Alignment, Depth of Knowledge, & Change

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Alignment has been an issue for as many as forty years, dating back to behavioral objectives and mastery-learning.

Factors Evaluating Alignment

- Standards-based Education
- Systemic Reform
- Criterion-Referenced Assessment
- No Child Left Behind (Title I)

U.S. Department of Education Guidelines

Dimensions important for judging the alignment between standards and assessments

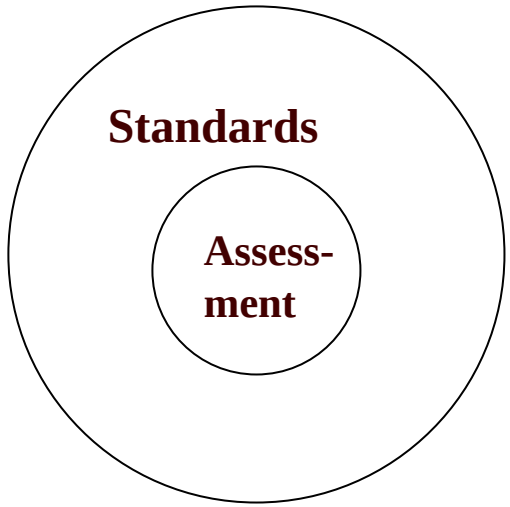
- ***Comprehensiveness***
- ***Content and Performance Match***
- ***Emphasis***
- ***Depth***
- ***Consistency with achievement standards***
- ***Clarity for users***

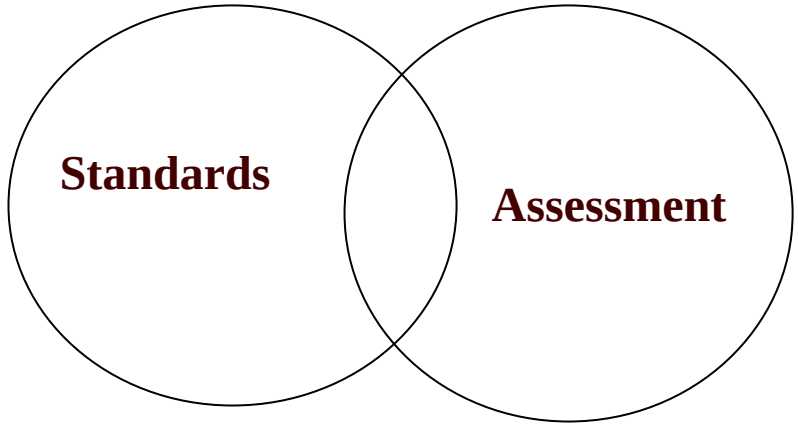
Assessment Validity	Standards and Assessment Alignment
Content	Breadth and Depth
Construct	Structure of Knowledge
Consequential	Fairness and Equitable

