

Webb levels and the Tennessee Curriculum

In 2006, the TN Department of Education conducted an external review of the TN Mathematics Standards that evaluated the standards through the lens of [Webb's Depth of Knowledge scale](#). Similar to Bloom's Taxonomy, Webb's scale categorizes a learning expectation in terms of the requisite knowledge or skill needed for a student to successfully meet this goal. Webb's four Levels are: Recall, Skill/Concept, Strategic Thinking, and Extended Thinking. The principal criterion for assigning a CLE or GLE to a knowledge level is the verb used in the learning expectation statement and the level of student engagement required to achieve the desired outcome.

The rigor and relevance of earlier versions of the *TN Mathematics Framework* was identified by these external reviewers as a target for improvement. The addition of the Process Standard strand is a direct response to the panel's recommendations and illustrates that expectations have been raised for all K-12 mathematics students Appendix D shows in tabular form Webb's Level of Knowledge data from the *2007 Mathematics Curriculum Frameworks*.

Four levels were used to rate depth of knowledge:

- Level 1 (recall) requires simple recall of such information as a fact, definition, term, or simple procedure.
- Level 2 (skill/concept) involves some mental skills, concepts, or processing beyond a habitual response; students must make some decisions about how to approach a problem or activity. Keywords distinguishing a Level 2 item include classify, organize, estimate, collect data, and compare data.
- Level 3 (strategic thinking) requires reasoning, planning, using evidence, and thinking at a higher level.
- Level 4 (extended thinking) requires complex reasoning, planning, developing, and thinking, most likely over an extended time. Cognitive demands are high, and students are required to make connections both within and among subject domains.

from <http://wceruw.com/news/coverStories/aligning_alternate_assessments.php>

The new curriculum has been designed to positively impact the focus and cognitive level of the educational experience for students across all grades and courses. To determine if the design has undergone the desired changes, we can look at the Webb levels of cognitive development for both the former curriculum and the new curriculum. There are four Webb levels, with level 1 requiring the least cognitive development and level requiring the most. The following information compares the Webb depth-of-knowledge analysis for the GLEs of the new curriculum with the Learning Expectations of the former curriculum as informed by examination of the Accomplishments, the State Performance Indicators and the Teacher Performance Indicators. In other words, the different expectations were evaluated to determine the Webb depth-of-knowledge levels through examining the descriptions of student outcomes.

Focus of Curriculum: One of the major changes to the curriculum was intended to be an increase in the focus of the curriculum at each grade level – in other words, to narrow the number of topics developed. In addition to directing the goals of the grade to parallel NCTM Focal Points, the need to narrow the curriculum to allow the teacher to spend more time on the grade specific content was critical. This should mean a decrease in the total number of concepts. Additionally, the number of concepts in each Webb level was of concern. The new curriculum can be compared to the former curriculum through the following data analysis:

Table 1: Former Curriculum Learning Expectations Count by Webb Level

	Level 1	Level 2	Level 3	Level 4	Total
Kindergarten	6	6	1	0	13
First	4	9	2	0	15
Second	6	7	3	1	17
Third	6	7	2	0	15
Fourth	4	4	5	2	15
Fifth	5	5	7	0	17
Sixth	2	7	8	0	17
Seventh	4	6	7	0	17
Eighth	6	5	6	0	17
Algebra I	14	11	18	0	43
Geometry	12	3	10	0	25
Algebra II	14	10	13	2	39

The number of Learning Expectations per grade level in the former curriculum includes only the Learning Expectations; in other words the SPI and TPI count is not included. If you included the count for the SPIs and/or the TPIs, the difference between the curricula would be even greater. By comparing the chart above and the chart below, you can see that the grade level concepts are more evenly distributed across the grades. Additionally, there are no extra SPI and TPI goals to be added as necessary learning goals. Comparing this to the chart below, this conclusion is that the number of learning topics is reduced by approximately $1/3$ to $1/2$ per grade.

Table 2: New Curriculum GLE/CLE - Count by Webb Level

	Level 1	Level 2	Level 3	Level 4	Total
Kindergarten	4	13	3	1	21
First	5	7	6	1	19
Second	7	7	7	1	22
Third	5	7	10	3	25
Fourth	9	5	7	2	23
Fifth	8	5	8	2	23
Sixth	6	5	12	2	25
Seventh	8	9	12	3	32
Eighth	4	7	9	6	26
Algebra I	2	3	11	7	23
Geometry	0	3	11	10	24
Algebra II	0	3	9	14	26

Webb Level: To examine the impact of the new curriculum design on the Webb Levels of the content, examination of the previous tables show that in the former curriculum the level 4 concepts were minimal at all grade levels. Additionally, the majority of the curriculum goals are level 1 or level 2. On the other hand, the new curriculum has increased the number of level 4 requirements at all grade levels; there is an expanding expectation for level 4 concepts as the student progresses through the different grades. This progression clearly expects more as students have developed stronger academic skills. The comparison between the curricula based on Webb level can also be viewed through examining the distribution by percentages.

