Webb's Depth of Knowledge Guide

Career and Technical Education Definitions

2009

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Webb (1997) developed a process and criteria for systematically analyzing the alignment between standards and standardized assessments. Since then the process and criteria have demonstrated application to reviewing curricular alignment as well. This body of work offers the Depth of Knowledge (DOK) model employed to analyze the cognitive expectation demanded by standards, curricular activities and assessment tasks (Webb, 1997). The model is based upon the assumption that curricular elements may all be categorized based upon the cognitive demands required to produce an acceptable response. Each grouping of tasks reflects a different level of cognitive expectation, or depth of knowledge, required to complete the task. It should be noted that the term knowledge, as it is used here, is intended to broadly encompass all forms of knowledge (i.e. procedural, declarative, etc.). The following table reflects an adapted version of the model.

DOK Level	Title of Level
1	Recall and Reproduction
2	Skills and Concepts
3	Short-term Strategic Thinking
4	Extended Thinking

DOK level are assigned to each course objective the following served as general guidelines for developers:

- The DOK level assigned should reflect the level of work students are most commonly required to perform in order for the response to be deemed acceptable.
- The DOK level should reflect the _complexity_ of the cognitive processes demanded by the task outlined by the objective, rather than its _difficulty_. Ultimately the DOK level describes the kind of thinking required by a task, not whether or not the task is "difficult".
- If there is a question regarding which of two levels a statement addresses, such as Level 1 or Level 2, or Level 2 or Level 3, it is appropriate to select the higher of the two levels.
- The DOK level should be assigned based upon the cognitive demands required by the central performance described in the objective.
- **The objective's central verb(s) alone is/are _not sufficient_ information to assign a DOK level. Developers must also consider the complexity of the task and/or information, conventional levels of prior knowledge for students at the grade level, and the mental processes used to satisfy the requirements set forth in the objective.**

LEVEL 1 – RECALL & REPRODUCTION

Curricular elements that fall into this category involve basic tasks that require students to recall or reproduce knowledge and/or skills. The subject matter content at this particular level usually involves working with facts, terms and/or properties of objects. It may also involve use of simple procedures and/or formulas. There is little transformation or extended processing of the target knowledge required by the tasks that fall into this category. Key words that often denote this particular level include: list, identify and define. A student answering a Level 1 item either knows the answer or does not; that is, the answer does not need to be "figured out" or "solved."

POSSIBLE PRODUCTS

Quiz	List	Collection	Podcast	Social bookmarking
Definition	Workbook	Explanation	Categorizing/Tagging	Searching
Fact	Reproduction	Show and Tell	Commenting	Googling
Worksheet	Vocabulary Quiz	Outline	Bulleting	
Test	Recitation	Blog	Highlighting	
Label	Example	Wiki	Social networking	

ROLES

TEACHER		STUDENT	
Directs	Tells	Responds	Absorbs
Shows	Examines	Remembers	Recognizes
Questions	Evaluates	Memorizes	Describes
Demonstrates	Listens	Explains	Translates
Compares	Contrasts	Restates	Demonstrates
Examines		Interprets	

POTENTIAL ACTIVITIES

- Develop a concept map showing a process or describing a topic.
- Make a timeline
- Write a list of keywords you know about…
- Make a chart showing…
- Recite a fact related to…
- Write in your own words…
- Cut out, or draw a picture that illustrates an event, process, or story.
- Report or present to the class.
- Make a cartoon strip showing the sequence of an event, process, or story.
- Write and perform…
- Write a brief outline and explain the event, process, or story.
- Write a summary report of the event
- Prepare a flow chart that illustrates the sequence of events.
- Paraphrase a chapter in the book
- Retell in your own words
- Outline the main points

- Recall, restate, remember, or recognize a fact, term, or property(Recognizing, listing, describing, identifying, retrieving, naming, locating, finding)
- Using basic calculation tasks involving only one step (i.e. addition, subtraction, etc), complete the following…
- Locate or retrieve information in verbatim form.
- Straight-forward recognition tasks related to identifying features, objects and/or steps that don't vary greatly in form (i.e. recognizing features of basic tools).
- Writing tasks that involve applying a standard set of conventions and or criteria that should eventually be automated (i.e. using punctuation, spelling, etc)
- Basic measurement tasks that involve one step (i.e. using a ruler to measure length)
- Use this simple formula where at least one of the unknowns are provided to…
- Locating information in maps, charts, tables, graphs, and drawings

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Level 2 – Working with Skills & Concepts

Level 2 includes the engagement of some mental processing beyond recalling or reproducing a response. This level generally requires students to contrast or compare people, places, events and concepts; convert information from one form to another; classify or sort items into meaningful categories ; describe or explain issues and problems, patterns , cause and effect, significance or impact, relationships, points of view or processes. A Level 2 "describe or explain" would require students to go beyond a description or explanation of recalled information to describe or explain a result or "how" or "why." The learner should make use of information in a context different from the one in which it was learned.

