

Blooms Taxonomy

In 1956, Benjamin Bloom headed a group of educational psychologists who developed a classification of levels of intellectual behavior important in learning. This became a taxonomy including three overlapping domains; the cognitive, psychomotor, and affective. Each of the domains can be utilized through the interaction of media.

Cognitive learning is demonstrated by knowledge recall and the intellectual skills: comprehending information, organizing ideas, analyzing and synthesizing data, applying knowledge, choosing among alternatives in problem-solving and evaluating ideas or actions. This domain on the acquisition and use of knowledge is predominant in the majority of courses. Bloom identified six levels within the cognitive domain, from the simple recall or recognition of facts, as the lowest level, through increasingly more complex and abstract mental levels, to the highest order which is classified as evaluation. Verb examples that represent intellectual activity on each level are listed here.

1. **Knowledge:** arrange, define, duplicate, label, list, memorize, name, order, recognize, relate, recall, repeat, reproduce state.
2. **Comprehension:** classify, describe, discuss, explain, express, identify, indicate, locate, recognize, report, restate, review, select, translate,
3. **Application:** apply, choose, demonstrate, dramatize, employ, illustrate, interpret, operate, practice, schedule, sketch, solve, use, write.
4. **Analysis:** analyze, appraise, calculate, categorize, compare, contrast, criticize, differentiate, discriminate, distinguish, examine, experiment, question, test.
5. **Synthesis:** arrange, assemble, collect, compose, construct, create, design, develop, formulate, manage, organize, plan, prepare, propose, set up, write.
6. **Evaluation:** appraise, argue, assess, attach, choose compare, defend estimate, judge, predict, rate, core, select, support, value, evaluate.

Affective learning is demonstrated by behaviors indicating attitudes of awareness, interest, attention, concern, and responsibility, ability to listen and respond in interactions with others, and ability to demonstrate those attitudinal characteristics or values which are appropriate to the test situation and the field of study. This domain relates to emotions, attitudes, appreciations, and values, such as enjoying, conserving, respecting, and supporting. Verbs applicable to the affective domain include accepts, attempts, challenges, defends, disputes, joins, judges, praises, questions, shares, supports, and volunteers.

Psychomotor learning is demonstrated by physical skills; coordination, dexterity, manipulation, grace, strength, speed; actions which demonstrate the fine motor skills such as use of precision instruments or tools, or actions which evidence gross motor skills such as the use of the body in dance or athletic performance. Verbs applicable to the psychomotor domain include bend, grasp, handle, operate, reach, relax, shorten, stretch, write, differentiate (by touch), express (facially), perform (skillfully).

from "The Distance Learning Technology Resource Guide," by Carla Lane

WRITING INSTRUCTIONAL OBJECTIVES

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Educators have used instructional, or behavioral, objectives for at least four decades. Robert Mager's little text, *Preparing Instructional Objectives*, first printed in 1962, assisted many instructors in formulating and writing objectives. Since then, the use of objectives has become commonplace in education. The National Accrediting Agency for Clinical Laboratory Sciences (NAACLS) also affirms the value of objectives. Specifically, Essentials 12 and 13 address the importance of incorporating objectives within the curriculum and specific units of study.

The purpose of this unit is to assist the educator in writing objectives using a standard protocol. Objectives are not difficult to write if one follows the guidelines noted below.

Instructional objectives are written for the student and they state what the student is expected to do following instruction. Objectives are specific, observable, and measurable learning outcomes. In contrast, goals are general and non-specific. Goals are appropriate for an entire course or a curriculum of study, while objectives are written for individual units of study.

There are benefits to incorporating objectives within our coursework. Objectives emphasize major points and reduce non-essential material. Objectives simplify note taking and cue the students to emphasize major points. Objectives assist students in organizing and studying content material. They guide the students to what is expected from them and help them to study important information. Objectives assist the student in studying more efficiently. Finally, when examination items mirror objectives, students can use the objectives to anticipate test items.