Table 3: Former Curriculum GLE/CLE - % by Webb Level

	Level 1	Level 2	Level 3	Level 4
Kindergarten	46.15%	46.15%	7.69%	0.00%
First	26.67%	60.00%	13.33%	0.00%
Second	35.29%	41.18%	17.65%	5.88%
Third	40.00%	46.67%	13.33%	0.00%
Fourth	26.67%	26.67%	33.33%	13.33%
Fifth	29.41%	29.41%	41.18%	0.00%
Sixth	11.76%	41.18%	47.06%	0.00%
Seventh	23.53%	35.29%	41.18%	0.00%
Eighth	35.29%	29.41%	35.29%	0.00%
Algebra I	32.56%	25.58%	41.86%	0.00%
Geometry	48.00%	12.00%	40.00%	0.00%
Algebra II	35.90%	25.64%	33.33%	5.13%

Note that the only grades including level 4 concepts are grades 2, 4, and Algebra II. In general, 60% of all learning expectations in all grades are level 1 or level 2. Within each grade level, the distribution between Webb levels is fairly even. In fact, summarized across all grades, the average number of GLE/CLE per Webb level for the former curriculum are provided in the next table.

Table 4: Average % of concepts by Webb Level in Former Curriculum

	Level 1	Level 2	Level 3	Level 4
Average	32.60%	34.93%	30.44%	2.03%

With regard to the new curriculum, the expectations increase for the Webb levels as the grade level increases. The increase in expectation for the Webb levels increases each year, with substantial increases beginning in eighth grade and extending into the high school courses. Even more dramatically, by high school there are no concepts developed/tested at Webb level 1. Although level 1 instruction and learning are occurring at all grades, the higher grades are no longer evaluating the introductory learning levels.

Table 5: New Curriculum GLE/CLE - % by Webb Level

	Level 1	Level 2	Level 3	Level 4
Kindergarten	19.05%	61.90%	14.29%	4.76%
First	26.32%	36.84%	31.58%	5.26%
Second	31.82%	31.82%	31.82%	4.55%
Third	20.00%	28.00%	40.00%	12.00%
Fourth	39.13%	21.74%	30.43%	8.70%
Fifth	34.78%	21.74%	34.78%	8.70%
Sixth	24.00%	20.00%	48.00%	8.00%
Seventh	25.00%	28.13%	37.50%	9.38%
Eighth	15.38%	26.92%	34.62%	23.08%
Algebra I	8.70%	13.04%	47.83%	30.43%
Geometry	0.00%	12.50%	45.83%	41.67%
Algebra II	0.00%	11.54%	34.62%	53.85%

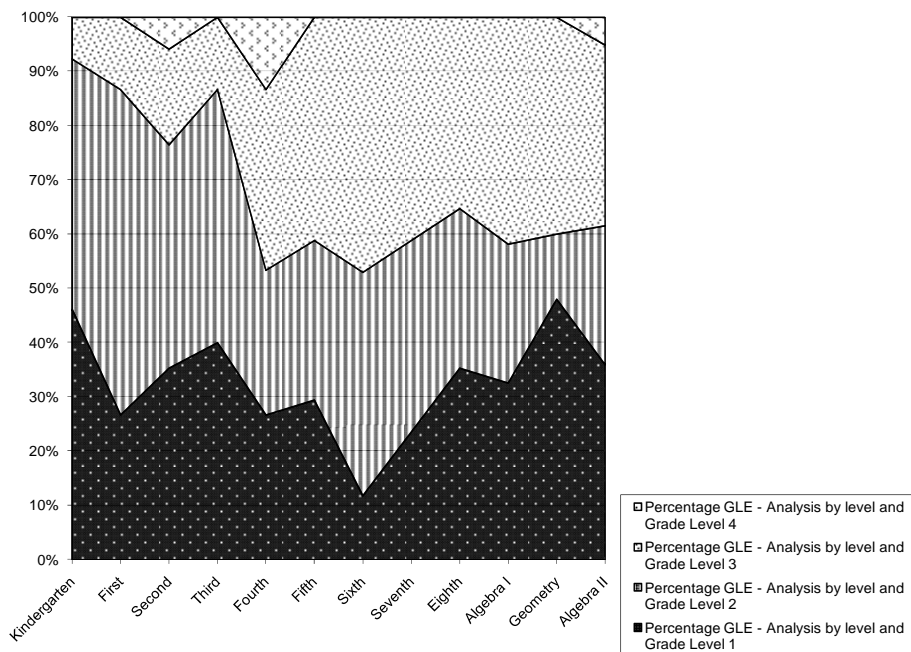
Looking at the averages for the new curriculum clearly illustrates the success in increasing the level of cognitive expectation the curriculum as a whole.