Elements found in a curriculum that fall in this category involve working with or applying skills and/or concepts to tasks related to the field of study in a laboratory setting. The subject matter content at this particular level usually involves working with a set of principles, categories, heuristics, and protocols. At this level students are asked to transform/process target knowledge before responding. Example mental processes that often denote this particular level include: summarize, estimate, organize, classify, and infer.

POSSIBLE PRODUCTS

Photograph	Presentation	Reverse-Engineering	Blog Commenting
Illustration	Interview	Cracking Codes	Blog Reflecting
Simulation	Performance	Linking	Moderating
Sculpture	Dairy	Mashing	Testing (Alpha/Beta)
Demonstration	Journal	Relationship Mind Maps	Validating

ROLES

TEACHER		STUDENT	
Shows	Facilitates	Solves problems	Demonstrates use of knowledge
Observes	Evaluates	Calculates	Compiles
Organizes	Questions	Completes	Illustrates
		Constructs	

POTENTIAL ACTIVITIES

- Classify a series of steps
- Construct a model to demonstrate how it looks or works
- Practices a play and perform in class
- Make a diorama to illustrate an event
- Write a diary/blog entry
- Make a scrapbook about the area of study
- Make a topographic map
- Make up puzzle or game about the topic
- Write an explanation about this topic for others
- Make a model…
- Routine application tasks (i.e. applying a simple set of rules or protocols to a laboratory situation the same way each time)
- Explaining the meaning of a concept and/or explaining how to perform a particular task
- Stating relationships among a number of concepts and or principles

- More complex recognition tasks that involve recognizing concepts and processes that may vary in how they "appear"
- More complex calculation tasks (i.e. multi-step calculations such as standard deviation)
- Research projects and writing activities that involve locating, collecting, organizing and displaying information (i.e. writing a report with the purpose to inform; meeting all steps of the writing process)
- Measurement tasks that occur over a period of time and involve aggregating/organizing the data collected in to basic presentation forms such as a simple table or graph

LEVEL 3 – SHORT-TERM STRATEGIC THINKING

Items falling into this category demand a short-term use of higher order thinking processes, such as analysis and evaluation, to solve real-world problems with predictable outcomes. Stating one's reasoning is a key marker of tasks that fall into this particular category. The expectation established for tasks at this level tends to require coordination of knowledge and skill from multiple subject-matter areas to carry out processes and reach a solution in a project-based setting. Key processes that often denote this particular level include: analyze, explain and support with evidence, generalize, and create.

POSSIBLE PRODUCTS

Graph	Survey	Debate	Conclusion	Podcast
Spreadsheet	Database	Panel	Program	Publishing
Checklist	Mobile	Report	Film	Wiki-ing
Chart	Abstract	Evaluating	Animation	
Outline	Report	Investigation	Video cast	

ROLES

TEACHER		STUDENT		
Probes	Guides	Discusses	Uncovers	Argues
Observes	Evaluates	Debates	Thinks deeply	Tests
Acts as a resource	Questions	Examines	Questions	Calculates
Organizes	Dissects	Judges	Disputes	Compares
Clarifies	Accepts	Assesses	Decides	Selects
Guides		Justifies		

POTENTIAL ACTIVITIES

- Use a Venn Diagram that shows how two topics are the same and different
- Design a questionnaire to gather information
- Survey classmates/industry members to find out what they think about a particular topics
- Make a flow chart to show the critical stages.
- Classify the actions of the characters in book
- Prepare a report about an area of study
- Conduct an investigation to produce information to support a view
- Write a letter to the editor after evaluation product
- Prepare and conduct a debate
- Prepare a list of criteria to judge
- Write a persuasive speech arguing for/against…
- Make a booklet about five rules you see as important. Convince others.
- Form a panel to discuss viewpoints on…
- Write a letter to… advertising on changes needed.
- Prepare a case to present your view about

- Short-term tasks and projects placing a strong emphasis on transferring knowledge to solve predictable problems
- Explaining and/or working with abstract terms and concepts
- Recognition tasks when the environment observed is real-world and often contains extraneous information which must be sorted through
- Complex calculation problems presented that draw upon multiple processes
- Writing and or explaining tasks that require altering a message to "fit" an audience
- Creating graphs, tables and charts where students must reason through and organize the information with instructor prompts
- Identifying a research question and/or designing investigations to answer a question
- Tasks that involve proposing solutions or making predictions

Level 4 – Extended Strategic Thinking

Curricular elements assigned to this level demand extended use of higher order thinking processes such as synthesis, reflection, assessment and adjustment of plans over time. Students are engaged in conducting investigations to solve real-world problems with unpredictable outcomes. Employing and sustaining strategic thinking processes over a longer period of time to solve the problem is a key feature of curricular objectives that are assigned to this level. Key strategic thinking processes that denote this particular level include: synthesize, reflect, conduct, and manage.

