Thinking Skills for the Learning Process

Preview

Introduction

Learners use many different thinking skills during a course of instruction. Not all learners think in the same ways. Not all learners express their inner world of ideas in the same words as other learners. Some learners may need to improve their thinking skills to master the course objectives.

We include here a set of concept definitions, along with examples and non-examples, of the thinking skills that learners need to use.

Purpose

We encourage all learners to —

- think about their thinking.
- communicate about their thinking, using this common set of concept definitions and labels.

Table of thinking skills

This table summarizes general thinking skills for each developmental phase of learning.

Phase	Description	General Skills
Input	Worker collects data and information from the external world for processing	• Knowledge acquisition • Memory
Process	Worker processes internal data and information from senses and memory.	• Process • Metacognition
Output	Worker expresses data and information as communication with others.	Expressive skills — • speaking • writing • presenting

One-person process?

"Process" tags the personal and individual phases that occur during one worker's learning actions and situations.
The knowing field, process, applies to collaborative systems that generally require more than one worker. One very versatile worker may assume all of the collaborative roles in a process. Learning requires versatility.

More…

More… Preview

Action or Process

If an action is the steps that one worker takes to carry out a task, then a process is the "dance" that workers perform together to add value to input. In an orchestra or jazz combo, the clarinetist plays an "action" and the whole ensemble performs a "process."

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You can find the following information on the pages shown.

Definition

Thinking skills are internal methods a human being develops gradually to process information. Thinking includes physical and mental procedures by which a person can —

- collect data and information for processing.
- recall data and information previously learned.
- process data and information.
- express data and information as communication.

References

Thomas D. Kimball, Ph.D., compiled this list of thinking skills and adapted the definitions from ideas of Robert Ennis, Jean Piaget, and Robert Sternberg.

An excellent reference fro all aspects of thinking skills is:

Developing Minds, edited by Arthur Costa, published by Association of Supervision and Curriculum Development, Alexandria, VA, 1985.

Thinking Skills for the Input Phase

Introduction

During the input phase, the worker collects data and information from the external world for processing.

Distinction between data and information

Data are elements of knowledge that the learner has not yet organized or processed in any way.

Information is data which someone has already "formed" into meaningful relationships with other knowledge.

Learning guides, such as the present one, use the principles of structured writing to give learners information shaped as "advanced organizers."

Table: specific input skills

This table summarizes specific thinking skills for the input phase of learning.

Knowledge Acquisition	Memory
• Observing • Perceiving • Conceiving — – Discriminating – Grouping – Tagging – Classifying – Sorting – Seriating	• Working — – Rehearsing – Recalling • Storing *Notes:* – Working memory often gets the tag, "short-term" memory. – Storing is a "hard-wired" activity. It is not a trainable skill. – Storing memory often gets the tag, "long-term" memory. – Storing occurs automatically whenever one repeatedly associates contents with strong emotions of anger, fear, hate, love, lust, joy.

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Thinking Skills for the Process Phase

Introduction

During the process phase, the worker processes internal data and information from senses and memory.

Table: specific process skills

This table summarizes specific thinking skills for the process phase of learning.

Process Skills	Metacognitive Skills
Simple skills: • Applying • Analyzing • Synthesizing • Determining the meaning of statements • Relating cause and effect	Simple skills: • Questioning • Taking another point of view • Predicting trends • Planning • Monitoring • Evaluating • Judging in various situations
Complex skills: • Generalizing — inducing • Inferring — deducing	Complex skills: • Problem solving • Decision making

Note

"Process" tags the personal and individual phases that occur during one worker's learning actions and situations.

The knowing field, process, applies to collaborative systems that generally require more than one worker. One very versatile worker may assume all of the collaborative roles in a process. Learning requires versatility.

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Thinking Skills for the Output Phase

Introduction

During the output phase, the worker expresses data and information as communication through speaking, writing, and presenting. The worker adds external interactions with others to the internal interactions with self.