There are four components of an objective: 1) the action verb, 2) conditions, 3) standard, and 4) the intended audience (always the student). The action verb is the most important element of an objective and can never be omitted. The action verb states precisely what the student will do following instruction. Verbs are categorized by domains of learning and various hierarchies. Benjamin Bloom and his colleague, David Krathwohl, were pioneers in categorizing the domains and levels.

The three domains of learning are the cognitive domain that emphasizes thinking; the affective domain highlighting attitudes and feelings; and the psychomotor domain featuring doing. The first domain that was characterized by Bloom was the cognitive, which is further divided into six levels or hierarchies.

Cognitive (Thinking) Domain

Knowledge
Comprehension
Application
Analysis
Synthesis
Evaluation

Sometimes the six hierarchies or levels listed above are grouped into three categories:

Level 1. Recall – Knowledge and Comprehension
Level 2. Interpretation – Application and Analysis
Level 3. Problem-Solving – Synthesis and Evaluation

Recall objectives are at the basic taxonomic level and involve recall or description of information. Interpretation is a higher level of learning and involves application and examination of knowledge. Problem-solving skills test the highest level of learning and involve construction and assessment of knowledge. Examples of appropriate verbs for use with each of the three domains follow.

**Writing Objectives: Key Verbs
Attitudinal or Affective (Valuing) Domain**

			<u>ORGANIZATION</u>	<u>CHARACTERIZATION BY A VALUE OR VALUE COMPLEX</u>
	<u>RESPONDING</u>	<u>VALUING</u>		
<u>RECEIVING</u>	Accept	Adopt	Anticipate	Act
Acknowledge	Allow	Aid	Collaborate	Administer
Attend (to)	Answer	Care (for)	Confer	Advance
Follow	Ask	Complete	Consider	Advocate
Listen	Assist	Compliment	Consult	Aid
Meet	Attempt	Contribute	Coordinate	Challenge
Observe	Choose	Delay	Design	Change
Receive	Communicate	Encourage	Direct	Commit (to)
	Comply	Endorse	Establish	Counsel
	Conform	Enforce	Facilitate	Criticize
	Cooperate	Evaluate	Follow through	Debate
	Demonstrate	Expedite	Investigate	Defend
	Describe	Foster	Judge	Disagree
	Discuss	Guide	Lead	Dispute
	Display	Initiate	Manage	Empathize
	Exhibit	Interact	Modify	Endeavor
	Follow	Join	Organize	Enhance
	Give	Justify	Oversee	Excuse
	Help	Maintain	Plan	Forgive
	Identify	Monitor	Qualify	Influence
	Locate	Praise	Recommend	Motivate
	Notify	Preserve	Revise	Negotiate
	Obey	Propose	Simplify	Object
	Offer	Query	Specify	Persevere
	Participate (in)	React	Submit	Persist
	Practice	Respect	Synthesize	Praise
	Present	Seek	Test	Profess
	Read	Share	Vary	Promote
	Relay	Study	Weigh	Promulgate
	Reply	Subscribe		Question
	Report	Suggest		Reject
	Respond	Support		Resolve
	Select	Thank		Seek
	Try	Uphold		Serve
				Strive
				Solve
				Tolerate
				Volunteer (for)

The affective domain is concerned with changes (growth) in interests, attitudes and values. It is divided into five major classes arranged in hierarchical order based on level of involvement (from receiving, to characterization by a value).

