Bloom's Taxonomy of Thinking and Learning

"Questions may be the most powerful technology we have ever created."
- Jamie McKenzie, Beyond Technology

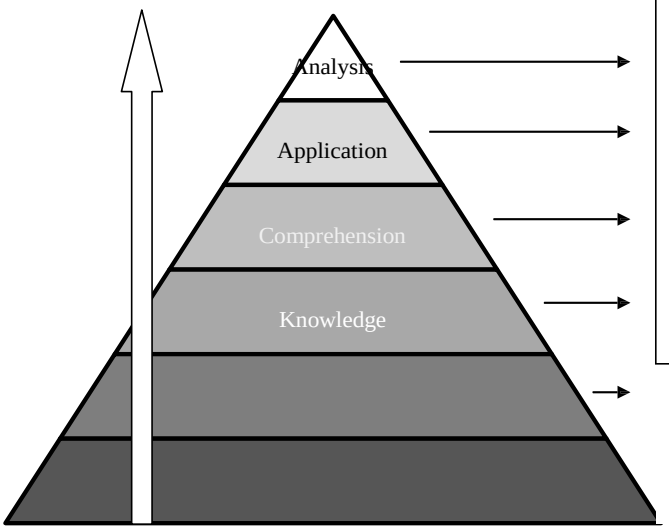
Think about a special skill, interest, or athletic ability that you have…

- How did you first learn it? What skills did you first develop?
- How did you continue to improve and become proficient?
- What is something that you know or can do now that you didn't know or you weren't able to do when you started?
- What would have happened if you had not been willing to learn new things or develop new skills? Would you have stayed a novice versus the expert you are now?

Abilities **grow** from basic levels to more advanced levels – you always need the basics, but you must build on them to become more skilled.

Likewise, college professors expect students to learn not only the basic *facts*, but also the *theories and concepts* that underlie those facts. One way of visualizing this process is through Bloom's Taxonomy of Thinking and Learning, which shows the levels of thinking that college students must engage in to be academically successful as well as to perform well on course exams. Students begin as novice learners/thinkers and develop into expert learners, thinking more critically about information. You help students develop these skills by applying Bloom's Taxonomy to teaching methods and questioning techniques.

The foundation of Bloom's Taxonomy is the basic **knowledge** level of thinking (often called "rote memorization") and the "pyramid" of learning moves upward toward more complex levels of thinking, as described below.



Evaluation: Critique information, make informed opinions and judgments

Synthesis: Use current knowledge to form a new idea, conclusion, or product

Analysis: Notice patterns of facts, data, concepts, compare and contrast, and make informed conclusions

Application: Apply what you know to different "real-world" situations

Comprehension: Restate and summarize information, like telling the plot of a story or movie

Knowledge: memorize and recall facts, figures, and concepts

Cognitive Load

Explaining Why Students "Tune-out"

Phenomenon of Tuning-Out

Think of a classroom setting where you were either bored or overwhelmed. Both of these feelings lead to tuning out, where a student's focus is no longer on the material but on their phone, what their evening plans are, or the upcoming sporting event. Below is a chart of typical instructor behaviors that lead to tuning out.

Bored	Overwhelmed
Present simple material too slowly	Present difficult material too fast
Provide overly simple, tedious or irrelevant tasks	Provide a complex task with many directions
Cover a topic repeatedly that does not require it.	Breeze through a topic that is difficult
Does not engage the students	Imposes unrealistic demands on students

By analyzing the causes of these two student reactions, a pattern begins to emerge. There is a "sweet spot" when teaching material that engages the students in the material without overwhelming them. This is where cognitive load becomes relevant.

Cognitive Load

Cognitive load is the cognitive demand of a learning task. There are two factors that determine the load placed on a student.

1. Intrinsic difficulty of the material
2. Difficulty or complexity of the learning activity

Unfortunately, as an SI leader, you cannot control the difficulty of the material the students have to learn. However, you can choose which learning activity to use when teaching a new concept. Thus, your responsibility as an SI leader lies in determining what topics to cover from the course and then selecting appropriate learning activities to match those topics.