POSSIBLE PRODUCTS

Film	Project	New Game	Newspaper
Story	Plan	Song	Media Product

ROLES

TEACHER		STUDENT		
Facilitates	Extends	Designs	Formulates	Plans
Reflects	Analyses	Takes risks	Modifies	Creates
Evaluates		Proposes		

POTENTIAL ACTIVITIES

- Applying information to solve ill-defined problems in novel situations
- Tasks that require a number of cognitive and physical skills in order to complete
- Writing and/or research tasks that involve formulating and testing hypotheses over time
- Tasks that require students to make multiple strategic and procedural decisions as they are presented with new information throughout the course of the event
- Tasks that require perspective taking and collaboration with a group of individuals
- Creating graphs, tables, and charts where students must reason through and organize the information without instructor prompts
- Writing tasks that have a strong emphasis on persuasion
- Devise a way to…
- Develop a menu for a new restaurant using a variety of healthy foods
- Sell an idea
- Write a jingle to advertise a new product
- Conduct an internship in industry where students are faced with real-world, unpredictable problems

A Model of Learning Objectives

based on

A Taxonomy for Learning, Teaching, and Assessing:
A Revision of Bloom's Taxonomy of Educational Objectives

Among other modifications, Anderson and Krathwohl's (2001) revision of the original Bloom's taxonomy (Bloom & Krathwohl, 1956) redefines the cognitive domain as the intersection of the Cognitive Process Dimension and the Knowledge Dimension. This document offers a three-dimensional representation of the revised taxonomy of the cognitive domain.

Although the Cognitive Process and Knowledge dimensions are represented as hierarchical steps, the distinctions between categories are not always clear-cut. For example, all procedural knowledge is not necessarily more abstract than all conceptual knowledge; and an objective that involves analyzing or evaluating may require thinking skills that are no less complex than one that involves creating. It is generally understood, nonetheless, that lower order thinking skills are subsumed by, and provide the foundation for higher order thinking skills.

The Knowledge Dimension classifies four types of knowledge that learners may be expected to acquire or construct—ranging from concrete to abstract (Table 1).

Table 1. The Knowledge Dimension – major types and subtypes

concrete knowledge			abstract knowledge
factual	**conceptual**	**procedural**	**metacognitive***
knowledge of terminology knowledge of specific details and elements	knowledge of classifications and categories knowledge of principles and generalizations knowledge of theories, models, and structures	knowledge of subject-specific skills and algorithms knowledge of subject-specific techniques and methods knowledge of criteria for determining when to use appropriate procedures	strategic knowledge knowledge about cognitive tasks, including appropriate contextual and conditional knowledge self-knowledge

(Table 1 adapted from Anderson and Krathwohl, 2001, p. 46.)

*Metacognitive knowledge is a special case. In this model, "metacognitive knowledge is knowledge of [one's own] cognition and about oneself in relation to various subject matters . . ." (Anderson and Krathwohl, 2001, p. 44).

This taxonomy provides a framework for determining and clarifying learning *objectives*.
Learning *activities* often involve both lower order and higher order thinking skills as well as a mix of concrete and abstract knowledge.

The Cognitive Process Dimension represents a continuum of increasing cognitive complexity—from lower order thinking skills to higher order thinking skills. Anderson and Krathwohl (2001) identify nineteen specific cognitive processes that further clarify the scope of the six categories (Table 2).

Table 2. The Cognitive Processes dimension — categories & cognitive processes and alternative names

lower order thinking skills ⟶				higher order thinking skills	
remember	**understand**	**apply**	**analyze**	**evaluate**	**create**
recognizing • identifying recalling • retrieving	interpreting • clarifying • paraphrasing • representing • translating exemplifying • illustrating • instantiating classifying • categorizing • subsuming summarizing • abstracting • generalizing inferring • concluding • extrapolating • interpolating • predicting comparing • contrasting • mapping • matching explaining • constructing models	executing • carrying out implementing • using	differentiating • discriminating • distinguishing • focusing • selecting organizing • finding coherence • integrating • outlining • parsing • structuring attributing • deconstructing	checking • coordinating • detecting • monitoring • testing critiquing • judging	generating • hypothesizing planning • designing producing • constructing

(Table 2 adapted from Anderson and Krathwohl, 2001, pp. 67–68.)