**Writing Objectives: Key Verbs
Psychomotor (Doing or Skills) Domain**

Absorb	Dispense	Macerate	Separate
Add	Dispose	Measure	Set
Adsorb	Dissect	Mix	Sever
Adjust	Dissolve	Moisten	Shake
Aliquot	Drain	Mount	Sharpen
Apply	Draw	Observe	Ship
Aspirate	Dry	Obtain	Siphon
Assemble	Elute	Open	Spin
Balance	Employ	Operate	Spread
Bind	Estimate	Pack	Squeeze
Blend	Evacuate	Palpate	Stain
Build	Examine	Participate	Standardize
Calculate	Expel	Perform	Start
Calibrate	Fasten	Pick	Stick
Centrifuge	Fill	Pipet	Stir
Change	Filter	Place	Stop
Choose	Fractionate	Plate	Stopper
Classify	Frame	Plot	Store
Clean	Freeze	Position	Suspend
Collate	Grade	Pour	Take
Collect	Grasp	Prepare	Test
Combine	Grind	Press	Thaw
Connect	Group	Process	Thread
Construct	Guide	Produce	Tilt
Control	Handle	Program	Time
Combine	Heat	Pull	Tip
Confirm	Hemolyze	Puncture	Titrate
Connect	Identify	Push	Trim
Construct	Illustrate	Read	Touch
Control	Incubate	Record	Transfer
Cool	Inject	Release	Troubleshoot
Correct	Input	Remove	Turn
Count	Insert	Replace	Type
Create	Invert	Resuspend	Use
Crush	Investigate	Retest	Utilize
Cut	Isolate	Rinse	View
Decant	Label	Roll	Warm
Demonstrate	Locate	Rotate	Wash
Describe	Localize	Save	Watch
Design	Lyse	Scan	Weigh
Dialyze	Maintain	Score	Withdraw
Differentiate	Make	Screen	Wipe
Dilute	Maneuver	Seal	Wrap
Discard	Manipulate	Select	
Dismantle	Mark	Sensitize	

Writing Objectives

The ABCD method of writing objectives is similar to the theory explained here; the terminology is just slightly different. *A* is the audience, always the student. *B* is the behavior or the action verb. *C* is the condition for the objective and *D* is the degree of achievement or acceptable criteria.

Conditions

Conditions describe the relevant factors associated with the desired performance. For example:

1. after attending a lecture. . . .
2. following review of a demonstration. . . .
3. given a case study. . . .
4. after completing the assignment. . . .
5. given a specific instrument. . . .

Criteria

The criteria are specified as the acceptable level of achievement desired. They tell how well the learner must perform. This part of the objective may be omitted when there is no deviation from standard procedures or protocols. For example:

1. percent of correct responses
2. within a given time period
3. in compliance with criteria presented by the faculty

Order and Tense

There is a preferred order when writing objectives. The condition is usually placed first, followed by the behavior or verb, and then the criteria. Objectives are written in the future tense. For example:

Recall: After attending lecture and reading the assigned materials, the student will state the function of a thermometer.

Interpretation: After attending lecture and studying the assigned materials, the student will demonstrate how a thermometer works.

Problem-Solving: After attending lecture and studying the assigned materials (including problem sets), the student will formulate the degrees in C given the degrees in F, or vice versa.

To avoid redundancy in writing objectives an educator often lists a single condition with the objectives underneath.

After attending lecture and studying the assigned materials, the student will:

1.
2.
3.

Nonfunctional Verbs

The following verbs cannot be measured or are redundant. They should be avoided when writing objectives.

able to	shows interest in
appreciation for	knows
awareness of	has knowledge of
capable of	learns
comprehend	memorizes
conscious of	understands
familiar with	will be able to

Examples of Objectives for the Cognitive Domain

Poor	To increase the student's ability to visually identify white cells on a differential.
Better	The student will identify correctly all white cells on a differential.

Poor	The student will gain knowledge of automated chemistry tests.
Better	The student will state the principle for each automated chemistry test listed.

Poor	The student will be familiar with red blood cell maturation in the bone marrow.
Better	The student will diagram the maturation of red blood cells.

Poor	The student will understand the interpretation of hemoglobin electrophoresis patterns.
Better	Given several electrophoretic scans, the student will correctly diagnose each normal or abnormal pattern.

Levels Within the Cognitive Domain

LEVEL #1. KNOWLEDGE

Knowledge involves recognition or recalling of

- definitions
- specifics

Here, one is expecting learners to:

- remember an idea, phenomenon, or a fact in somewhat the form in which it was presented.