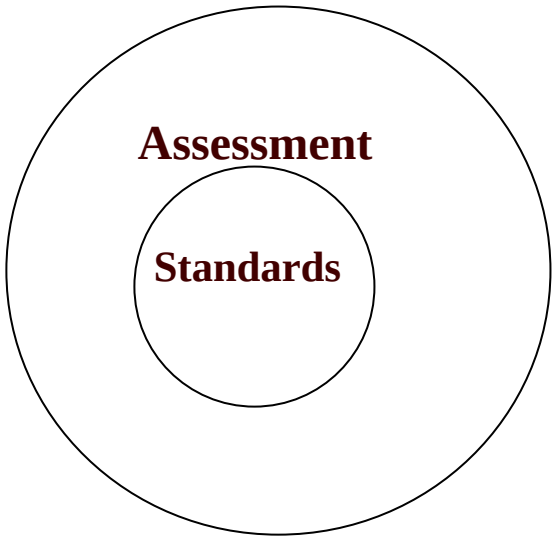
Alignment

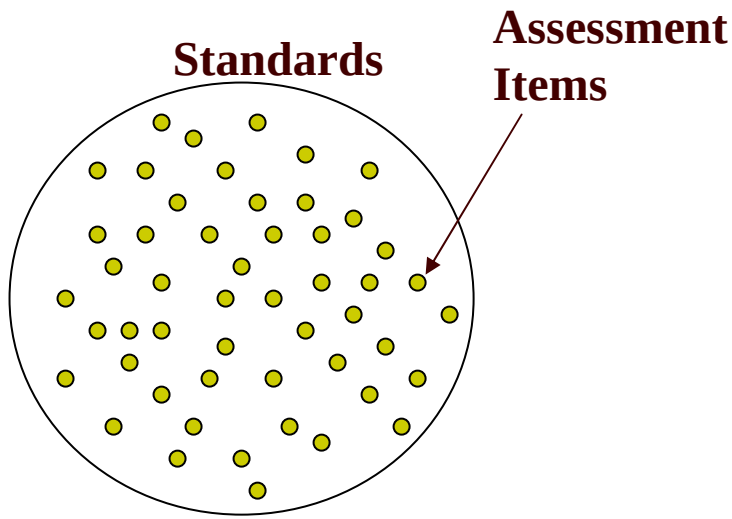
The degree to which expectations and assessments are in agreement and serve in conjunction with one another to guide the system toward students learning what is expected.

Degree of Alignment









Five General Criteria

1. Content Focus
2. Articulation Across Grades and Ages
3. Equity and Fairness
4. Pedagogical Implications
5. System Applicability

Specific Criteria

Content Focus

A. Categorical Concurrence

B. Depth-of-Knowledge Consistency

C. Range-of-Knowledge Correspondence

D. Structure-of-Knowledge Comparability

E. Balance of Representation

F. Dispositional Consonance

Tyler's Behavioral Aspect of the Objectives (course dependent)

1. Understanding of important facts and principles
2. Familiarity with dependable sources of information
3. Ability to interpret data
4. Ability to apply principles
5. Ability to study and report results of study
6. Broad and mature interests
7. Social attitudes

Bloom Taxonomy

Knowledge Recall of specifics and generalizations; of methods and processes; and of pattern, structure, or setting.

Comprehension Knows what is being communicated and can use the material or idea without necessarily relating it.

Applications Use of abstractions in particular and concrete situations.

Analysis Make clear the relative hierarchy of ideas in a body of material or to make explicit the relations among the ideas or both.

Synthesis Assemble parts into a whole.

Evaluation Judgments about the value of material and methods used for particular purposes.

Marzano's Dimension of Thinking (Wisconsin DPI) (1989)

- Gathering Information
  - Observe, recall, question
- Organizing Information
  - Represent, compare, classify, order
- Analyzing Information
  - Attributes and components, patterns and relationships, main points, accuracy and adequacy
- Generating Information
  - Infer, predict, elaborate
- Integrating Information
  - Summarize, restructure
- Evaluating Information
  - Establish criteria, verify

Depth of Knowledge (1997)

Level 1 Recall

Recall of a fact, information, or procedure.

Level 2 Skill/Concept

Use information or conceptual knowledge, two or more steps, etc.

Level 3 Strategic Thinking

Requires reasoning, developing plan or a sequence of steps, some complexity, more than one possible answer.

Level 4 Extended Thinking

Requires an investigation, time to think and process multiple conditions of the problem.

Three Methods:

- Common Framework
- Expert Consensus
- Common Criteria

Content-by-Process Framework

Topics	Categories of Cognitive Demand			
Measurement & Calculation in Science	Coverage	Memorize Facts/etc.	Understand Concepts	Perform Procedures
The International System	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
Mass & Weight	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
Length	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
Volume	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
Time	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
Temperature	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3

Survey of Enacted Curriculum
Mathematics Cognitive Levels

- Memorize

  Recall basic mathematics facts; etc.
- Perform procedures

  Do computational procedures or algorithms; etc.
- Demonstrate understanding

  Communicate mathematical ideas; use representations to model mathematical ideas; etc.
- Conjecture, generalize, prove

  Determine the truth of a mathematical pattern or proposition; write formal or informal proof; etc.
- Solve non-routine problems, make connections

  Apply and adapt a variety of appropriate strategies to solve problems; etc.

Grade 8 Standards from Three States

State A:

The student will use proportions to solve scale-model problems with fractions and decimals.

State B:

Students compute with rational numbers expressed in a variety of forms; they solve problems involving ratios, proportions, and percentages. Use ratio and proportion to solve problems.