Table 6: Average % of concepts by Webb Level in New Curriculum

	Level 1	Level 2	Level 3	Level 4
Average	20.35%	26.18%	35.94%	17.53%

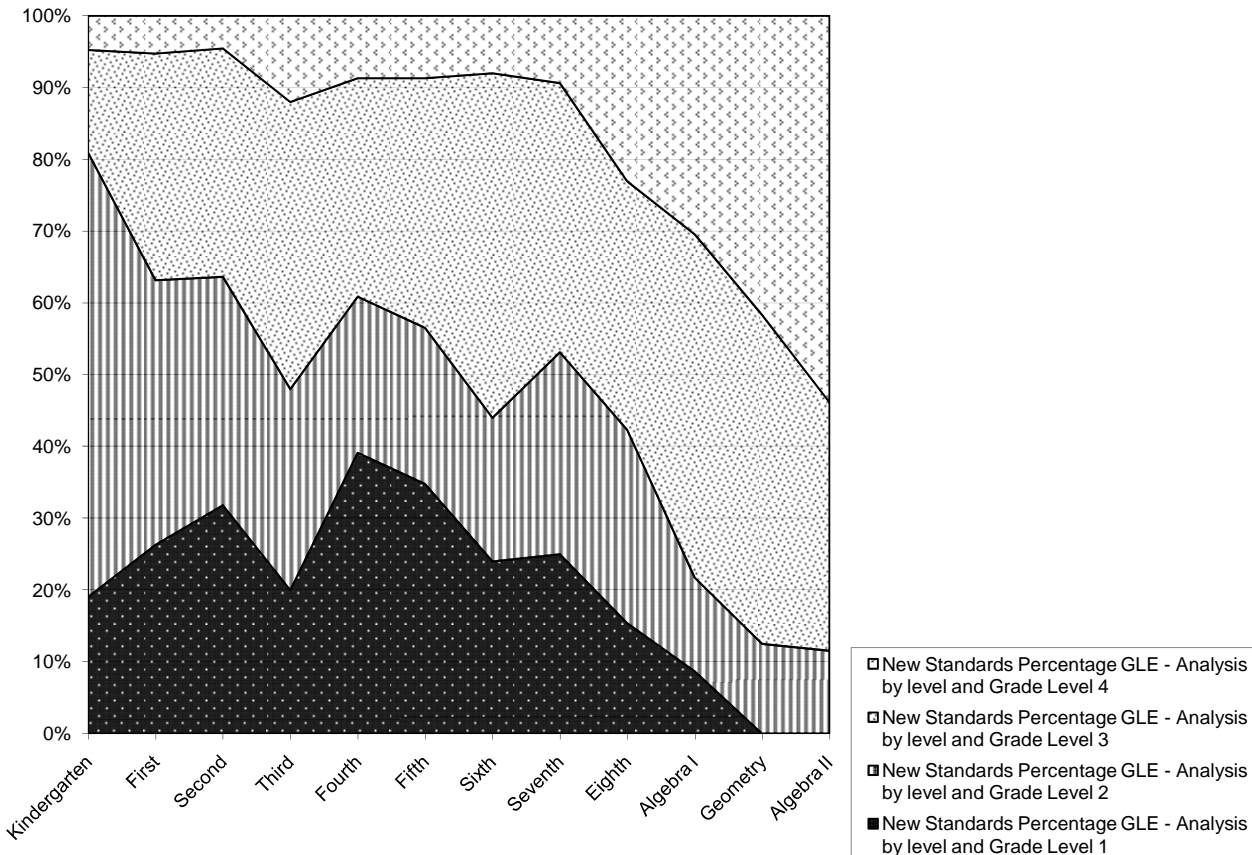
Changing the Curriculum across the Grades: Perhaps the greatest difference in the new curriculum is that the “flow” of the curriculum across grade levels more closely matches the flow recommended by NCTM and prepares the students for the material as gauged by NAEP testing and ACT testing regimens. Looking at the following graph, you can see that the former curriculum basically maintained the curriculum distribution constant at 60% of the curriculum was level 1 or level 2 for all grade levels. The only exceptions were pretty much limited to grades 4 & 8.

Figure 1: Former Curriculum - Webb level distribution by grade



On the other hand, within the new curriculum the Webb level expectations across grade levels clearly increases as the student progresses through school. The level 1 material decreases as students build more on previous work and are asked to deal with material at increasingly greater cognitive levels. In particular, you can see increases in the level 3 material between grades 4 and 8 and extensive increases in level 4 material after grade 8.

Figure 2: New Curriculum - Webb level distribution by grade



Within the new curriculum, the level 2 material, which is the level which encourages practice, paraphrasing, and comparison, is included fairly evenly at all grade levels. As students increase their abilities to communicate, problem solve, and analyze, the level 3 and level 4 material increases.