For example, one might design an activity that requires a learner to:

- write the formula for ethyl alcohol
- define diuresis
- list the six levels in the cognitive domain of Bloom's taxonomy

Generally, KNOWLEDGE encompasses the cognitive process of remembering learned material

LEVEL#2. COMPREHENSION

Comprehension usually involves

- translation
- associations

Here, one is expecting the learner to:

- communicate an idea or thing (event) in a new or different form (translation)
- see relationships among things or events (associations)

For example, one might design an activity that requires a learner to:

- describe three distinguishing features of the Lewis blood group system
- explain the rationale for using "selective media" in microbiology

Generally, COMPREHENSION encompasses the cognitive process of explaining material that has been learned.

LEVEL #3 APPLICATION

Application is described by Bloom as “the use of abstract forms in particular and concrete situations. The abstractions may be in the form of general ideas, rules or procedures, generalized methods.”

In application, one expects the learner to

- relate or apply ideas to new situations
- use what he/she comprehends from a variety of areas to solve problems

For example:

- when given the clinical situation of a patient needing a transfusion, submit the most suitable blood product to be used
- apply Universal Precautions to establish and maintain a safe laboratory environment

Generally, APPLICATION involves using knowledge to find or develop new solutions.

LEVEL #4 ANALYSIS

Analysis involves examining

- elements
- relationships
- organizational principles

Here, one is expecting the learner to:

- break “things” down into their component parts
- uncover the unique characteristics of a concept or event

For example,

- when given a patient’s hematologic data, appraise that data to ascertain whether they are internally consistent and can be reported
- when given various cell panels, analyze the results to identify an unexpected antibody(s)

Generally, ANALYSIS involves the ability to break down material into component parts so that its organizational structure may be understood.

LEVEL #5 SYNTHESIS

Synthesis involves an ability to

- generate a set of abstract relations (to “hypothesize”)
- create a plan or propose a set of operations

Here, one is expecting the learner to:

- take “things “ and reorganize them in a new way
- create new or original concepts

For example,

- prepare appropriate financial statements for decision-making
- propose a “core laboratory” structure to optimize efficiency and effectiveness

Note: the processes with SYNTHESIS involve inductive, not deductive reasoning. This can be difficult when one considers that the profession of clinical laboratory science usually uses information to arrive at conclusions. (We are skilled deductive thinkers, but may not be as skilled inductive thinkers.) Thus, preparing objectives at this level may be difficult.

LEVEL #6 EVALUATION

Evaluation includes the ability to judge, using

- internal standards and
- external criteria

to bring about informed decisions

Here, one is expecting the learner to:

- make judgments about “things” or events based on internal and external criteria
- accept or reject “things” or events based on established standards

For example:

- evaluate and select a chemistry automated system in view of costs, personnel, productivity and space available
- validate all of the laboratory data received from a patient with a recent bone marrow transplant

Generally, this cognitive function involves the ability to judge the value of some thing for a given purpose.

The educator should use a combination of all three levels of cognitive verbs when writing learning outcomes. The test question should reflect the level of the objective; thus if an objective is recall, then a similar verb like “state” should be used in the test question. If the objective is problem solving, then the test question might use a verb such as “diagnose” or “evaluate.”

Additional Examples of Objectives

Lecture Objectives (Hemolytic Anemias)

After attending the lecture, reading the assignment, and performing the tests in the laboratory, the student will:

1. Define the term hemolytic anemia. (recall)
2. Classify the major hemolytic anemias by their intrinsic or extrinsic causes. (recall)
3. Summarize each disease discussed in lecture including distinguishing characteristics, clinical manifestations, laboratory findings, pathology, and treatment. (recall)
4. For each disease discussed in lecture, determine the appropriate tests to resolve the problem. Include the principle and mechanism of each test in the evaluation. (interpretation)
5. Given a set of laboratory data and patient history, correctly diagnose the disease. (problem-solving)

Affective Objectives

After attending a lecture on Essential Functions, the student will exhibit the following behaviors:

1. Communicate effectively in written and spoken English.
2. Appropriately assess nonverbal and verbal communication.
3. Follow written and verbal directions.
4. Work independently and with others under time constraints.