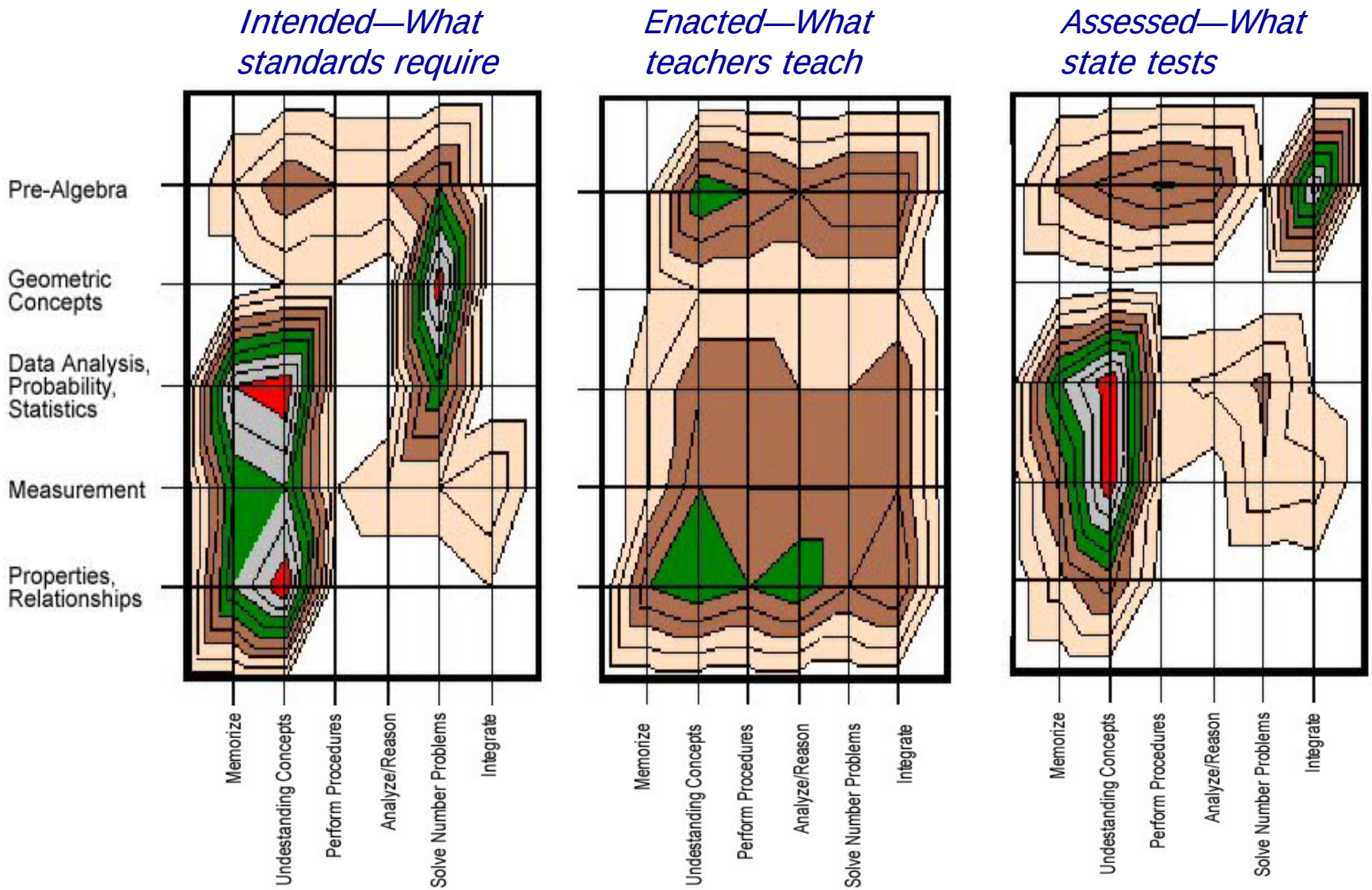
State C:

Apply proportional thinking in a variety of problem situations that include, but are not limited to: 1) ratios and proportions, and 2) percents, including those greater than 100 and less than one.

Survey of Enacted Curriculum
English Language Arts Cognitive Levels

- Recall
  - Provide facts, terms, definitions, conventions; describe; etc.
- Demonstrate/Explain
  - Follow instructions; give examples; etc.
- Analyze/investigate
  - Categorize, schematize; distinguish fact from opinion; make inferences, draw conclusions; etc.
- Evaluate
  - Determine relevance, coherence, logical, internal consistency; test conclusions; etc.
- Generate/create
  - Integrate, dramatize; predict probable consequences; etc.