Closed & Open-Ended Questions

Type of Question	Connection to Bloom's	Example Questions
Closed-Ended Questions	Appropriate for Knowledge level of learning. Helps you and students confirm their understanding and quickly identify knowledge gaps.	"Is this a homozygous or heterozygous plant?" "What is the definition of reward power?"
Open-Ended Questions	Appropriate for Comprehension through Evaluation levels of learning. Requires students to "dive deep": explain, make connections and associations, and develop deeper understanding of concepts.	"Why are diamonds not considered *scarce* in economic terms?" "When would an aligning action be detrimental?" "What disease would create the bone deformity that you see in this picture?"

"Which one" questions ask students to collect information and make informed decisions. Example: "Which serious public health issue most deserves research funding from NFS?"

"How" questions ask students to understand problems, weigh options from different points of view, and propose solutions. Example: "Propose a solution to a specific environmental problem in Utah. Explain how your proposal will work, and why it is the best option."

"What if" or hypothetical questions ask students to use the knowledge they have to pose a hypothesis and consider options. Example: "What if unique censorship laws were enacted for the internet that are different than print media?"

"Should" questions ask students to make a moral or practical decision based on evidence. Example: "Should we discontinue trade with China?"

"Why" questions ask students to understand cause and effect, to understand relationships, and to help them get to the essence of an issue. Example: "Why do people abuse children?"

Wait Time vs Think Time

The primary objective of SI is to help students process and understand course information. Processing information requires that students engage in multiple cognitive tasks of varying complexity for which they need uninterrupted time to reflect, integrate information, and form a response. This is especially important when asking students to "dive deep".

In many classrooms students are not allowed sufficient processing time. Teachers often make the mistakes of:

- asking a question and answering it themselves.
- asking one student a question, providing insufficient time, and then posing the same question to another student .
- asking more than one question at a time and confusing students.

Wait time is an instructional tool that can enhance students' learning experiences. In 1972, Mary Budd Rowe conducted classroom research to assess average wait time used by teachers. The majority of teachers waited less than three seconds after posing a question to their students. Rowe identified that when teachers increase their wait time to three or more seconds, the following benefits were demonstrated:

	Increased	Decreased
Student	• length, accuracy, and complexity of responses • voluntary responses • initiation of discussions	• "*I don't know*" and no answer responses
Teacher	• variety and flexibility of questioning strategies • quality and variety of questions that resulted in higher levels of student thinking	• number of questions

It is really more accurate to reframe Wait Time as **Think Time**, defined as "*uninterrupted silence by teacher and students so both can complete necessary information processing"* (Stahl, 1990). The primary purpose for think time is to provide a silent period for students and teachers to complete on-task thinking.

Types of Think Time silence

1. After a leader asks a question. Silence follows a clear question that contains adequate cues for students, e.g., *"What is the difference between a change **on** the demand curve and a shift of the entire curve"?*
2. During a student's response. The leader provides sufficient hesitation time before the student continues or completes his/her answer.
3. After a student responds. The leader is silent to allow other students time to consider the response before they comment.
4. Leader pause time. The leader is silent while considering what his/her next statement or behavior will be.

Think Time is a tool you can immediately implement in your first - and every - SI session!

Learning Styles

"Learning Style" refers to the uniqueness of each learner and acknowledges individual differences that affect the learning process. These differences are caused by a complex combination of factors that include the learner's personality, heredity, cognitive skills, mental processing, confidence, attitude, and sensory intake. Learning styles determine an individual's preferred manner for acquiring, processing, and using information while learning. Learning styles are evident when observing students' academic strengths, weaknesses, skills, and interests.

A Case Study

"Consider Mark. His favorite subject is political science, and he enjoys his study of historical movements. When studying for his POLS 1100 exams, Mark analyzes events, trying to determine what is responsible for the various social, political, and historical changes he has been reading about. He understands the importance of names and dates, but they are less significant and interesting to him than the *why* of events and understanding their effects.