5. Prioritize requests and work concurrently on at least two different tasks.
6. Maintain alertness and concentration during a normal work period.
7. Apply knowledge, skills, and values learned from course work and life experiences to new situations.
8. Show respect for self and others
9. Project an image of professionalism including appearance, dress, and confidence.

Psychomotor Objectives

Upon completion of the laboratory exercise the student will:

1. Correctly perform the electrophoretic procedure and obtain a satisfactory pattern that could be accurately interpreted by both the student and the faculty member.
2. Interpret normal and abnormal electrophoretic patterns with 100% accuracy as compared with patterns interpreted by the CLS.
3. Using a densitometer, obtain the concentration of each protein fraction within 10% of faculty member's results.
4. Perform calcium determinations on serum using a direct spectrophotometric method within 10% of the reported result.
5. Demonstrate skill in using micropipetting devices to the satisfaction of the faculty member.

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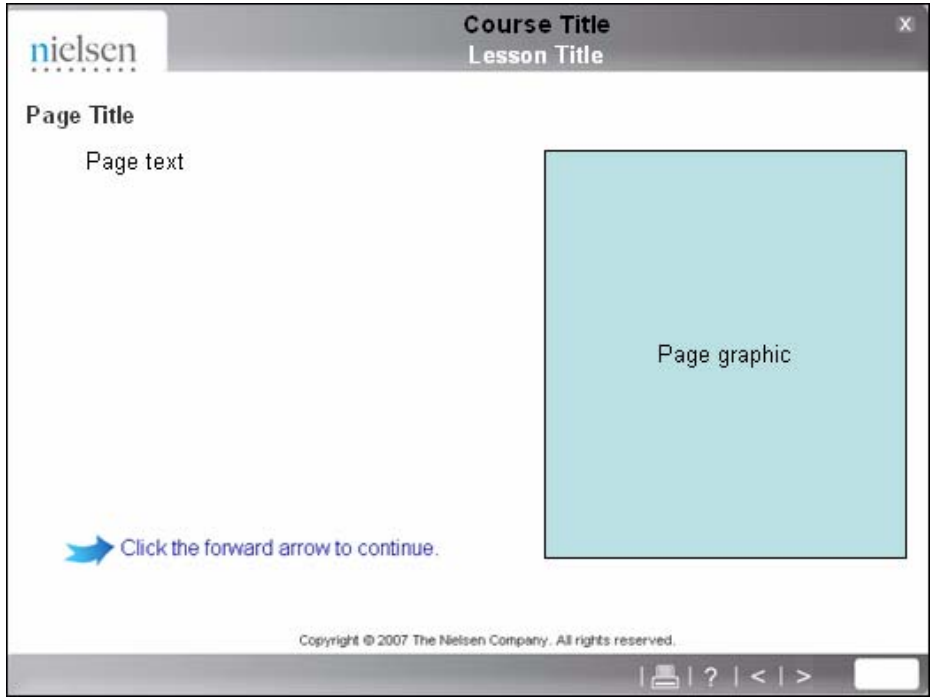
Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
Cite	Add	Acquire	Analyze	Abstract	Appraise
Count	Approximate	Adapt	Audit	Animate	Assess
Define	Articulate	Allocate	Blueprint	Arrange	Compare
Describe	Associate	Alphabetize	Breadboard	Assemble	Conclude
Draw	Characterize	Apply	Break Down	Budget	Contrast
Enumerate	Clarify	Ascertain	Characterize	Categorize	Counsel
Identify	Classify	Assign	Classify	Code	Criticize
Index	Compare	Attain	Compare	Combine	Critique
Indicate	Compute	Avoid	Confirm	Compile	Defend
Label	Contrast	Back Up	Contrast	Compose	Determine
List	Convert	Calculate	Correlate	Construct	Discriminate
Match	Defend	Capture	Detect	Cope	Estimate
Meet	Detail	Change	Diagnose	Correspond	Evaluate
Name	Differentiate	Classify	Diagram	Create	Explain
Outline	Discuss	Complete	Differentiate	Cultivate	Grade
Point	Distinguish	Compute	Discriminate	Debug	Hire
Quote	Elaborate	Construct	Dissect	Depict	Interpret
Read	Estimate	Customize	Distinguish	Design	Judge
Recall	Example	Demonstrate	Document	Develop	Justify
Recite	Explain	Depreciate	Ensure	Devise	Measure
Recognize	Express	Derive	Examine	Dictate	Predict
Record	Extend	Determine	Explain	Enhance	Prescribe
Repeat	Extrapolate	Diminish	Explore	Explain	Rank
Reproduce	Factor	Discover	Figure Out	Facilitate	Rate
Review	Generalize	Draw	File	Format	Recommend
Select	Give	Employ	Group	Formulate	Release
State	Infer	Examine	Identify	Generalize	Select
Study	Interact	Exercise	Illustrate	Generate	Summarize
Tabulate	Interpolate	Explore	Infer	Handle	Support
Trace	Interpret	Expose	Interrupt	Import	Test
Write	Observe	Express	Inventory	Improve	Validate
	Paraphrase	Factor	Investigate	Incorporate	Verify
	Picture Graphically	Figure	Lay Out	Integrate	
	Predict	Graph	Manage	Interface	
	Review	Handle	Maximize	Join	
	Rewrite	Illustrate	Minimize	Lecture	
	Subtract	Interconvert	Optimize	Model	
	Summarize	Investigate	Order	Modify	
	Translate	Manipulate	Outline	Network	
	Visualize	Modify	Point Out	Organize	
		Operate	Prioritize	Outline	
		Personalize	Proofread	Overhaul	
		Practice	Query	Plan	
		Predict	Relate	Portray	
		Prepare	Select	Prepare	
		Price	Separate	Prescribe	
		Process	Size Up	Produce	
		Produce	Subdivide	Program	
		Project	Summarize	Rearrange	
		Protect	Train	Reconstruct	
		Provide	Transform	Refer	
		Relate		Relate	
		Sequence		Reorganize	
		Show		Revise	
		Simulate		Rewrite	
		Sketch		Specify	
		Solve		Summarize	
		Subscribe		Write	
		Tabulate			
		Transcribe			
		Translate			
		Use			
		Utilize			