Enacted, *Intended*, and *Assessed* Curriculum



Achieve Matrix

Grade 3 Mathematics Data Analysis and Probability

Obj. #	Text of Objective	A	B	Content Centrality	Type of Performance Centrality	Source of Challenge
Organize, describe and make predictions from existing data						
10.A. 1a	Organize and display data using pictures, tallies, tables, charts, or bar graphs.	81				
10A. 1b	Answer questions and make predictions based on given data.	5				
		20				
		41				
		53				
		66				
		69				

Achieve Alignment Criteria

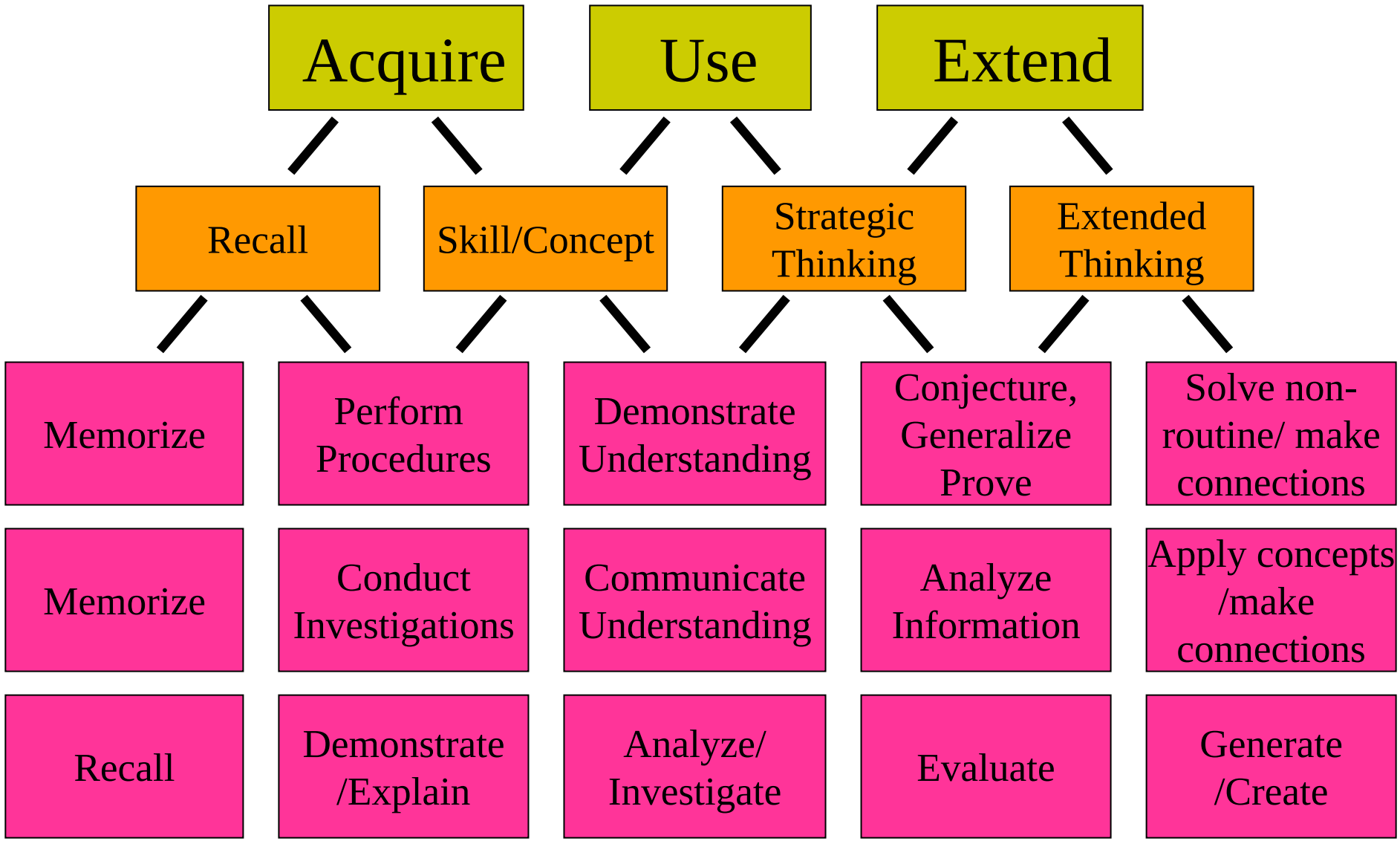
Item-Standard Match

- Content Centrality
- Performance Centrality
- Source of Challenge

Instrument-Standard Match

- Level of Challenge
- Balance
- Range

Expectations for Student Performance



Which of these means about the same as the word *gauge*?