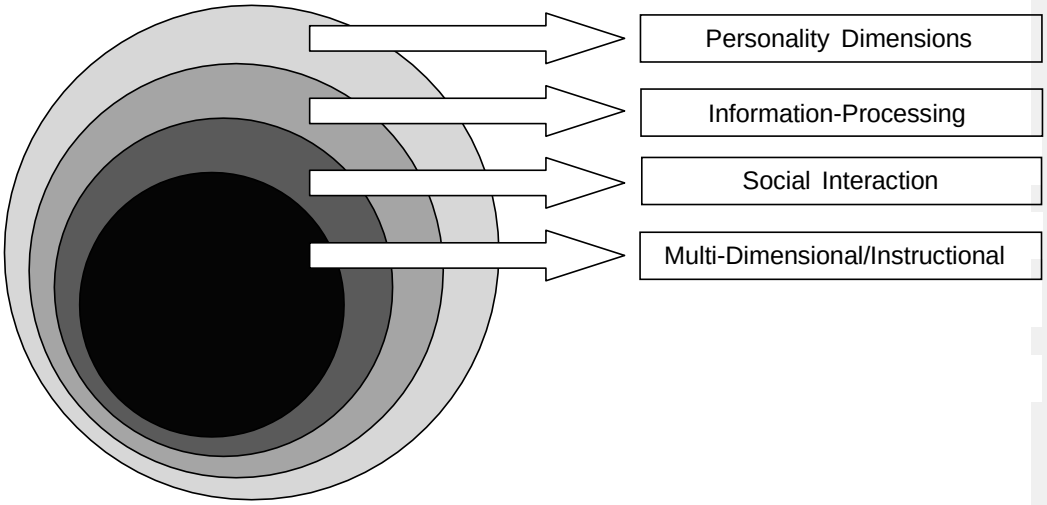
Mark is also taking BIO 1010. He studies for his biology exam in the same way he studied for his history test. Unfortunately, he earned an F of his biology exam. Instead of studying facts, committing important terminology to memory, and learning definitions, Mark studies concepts; his *analytical learning style* turned out to be inappropriate for the way his biology course was taught.

The reverse can also be true. Anne has a *factual learning style* that makes her comfortable with memorizing facts. Anne would do very well on that same biology test and yet find the history exam that stressed concepts and analysis of material very difficult."

No one learning style is better than another, yet it is important to be able to learn effectively regardless of what style is required for a given course. When you are aware of your learning style, you can use your strengths when preparing for classes. When leaders understand the concept of learning styles and preferences, they are able to use appropriate and effective strategies that help students' develop more positive attitudes towards learning.

Learning Style Models

There are many learning style theories, models, and assessments. One way to think about these various models is through Curry's (1987) "Onion Model", consisting of four layers or types of models.



Personality Dimensions: How basic personality affects our preferred approach to learning.

Information-Processing: Preferred intellectual approach to assimilating information.

Social Interaction: Preference for how students and teachers interact in the classroom.

Multi-Dimensional/Instructional: Preferred environment of learning.

All models stress the importance of identifying and addressing individual differences to improve the learning process. However, there are important differences among the models. Some models stress teachers accommodating style preferences through their teaching strategies while other models stress students' flexibility and adapting their study strategies.

VARK Learning Preferences

The learning model that we use in SI relates to how learners prefer to use their various senses to acquire and process information. The model is referred to as VARK, which stands for **Visual, Aural, Read-Write, and Kinesthetic**. While this model appears simple or "common sense," it is quite effective in guiding you to plan and prepare your activities so that your SI sessions meet the needs of a variety of students.

The table below offers suggestions to get you started.

Learning Preference	Session Tips
Visual The visual learner needs to see, observe, record, write.	• Use pictures, videos, computer software, textbooks, diagrams, graphs, charts, and tables • Use color to organize and identify information • Visualize words and facts to be retained; develop examples, analogies and metaphors • Practice quizzes, word games
Aural The aural learner needs to talk and listen.	• Use audio clips, videos, Podcasts • Participate in discussions, group assignments, group problem-solving, debates, study groups, and paired learning activities • Ask students to provide oral explanations • Provide oral summaries of information: to self or others • Ask students to create and ask potential test questions • Create mnemonics (memory aids)
Read-write The read-write learner needs to read material and organize information through writing (and/or typing).	• Review and discuss notes, textbook, handouts, glossaries, PowerPoint presentations, and supplemental readings • Rewrite notes; turn diagrams, charts, etc. into organized outlines • Create lists, flashcards, paragraph summaries, tables, and charts • Write out practice test questions and answers
Kinesthetic The tactile learner needs to be physically involved by doing and /or touching: "hands on" experience.	• Use physical materials to explain or represent concepts: models, objects, computer programs, "props" to represent abstract concepts, subject-related games and puzzles • Use a white board to solve problems and to draw diagrams, charts, tables, etc. • Rehearse, memorize while walking or exercising • Study by writing (or typing) over and over • Learn by doing: enact or re-enact with self or others • Represent abstract concepts or processes with physical materials or action involving students