Inter-dependent skills

Thinking skills from input, process, and output phases are interdependent. While expressive activities are happening, a speaker or writer or presenter will also be applying skills from input and process phases.

Difference between writing and speaking

The worker applies speaking and presenting skills while other persons are physically present. Applying one's writing skills occurs before a worker receives the document — rarely while the worker is physically present.

Table: specific output skills

This table summarizes specific thinking skills for the output phase of learning.

Speaking Skills	Presenting Skills	Writing Skills
• Evaluating spoken performance against quality standards of the listener(s) • Discriminating between a defective performance and one which meets standards of the listener(s)	• Evaluating resource management against quality standards of the observer(s) • Discriminating between a defective presentation and one which meets standards of the observer(s)	• Evaluating written product against quality standards of the worker(s) • Discriminating between a defective product and one which meets standards of the worker(s)

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Input Phase — Definitions

Introduction

General and specific definitions of the input phase thinking skills appear here.

Knowledge acquisition

Knowledge acquisition is the input phase thinking skill for —

- first-time learning.
- collecting data and information from the external world for internal processing.

List of skills

Workers use three knowledge acquisition skills, in this learning order:

- observing,
- perceiving, *and*
- conceiving.

Observing

Observing is a knowledge acquisition skill which uses one or more of the senses to collect data directly from external reality — seeing, smelling, tasting, hearing, touching, feeling motion or pressure or heat.

Perceiving

Perceiving is a knowledge acquisition skill which translates data from each of the senses into internal, physical knowledge of the external world.

The results of perceiving have the tag, "percepts."

Note: Thinkers automatically store sense knowledge as percepts in their brains and central nervous systems.

Conceiving

Conceiving is a knowledge acquisition skill that —

- forms mental knowledge of the external world.
- abstracts a concept from percepts by stripping away all their specific or unique features, while leaving the attributes they have in common.

Note: Six sub skills enable the learner to do conceiving. We list and define these six skills next.

More…

More… Input Phase — Definitions

Sub skills of conceiving This table tags and defines each sub skill of conceiving.

This sub skill…	is a conceiving skill that … .
Discriminating	points out identical, similar, or different properties and functions of two or more elements of data.
Grouping	puts together elements with the same or similar properties or functions.
Labeling or Tagging	names a group of the same or similar elements of knowledge with a label/tag based on a common property or function. *Note:* KnowSys uses "tag," not "label," as the name for output of the labeling skill, because "tag" uses less space and fewer keystrokes than "label."
Classifying	adds one or more as yet unidentified elements to an existing group, based on the same or similar properties or functions.
Sorting	• matches one or more identified elements to subgroups within an existing group, based on selected sets of properties or functions. • puts elements into existing categories of knowledge.
Seriating	orders subjects, objects, or events according to some consistent attribute. *Note:* Seriating by • units of time is *sequencing*. • repeated constructs is *patterning*. • personal value is *prioritizing*. • any other attribute is *ordering*.

Memory *Memory* is an input phase thinking skill for recalling or rehearsing data and information.

Recalling *Recalling* is a memory skill that brings information from long-term memory stores into working memory.

Rehearsing *Rehearsing* is a memory skill for

- maintaining data in working memory.
- transferring data to long-term memory by —
  - – discriminating,
  - – grouping,
  - – tagging,
  - – ordering,
  - – classifying,
  - – sorting, *and*
  - – seriating.

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Process Phase — Definitions

Introduction

General and specific definitions for the process phase thinking skills appear in this order:

1. Simple process thinking skills.
2. Simple metacognitive thinking skills.
3. Complex metacognitive thinking skills.

Note: The output from complex process thinking skills are display fields for four levels of a quality organization and its documentation system.

Process skills

Process skills are the phase thinking skills for processing data and information from senses and/or memory.

Metacognitive skills

Metacognitive skills are the process phase thinking skills for processing the output of other process thinking skills.

