLEDGE	SKILLS FOR REGULATION OF COGNITION
DECLARATIVE KNOWLEDGE ➢ *The factual knowledge the learner needs before being able to process new information or use critical thinking related to the topic* ➢ *Knowing about, what, or that* ➢ *Knowledge of one's skills, intellectual resources, and* ➢ *abilities as a learner* ➢ *Obtain knowledge through presentations, demonstrations, discussions* ➢ *"Remembering" & "Understanding" levels of thinking (Bloom)* **PROCEDURAL KNOWLEDGE** ➢ *The application of knowledge for the purposes of completing a procedure or process* ➢ *Knowledge about how to implement learning procedures (e.g. strategies)* ➢ *Requires students know the process as well as when toapply process in various situations* ➢ *Students can obtain knowledge through discovery, cooperative learning, and problem solving* ➢ *"Applying" level of thinking (Bloom)* **CONDITIONAL KNOWLEDGE** ➢ *The determination under what circumstances specific processes or skills should transfer* ➢ *Knowledge about when and why to use certain learning procedures* ➢ *Application of declarative and procedural knowledge with certain conditions presented* ➢ *Grasping why something works & under what conditions; why one approach is better than another* ➢ *Ability to develop new approaches* ➢ *Students can obtain knowledge through simulation* ➢ *"Analyzing", "Evaluating" & "Creating" levels of thinking (Bloom)* **CONCEPTUAL KNOWLEDGE** *Conceptual knowledge is a connected web of knowledge, a network in which the linking relationships are as prominent as the discrete bits of information. It cannot be learned by rote, but must be learned by thoughtful, reflective learning. It is the highest level of knowledge that one can aspire to....that of expert in a field of study.)*	**PLANNING** ➢ *Planning, goal setting, and allocating resources prior to learning* **INFORMATION MANAGEMENT STRATEGIES** ➢ *Skills and strategies used to process information efficiently (e.g. organizing, elaborating, summarizing, selective focusing)* **COMPREHENSION MONITORING** ➢ *Assessment of one's learning or strategy use* **DEBUGGING STRATEGIES** ➢ *Strategies used to correct comprehension and performance errors* **EVALUATION** ➢ *Analysis of performance and strategy effectiveness after a learning episode*

Metacognitive Awareness Inventory (MAI)

Directions – If the statement is TRUE for you, put 1 point in the score column. For each FALSE statement, give yourself 0 points in the score column. Total the score of each category and place in top half of Total box. Refer to page 2 for detailed descriptions of types of knowledge and concepts related to regulating cognition. Areas with lower scores (compared to possible points) are those that could use improvement. Ask your tutor to assist you in developing these areas.

KNOWLEDGE ABOUT COGNITION

DECLARATIVE KNOWLEDGE	SCORE
I understand my intellectual strengths and weaknesses.	
I know what kind of information is most important to learn.	
I am good at organizing information.	
I know what the teacher expects me to learn.	
I am good at remembering information.	
I have control over how well I learn.	
I am a good judge of how well I understand something.	
I learn more when I am interested in the topic.	
TOTAL	8

PROCEDURAL KNOWLEDGE	SCORE
I try to use strategies that have worked in the past.	
I have a specific purpose for each strategy I use.	
I am aware of what strategies I use when I study.	
I find myself using helpful learning strategies automatically.	
TOTAL	4

CONDITIONAL KNOWLEDGE	SCORE
I learn best when I know something about the topic.	
I use different learning strategies depending on the situation.	
I can motivate myself to learn when I need to.	
I use my intellectual strengths to compensate for my weaknesses.	
I know when each strategy I use will be most effective.	
TOTAL	5

REGULATION OF COGNITION

PLANNING	SCORE	COMPREHENSION MONITORING	SCORE
I pace myself while learning in order to have enough time.		I ask myself periodically if I am meeting my goals.	
I think about what I really need to learn before I begin a task.		I consider several alternatives to a problem before I answer.	
I set specific goals before I begin a task.		I ask myself if I have considered all options when solving a problem.	
I ask myself questions about the material before I begin.		I periodically review to help me understand important relationships.	
I think of several ways to solve a problem and choose the best one.		I find myself analyzing the usefulness of strategies while I study.	
I read instructions carefully before I begin a task.		I find myself pausing regularly to check my comprehension.	
I organize my time to best accomplish my goals.		I ask myself questions about how well I am doing while learning something new.	
TOTAL	7	TOTAL	7
INFORMATION MANAGEMENT STRATEGIES	**SCORE**	**DEBUGGING STRATEGIES**	**SCORE**
I slow down when I encounter important information.		I ask others for help when I don't understand something.	
I consciously focus my attention on important information.		I change strategies when I fail to understand.	
I focus on the meaning and significance of new information.		I re-evaluate my assumptions when I get confused.	
I create my own examples to make information more meaningful.		I stop and go back over new information that is not clear.	
I draw pictures or diagrams to help me understand while learning.		I stop and reread when I get confused.	
I try to translate new information into my own words.		TOTAL	5
I use the organizational structure of the text to help me learn		**EVALUATION**	**SCORE**
I ask myself if what I'm reading is related to what I already know.		I know how well I did once I finish a test.	
I try to break studying down into smaller steps.		I ask myself if there was an easier way to do things after I finish a task.	
I focus on overall meaning rather than specifics.		I summarize what I've learned after I finish.	
TOTAL	10	I ask myself how well I accomplish my goals once I'm finished.	
		I ask myself if I have considered all options after I solve a problem.	
		I ask myself if I learned as much as I could have once I finish a task.	
		TOTAL	6