**Cognitive Verbs
for Blooms
Taxonomy**

Storyboard Template

Course Title:

Lesson Title:



[whenever possible, replace with screen shot from actual course]

Page Title:	
Page Objective:	
Page Text (include hotwords and their definitions):	
Page Graphic(s), Description, or Sample:	
Directions for Learner:	
Directions for Developer:	
Learner Interactions on Page:	<p>Examples include:</p> <ul style="list-style-type: none"> - Read text, click next - Read directions, match terms, check answers, click next - Read scenario, analyze choices, select a choice, check answers, click next - Read directions, compare graphs, document similarities/differences, click close

Storyboard Template

Course Title:

Lesson Title:

Note to Subject Matter Experts and other Project Stakeholders:

After reviewing the storyboard to ensure that the content is accurate and examples/ideas for graphics and activities are appropriate, please indicate your approval of this storyboard by signing below. No new content changes will be accepted once the storyboard is approved. You will, however, have the opportunity to verify that the changes requested during storyboard review have been fully incorporated. Return this document, along with any comments or suggestions you may have to the Instructional Designer for incorporation and development of the tutorial.

Sign Off:

[Amy Dreher & Date]

[Project Team Lead & Date]

[Subject Matter Expert & Date]

[Subject Matter Expert & Date]

[Subject Matter Expert & Date]

CLT Design Principles

We actively support a learner-centered instructional model, accepting that an adult's knowledge is a function of their prior experiences, mental structures and beliefs used to interpret the world around them.