a. balance

b. measure

c. select

d. warn

A car odometer registered 41,256.9 miles when a highway sign warned of a detour 1,200 feet ahead. What will the odometer read when the car reaches the detour? (5,280 feet = 1 mile)

(a) 42,456.9

(b) 41,279.9

(c) 41,261.3

(d) 41,259.2

(e) 41,257.1

Did you use the calculator on this question?

☐ Yes ☐ No

$$\begin{array}{r} 121 \\ 13 \\ 32 \\ +\ 34 \\ \hline \end{array}$$

1) 190
2) 200
3) 290
4) N

This question refers to pieces *N*, *P*, and *Q*.

In Mr. Bell's classes, the students voted for their favorite shape for a symbol. Here are the results.

	Class 1	Class 2	Class 3
Shape *N*	9	14	11
Shape *P*	1	9	17
Shape *Q*	22	7	2

Using the information in the chart, Mr. Bell must select one of the shapes to be the symbol. Which one should he select and why?

The shape Mr. Bell should select: _____
Explain:

EXAMPLE OF STANDARDS AND DEPTH-OF-KNOWLEDGE LEVELSCONTENT AREA: GEOMETRY

	Mathematics Standard	Depth-of-Knowledge Level
State D Grade 8	**VI. Geometric and Spatial Sense**	
VI.2	Explore transformations of geometric figures.	3
State B Grade 8	**II. Geometry**	
II.4	Graph on a coordinate plane similar figures, reflections, and translations.	2
State A Grade 6	**IV. Geometry and Spatial Sense**	
IV.D.	Investigate and predict the results of transformations of shapes, figures, and models including slides, flips, and turns.	
IV.D.1	Identify and describe the results of translations (slides), reflections (flips), rotations (turns), or glide reflections.	2

Issues in Assigning Depth-of-Knowledge Levels

- Variation by grade level
- Complexity vs. difficulty
- Item type (MS, CR, OE)
- Central performance in objective
- Consensus process in training
- Aggregation of DOK coding
- Reliabilities

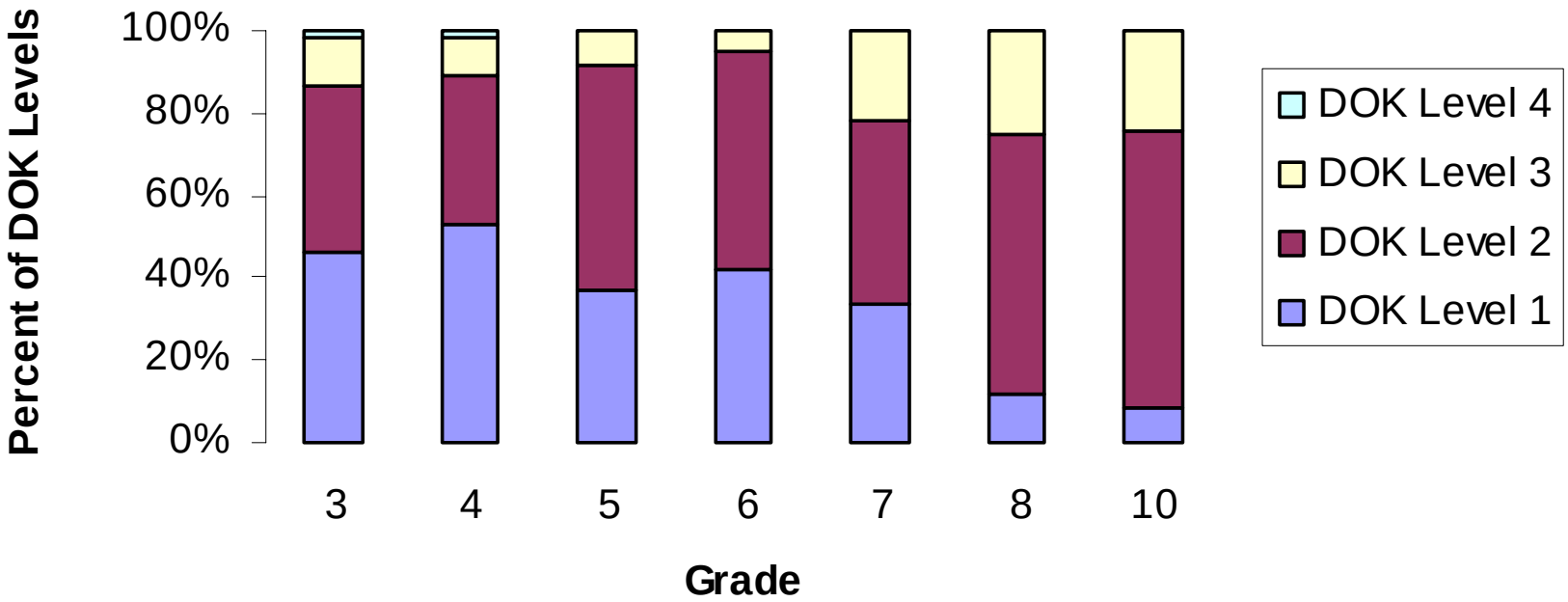
Distribution of Depth-of-Knowledge Levels from Different States Language Arts