Schraw, G. & Dennison, R.S. (1994). Assessing metacognitive awareness. Contemporary Educational Psychology, 19, 460-475.

Video 1: Beliefs That Make You Fail…Or Succeed

The first video examines common mistaken beliefs students often possess that undermine their learning. The video tries to correct those misconceptions with accurate beliefs about learning. (6:54)

Video 2: What Students Should Understand About How People Learn

The second video introduces a simple but powerful theory of memory, Levels of Processing, that can help students improve their study. (7:15)

Video 3: Cognitive Principles for Optimizing Learning

The third video operationalizes the concept of level of processing into four principles that students can use to develop effective study strategies. (5:46)

Video 4: Putting the Principles for Optimizing Learning into Practice

The fourth video applies the principles of deep processing to common study situations, including note taking and highlighting while reading. (9:17)

Video 5: I Blew the Exam, Now What?

This video addresses what students should and should not do when they earn a bad grade on an exam. (7:29)

http://www.samford.edu/how-to-study/default.aspx

All videos free on Youtube.com

LEARNING SUFFICIENCY DIAGRAM

Level of Thinking (Revised Bloom's HOTS)	Learning Outcome (Product)	Learning Metric (Gauge)	Learning Sufficiency (Confirmation)
Remembering	• Students are able to accurately define and recall basic terms, ideas, principles and concepts. • Students are able to mentally match stored information with exam questions that have embedded cues.	• Sufficiency of learning is gauged by the correctness and accuracy of information learned. • Quantity of information learned is indicative of successful study sessions.	• When students deem that they have gathered the correct information, that they can accurately recall it, and that they can do so with a sufficient quantity of items. • When they know the "whats."
Transition Zone - When students move beyond only being able to describe, classify, list, and/or recall information to explaining, expounding and connecting this information to key principles, concepts or theories. In essence, the learner moves from only asking: "What is the correct information?" to asking, "Why is the information relevant?"			
Understanding	• Students are able to explain why the information is relevant. • Students are able to demonstrate the connections between discrete items and overarching principles, concepts or ideas.	• Quantity of rationales gathered is a barometer of success. • Significance of logical points is an indicator of successful studying.	• When students sense that they can provide ample coherent rationales for what they are learning. • When they know the "whys."
Transition Zone - When students' knowledge extends beyond being able to provide rationales for the information to being able to conceptualize how the information is used or is sequenced, in addition to why it is important. The learner moves from asking: "Why is this information relevant?" to asking, "How does this apply in various real and/or abstract contexts?"			
Applying	• Students are able to abstractly apply knowledge to new situations or problems with few or no cues.	• Adequate learning is achieved if knowledge can be applied. • Clarity of application is a key measurement.	• When students sense that they can transfer what they have learned to other contexts.
Transition Zone - When students can perceive subtle distinctions within and between similar processes, functions or concepts in addition to simply knowing how they work. Besides applying the information, the learner is asking: "How is the information or applications of the information comparable and what are the distinctions?"			
Analyzing	• Students are able to distinguish between seemingly similar sets of information. • Students are able to differentiate between levels of significance.	• Sufficient learning has been achieved if all relevant factors have been considered.	• When students sense that they have accounted for all factors that should be considered. • When students sense that they have recognized all applicable patterns, trends or distinctions.
Transition Zone - When students can render decisions based on their analysis. This is a summative process in which students can determine courses of action, draw likely conclusions and/or render sound judgments. Evaluation is a natural progression of analysis; therefore, it follows the analyzing stage.			
Evaluating	• Students are able to make decisions, draw conclusions and exercise judgment. • Students are able to foresee implications of decisions, courses of actions or solutions.	• Soundness of decision or course of action is an indicator of successful studying. • Consideration of implications of decisions is a gauge of succesful studying.	• When students sense that their conclusions are based on thorough analysis. • When students sense that they have considered all implications.
Transition Zone - When students generate their own thoughts, interpretations and outcomes based on thorough analysis and evaluation of all relevant factors. The creating process involves the students' development of a point of view, taking a position with the information or producing a new outcome.			
Creating	• Students are able to blend information in ways that generate their own thoughts, ideas, viewpoints and positions.	• Sufficient learning is gauged by originality.	• When students sense that their ideas, viewpoints and/or positions are satisfactorily sound and sufficiently novel.