More…

More… Process Phase — Definitions

Simple process skills

This table tags and defines each simple process skill.

This skill…	is a simple process skill by which the worker… .
Applying	• takes knowledge from the original setting where learned. • fits it into a new setting. • maintains the same relationships among critical elements.
Analyzing	breaks up any whole into its parts to find out their nature, proportion, function, *or* relationship.
Synthesizing	forms a whole by bringing together separate parts.
Determining the meaning of statements	links together concepts within contextual patterns that frequently have gaps.
Generalizing	formulates or induces principles or rules from particular instances. *Alias:* Inducing, the opposite of deducing.
Relating cause and effect	attributes one or more effects as the direct, and usually irreversible, result of an action, process, *or* cause.
Inferring	derives — • an unknown principle from a known principle, • a specific statement from a general one, • a logical conclusion from premises, *or* • an opinion from known or assumed facts. • *Alias:* Deducing, the opposite of inducing.

More…

More… Process Phase — Definitions

Simple metacognitive skills

This table tags and defines each simple metacognitive skill.

This skill…	is a simple metacognitive skill by which the worker… .
Questioning	determines whether gaps exist in one's information, and if so, what information one needs to fill them.
Taking another point of view	perceives objects, subjects, or events as if through another person's senses, ideas, values, *or* beliefs.
Predicting trends	estimates consequences of events or behaviors, by recognizing patterns that repeat with high probability.
Planning	allocates resources in a sequence, based on predicted trends, before an action sequence.
Monitoring	judges whether present activity matches planned activity, during an action sequence.
Evaluating	judges the significance, value or worth of information, after an action sequence.
Judging	matches an assertion against one or more standards.

This output is an assertion…	based on demonstrable correspondence with… .
Fact	external reality
Opinion	reliable authority
Ambiguity	admitted ignorance of critical information

More…

More… Process Phase — Definitions

Complex process skills

This table tags and defines each complex process skill.

These skills…	are the complex process skills for… .
Problem solving	resolving a difficulty or departure from standard performance, the cause of which is unknown *Note:* Problem solving involves • many other simple process thinking skills, and • organizational functions of — – leading, – managing, – doing, *and* – proving. *Reference*: See *Where Do We Start?* in the appendix for more information about problem-solving or decision making situations.
Decision making	choosing a best alternative *Note:* Decision making involves • many other simple process thinking skills, and • organizational functions of — – leading, – managing, – doing, *and* – proving.

Decision-making process

This table displays the sequence of decision-making phases.

Phase	What's happening
1.	Identifying a problem situation, reliable information, and standards
2.	Proposing alternatives
3.	Predicting consequences
4.	Matching alternatives to standards
5.	Prioritizing alternatives
6.	Selecting one alternative or drawing a conclusion
7.	Judging effectiveness of results

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Output Phase — Definitions

Introduction

General and specific definitions for the output phase thinking skills appear here.

Skills table

This table tags and defines three output phase thinking skills

These skills…	are output phase thinking skills for…
Speaking	• evaluating spoken performance against quality standards of the listener(s) • discriminating between a defective performance and one that meets standards of the listener(s)
Presenting	• evaluating resource management against quality standards of the observer(s) • discriminating between a defective presentation and one which meets standards of the observer(s)
Writing	• evaluating written product against quality standards of the worker(s) • discriminating between a defective product and one which meets standards of the worker(s)

I-P-O table

This table displays input and output of thinking processes from simple levels to more complex levels.

Simple ↓ Complex	Input	Process	Output
	"Real world" data	Sense perception	Percepts
	Percepts	Cognition	Concepts
	Concepts	Metacognition	Assertions
	Assertions	Judgment • Certain • Probable • Conditional	Proposition • Fact • Opinion • Hypothesis
	Structured series of propositions	Syllogism • Certain • Probable	Inference • Logical • Dialectical
	Structured series of inferences	Theorizing	Theory *or* paradigm

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