In this context, the instructional designer's role is not to transmit information, but **to facilitate the learner's experience and practice with new knowledge**, because adult learners master those activities they actually practice.

Our online tutorials are based on five critical principles of adult learning theory.

- Adults learn best when they are **seeking resolution to a problem** or ready to accept information. As problem-solving individuals, adults look for learning based on a need to know.
- Development of new knowledge is easier when presented within the context of information that is already familiar to adults. This means providing a clear understanding about "**what's in it for me**" and showing the applicability or relationship of the new information to existing knowledge.
- Research supports the principle that adults learn best when they are actively involved in the process. **Presentations, meetings and lectures are the least opportune methods for delivering training because their role is passive.** The more actively the learner is applying or practicing the new knowledge, the more likely long term transfer of knowledge. Our tutorials attempt to have the learner actively involved for 33% or more of their learning experience.
- Individuals vary in the way they learn and they may prefer different **learning channels**. Whether adult learners prefer to listen, see, or do, they learn best when information is delivered through their individual learning channel preference. Tutorials should incorporate all learning channels in order to adequately meet the needs of all learners whatever their preferences.
- Adults are most interested and learn best when they **experience success**. Creating a positive learning climate that offers every learner an opportunity to experience a level of success motivates desire for learning. NU is responsible to design tutorials to ensure positive reinforcement for "Successive approximations of desired behavior." Simply put, instructional designers plan opportunities to reward small steps along the way in acquiring new learning, building and maintaining a positive learning climate.

Remember the Learner!

We will act as an advocate for the learner perspective in the development, planning, and delivery of learning materials; seeking and incorporating appropriate innovations.

Interaction

We strive to incorporate interaction throughout its online tutorials. There are three components to interactive tutorials: motivational, processing, and social.

Motivational

There are challenges to motivating learners in all delivery methodologies. Establishing the WIIFM (What's In It For Me) or showing how learning will help provide real life solutions in online tutorials motivates by offering the learner options and choices about their learning experience.

Assuming a motivated online learner may be a very costly assumption. When online learning doesn't maintain the learner's attention, motivation disappears. For that reason, online tutorials may experience problems with course completion or return user rates. By showing how learning will help provide real-life solutions and offering the learner choices in the learning process we enhance motivation.

Other examples of motivational interactions are:

- Identifying opportunities to select "Nice to Know" information for additional learning
- Adding "Skip the intro" options
- "Select where you want to begin" Floor Plans with discussion groups, audio files, reading rooms, self quiz centers, live chats, and "cyber snacks" (cartoons, quotes, etc.)
- Motivational components keep learner attention and allow the learner to tailor the online experience to their needs and improve motivation.

Processing

The processing component is the interaction between the learner and the content that supports information storage to long-term memory. This is an active component and is characterized by the interactive elements of online learning when the learner is actively engaged with the content.

Not all content requires processing. Only "Need to Know" content, that which is associated with the learning objectives, requires processing activities. The "Nice to Know" and "Additional Resources" aspects of training may enhance the overall learning experience but generally do not involve processing.

Processing activities may include:

- Simulations
- Crossword puzzles
- Quizzes
- Word Associations
- Role Plays
- Quizzes
- Graphic stories -what's wrong with this picture, etc.
- Dialogues
- Sequencing
- Sentence Completions
- Virtual Field Trips
- Memorizations
- Video Streaming

Social

Most learners enjoy classroom-based learning experiences due to the social components involved. Things like discussion, brainstorming, learning from others, networking at breaks, group activities, getting away from their desk, interaction with other people including the instructor, etc., are all examples of the social components of learning.

Designing social components into online learning increases a learner's motivation and can enhance the results of online training. Examples of online social components include:

- Voting/polling
- Learning agents
- Contact the instructor
- Electronic bulletin boards
- Handouts
- Links to live instructors for each online course