

HESS' COGNITIVE RIGOR MATRIX & CURRICULAR EXAMPLES: Applying Webb's Depth-of-Knowledge Levels to Bloom's Cognitive Process Dimensions – Math and Science

REVISED BLOOM'S TAXONOMY	WEBB'S DOK LEVEL 1 RECALL & REPRODUCTION	WEBB'S DOK LEVEL 2 SKILLS & CONCEPTS	WEBB'S DOK LEVEL 3 STRATEGIC THINKING/ REASONING	WEBB'S DOK LEVEL 4 EXTENDED THINKING
<p>Remember</p> <p>Retrieve knowledge from long-term memory, recognize, recall, locate, identify</p>	<ul style="list-style-type: none"> o Recall, observe, & recognize facts, principles, properties o Recall/ identify conversions among representations or numbers (e.g., customary and metric measures) 			
<p>Understand</p> <p>Construct meaning, clarify, paraphrase, represent, translate, illustrate, give examples, classify, categorize, summarize, generalize, infer a logical conclusion (such as from examples given), predict, compare/contrast, match like ideas, explain, construct models</p>	<ul style="list-style-type: none"> o Evaluate an expression o Locate points on a grid or number on number line o Solve a one-step problem o Represent math relationships in words, pictures, or symbols o Read, write, compare decimals in scientific notation 	<ul style="list-style-type: none"> o Specify and explain relationships (e.g., non-examples/examples; cause-effect) o Make and record observations o Explain steps followed o Summarize results or concepts o Make basic inferences or logical predictions from data/observations o Use models /diagrams to represent or explain mathematical concepts o Make and explain estimates 	<ul style="list-style-type: none"> o Use concepts to solve non-routine problems o Explain, generalize, or connect ideas using supporting evidence o Make and justify conjectures o Explain thinking when more than one response is possible o Explain phenomena in terms of concepts 	<ul style="list-style-type: none"> o Relate mathematical or scientific concepts to other content areas, other domains, or other concepts o Develop generalizations of the results obtained and the strategies used (from investigation or readings) and apply them to new problem situations
<p>Apply</p> <p>Carry out or use a procedure in a given situation; carry out (apply to a familiar task), or use (apply) to an unfamiliar task</p>	<ul style="list-style-type: none"> o Follow simple procedures (recipe-type directions) o Calculate, measure, apply a rule (e.g., rounding) o Apply algorithm or formula (e.g., area, perimeter) o Solve linear equations o Make conversions among representations or numbers, or within and between customary and metric measures 	<ul style="list-style-type: none"> o Select a procedure according to criteria/ problem and perform it o Solve routine problem applying multiple concepts or decision points o Retrieve information from a table, graph, or figure and use it solve a problem requiring multiple steps o Translate between tables, graphs, words, and symbolic notations (e.g., graph data from a table) o Construct models given criteria 	<ul style="list-style-type: none"> o Design investigation for a specific purpose or research question o Conduct a designed investigation o Use concepts to solve non-routine problems o Use & show reasoning, planning, and evidence o Translate between problem & symbolic notation when not a direct translation 	<ul style="list-style-type: none"> o Select or devise approach among many alternatives to solve a problem o Conduct a project that specifies a problem, identifies solution paths, solves the problem, and reports results
<p>Analyze</p> <p>Break into constituent parts, determine how parts relate, differentiate between relevant-irrelevant, distinguish, focus, select, organize, outline, find coherence, deconstruct</p>	<ul style="list-style-type: none"> o Retrieve information from a table or graph to answer a question o Identify whether specific information is contained in graphic representations (e.g., table, graph, T-chart, diagram) o Identify a pattern/trend 	<ul style="list-style-type: none"> o Categorize, classify materials, data, figures based on characteristics o Organize or order data o Compare/ contrast figures or data o Select appropriate graph and organize & display data o Interpret data from a simple graph o Extend a pattern 	<ul style="list-style-type: none"> o Compare information within or across data sets or texts o Analyze and draw conclusions from data, citing evidence o Generalize a pattern o Interpret data from complex graph o Analyze similarities/differences between procedures or solutions 	<ul style="list-style-type: none"> o Analyze multiple sources of evidence o Analyze complex/abstract themes o Gather, analyze, and evaluate information
<p>Evaluate</p> <p>Make judgments based on criteria, check, detect inconsistencies or fallacies, judge, critique</p>			<ul style="list-style-type: none"> o Cite evidence and develop a logical argument for concepts or solutions o Describe, compare, and contrast solution methods o Verify reasonableness of results 	<ul style="list-style-type: none"> o Gather, analyze, & evaluate information to draw conclusions o Apply understanding in a novel way, provide argument or justification for the application
<p>Create</p> <p>Reorganize elements into new patterns/ structures, generate, hypothesize, design, plan, construct, produce</p>	<ul style="list-style-type: none"> o Brainstorm ideas, concepts, or perspectives related to a topic 	<ul style="list-style-type: none"> o Generate conjectures or hypotheses based on observations or prior knowledge and experience 	<ul style="list-style-type: none"> o Synthesize information within one data set, source, or text o Formulate an original problem given a situation o Develop a scientific/mathematical model for a complex situation 	<ul style="list-style-type: none"> o Synthesize information across multiple sources or texts o Design a mathematical model to inform and solve a practical or abstract situation