Standard	Number of Objs. Under Standard	DOK Levels of Objs.	# of Objs by DOK Levels	% of Objs by DOK Levels
Michigan High School	55	1 2 3 4	0 15 31 9	0 27 57 16
West Virginia Grade 8	32	1 2 3 4	2 12 16 2	6 37 50 6
Alabama Grade 8	4	1 2 3	1 2 1	25 50 25

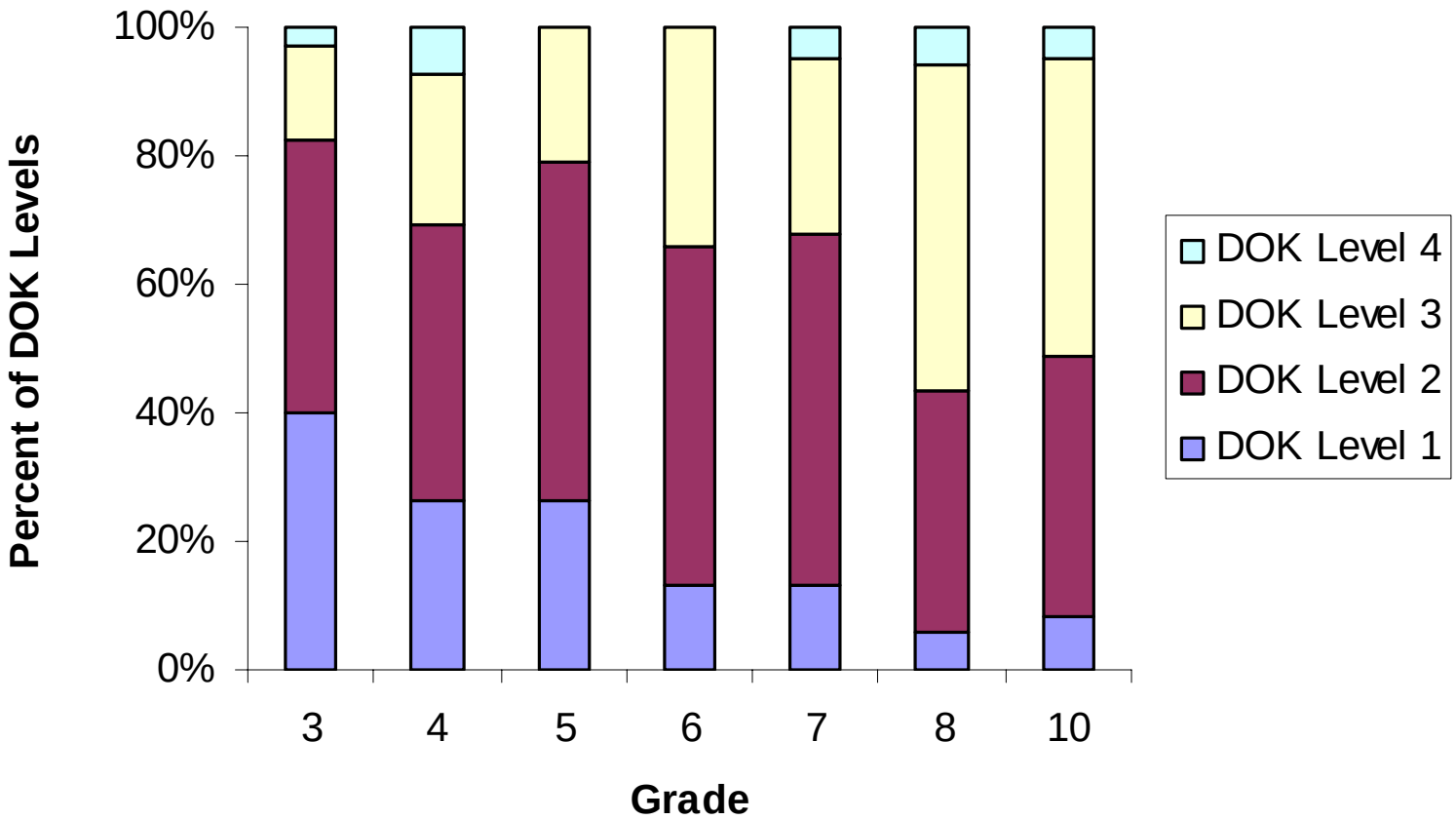
Distribution of Depth-of-Knowledge Levels from Different States Mathematics