A statement of a **learning objective** contains a **verb** (an action) and an **object** (usually a noun).

- The **verb** generally refers to [actions associated with] the intended **cognitive process**.
- The **object** generally describes the **knowledge** students are expected to acquire or construct. (Anderson and Krathwohl, 2001, pp. 4–5)

In this model, each of the colored blocks shows an example of a learning objective that generally corresponds with each of the various combinations of the cognitive process and knowledge dimensions.

Remember: these are **learning *objectives***—not learning *activities*. It may be useful to think of preceding each objective with something like: "Students will be able to . . ."

*Anderson, L.W. (Ed.), Krathwohl, D.R. (Ed.), Airasian, P.W., Cruikshank, K.A., Mayer, R.E., Pintrich, P.R., Raths, J., & Wittrock, M.C. (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's Taxonomy of Educational Objectives* (Complete edition). New York: Longman.

The Knowledge Dimension

metacognitive — Knowledge of cognition in general as well as awareness and knowledge of one's own cognition.

procedural — How to do something, methods of inquiry, and criteria for using skills, algorithms, techniques, and methods.

conceptual — The interrelationships among the basic elements within a larger structure that enable them to function together.

factual — The basic elements students must know to be acquainted with a discipline or solve problems in it.

The Cognitive Process Dimension

remember — Retrieve relevant knowledge from long-term memory.

understand — Construct meaning from instructional messages, including oral, written, and graphic communication.

apply — Carry out or use a procedure in a given situation.

analyze — Break material into constituent parts and determine how parts relate to one another and to an overall structure or purpose.

evaluate — Make judgements based on criteria and standards.

create — Put elements together to form a coherent whole; reorganize into a new pattern or structure.

Identify strategies for retaining information.

Recall how to perform CPR.

Recognize symptoms of exhaustion.

List primary and secondary colors.

Predict one's response to culture shock.

Clarify assembly instructions.

Classify adhesives by toxicity.

Summarize features of a new product.

Use techniques that match one's strengths.

Carry out pH tests of water samples.

Provide advice to novices.

Respond to frequently asked questions.

Deconstruct one's biases.

Integrate compliance with regulations.

Differentiate high and low culture.

Select the most complete list of activities.

Reflect on one's progress.

Judge efficiency of sampling techniques.

Determine relevance of results.

Check for consistency among sources.

Create an innovative learning portfolio.

Design an efficient project workflow.

Assemble a team of experts.

Generate a log of daily activities.

Model created by: Rex Heer
Iowa State University
Center for Excellence in Learning and Teaching
Updated January, 2012
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For additional resources, see:
www.celt.iastate.edu/teaching/RevisedBlooms1.html

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Curriculum Design Resource *[Draft]*

Anderson and Krathwohl

Anderson and Krathwohl (2001) revised Bloom's taxonomy incorporating the kinds of knowledge and the cognitive processes used to learn.

You are advised to familiarse yourself with the following both information sources to help you compile learning outcomes in the Knowledge and Understanding related categories of module learning outcomes.

Knowledge Dimension

- **Factual –** The basic elements that students must know to be acquainted with a discipline or solve problems in it. (terminology, specific details and elements)

- **Conceptual** – The interrelationships among the basic elements within a larger structure that enable them to function together. (classifications & categories, principles & generalisations, theories, models and structures)

- **Procedural** – How to do something; methods of inquiry, and criteria for using skills, algorithms, techniques, and methods. (subject-specific skills and algorithms, techniques and methods, criteria for determining when to use appropriate procedures)

- **Metacognitive Knowledge** – Knowledge of cognition in general as well as awareness and knowledge of one's own cognition. (strategic knowledge, cognitive tasks, including appropriate contextual and conditional knowledge, self-knowledge)

Cognitive Process Dimension

- **Remember** – Retrieving relevant knowledge from long-term memory. (recognizing, recalling)

- **Understand** – Determining the meaning of instructional messages, including oral, written, and graphic communication. (interpreting, exemplifying, classifying, summarizing, inferring, comparing, explaining)

- **Apply** – Carrying out or using a procedure in a given situation. (executing, implementing)

- **Analyze** – Breaking material into its constituent parts and detecting how the parts relate to one another and to an overall structure or purpose. (differentiating, organizing, attributing)

- **Evaluate** – Making judgments based on criteria and standards. (checking, critiquing)

- **Create** – Putting elements together to form a novel, coherent whole or make an original product. (generating, planning, producing)

Krathwohl (2002).