	Total Number of Objectives	DOK Level	# of Objs by Level	% within std by Level
Michigan High School	77	1 2 3 4	9 41 24 3	11 53 31 3
West Virginia Grade 8	34.25	1 2 3	4 20 8	12 62 25
Alabama Grade 8	14.75	1 2 3	6 7 1	42 50 7

Mathematics DOK Levels for Objectives by Grade



Reading Language Arts DOK Levels for Objectives by Grade



Implications of Depth-of-Knowledge Levels for Assessment Development

- Distribution (50% at or above)
- Varies by purpose for the assessment
- Vertical alignment
- Mandates (multiple measures definition)

Vertical Alignment Questions

- What level of *concurrence* is there between objectives for the two grades?
- To what extent do comparable objectives increase in *depth* from one grade to the next?
- To what extent does the *range* of content increase from one grade to the next?
- How does the *balance of representation* change from one grade to the next?

Type of Vertical Relationships

- Broader: The higher-grade standard reflects a broader application of the target skill or knowledge (generalizing from specific to additional applications).
- Deeper: The higher-grade standard reflects deeper mastery of the target skill or knowledge (e.g., application rather than recognition).
- Prerequisite: The lower-grade standard reflects a different, but prerequisite skill for mastery of the higher grade standard.
- New: The higher-grade standard is a new skill or knowledge unrelated to skills or knowledge covered at prior grades.
- Identical: The higher-grade standard appeared to be identical to one of the lower-grade standards.

Tindal's levels of complexity to rate standards for alternate assessments

- 1 – No clear behavioral dimension is present.
- 2 – Rote behavior chains are identified with very low-levels of complexity.
- 3 – Discrimination behavior is present with choice points for engaging in complex responses.
- 4 – Response classes are described with complex behavioral routines in multiple contexts.

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WAT WEB ALIGNMENT TOOL

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LOG OUT

Welcome to Web Alignment Tool

This tool is designed to produce reports on the alignment of curriculum standards and student assessments.

The process requires a group of reviewers first to assign depth-of-knowledge (DOK) levels to standards/objectives (Part I). Then reviewers are to code assessment items by identifying the depth-of-knowledge for each item and the corresponding standard/objective (Part II).

1. The steps in using this tool and the process include
2. Training on DOK levels for content area
3. Logging on
4. Selecting a state, content area, and grade
5. Individually coding DOK for each objective
6. Group reaching consensus on the DOK for each objective
7. Coding independently the DOK for each assessment item and corresponding objective(s)
8. Recording Source of Challenge and Notes

Internet

Web Sites

http://facstaff.wcer.wisc.edu/normw/

Alignment Tool
http://www.wcer.wisc.edu/WAT/index.aspx

Survey of the Enacted Curriculum
http://www.SECsurvey.org