Technical Report 2505

CBMSkills Mathematics Development

Authors arranged alphabetically

Gerald Tindal, PhD

Cengiz Zopluoglu, PhD

Aaron Glasgow

James Llewellyn

University of Oregon

Published by

Behavioral Research and Teaching
University of Oregon • 175 Education
5262 University of Oregon • Eugene, OR 97403-5262
Phone: 541-346-3535 • Fax: 541-346-5689
http://brt.uoregon.edu

Reference: Tindal, G., Zopluoglu, C., Glasgow, A., & Llewellyn, J. (2025). *CBMSkills Mathematics Development*. Eugene, OR: Behavioral Research and Teaching, University of Oregon,

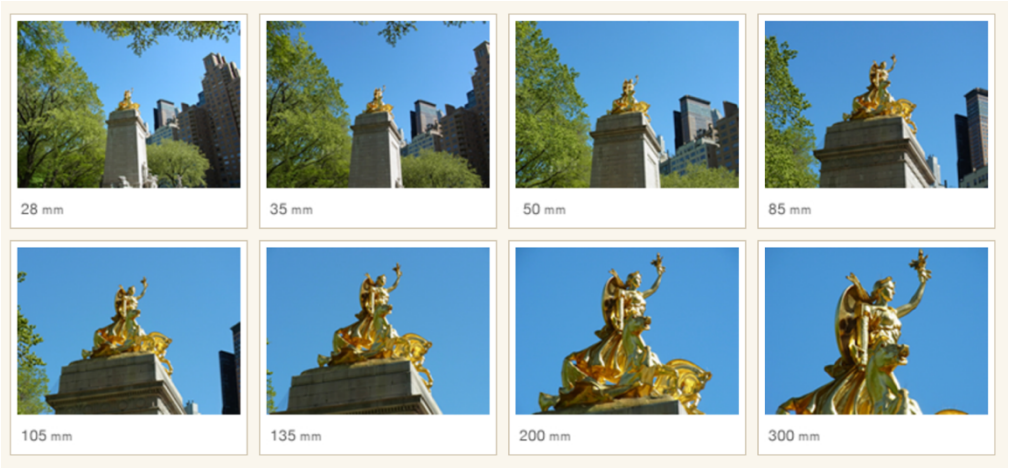
Abstract

This technical report describes the entire development process for all mathematics items and tests used in CBMSkills. A brief introduction highlights the purpose of the assessment system, noting their important relationship with easyCBM. Given the items are designed to provide teachers diagnostic information on students' specific skills within uniform domains (alternate items targeting the same skill), along with feedback to students on their correctness in item responses (and when incorrect, providing the answer that is correct as well as overall performance), these assessments are best used formatively that is integrated with instruction. Information is subsequently presented for each grade level describing the common core standards that serve as the blueprint for item development. Then the item development process is presented using various algorithms in Excel to create equivalent alternate items. After item development, a formal alignment of the CBMSkills with easyCBM is described in which the modules are formally reviewed for their potential in helping students be successful on easyCBM items with (a) adjustments made in coordinating the modules, and (b) another judge confirming/disconfirming the first alignment judgments. In the end, tables are presented on the number of easyCBM items that are sufficiently aligned so they can be used in a computer adaptive test (CAT) to place students in the CBMSkills modules for practice and feedback. The technical manual ends with an extensive set of tables placed in an appendix that present the reliability of alignment for each modules in each grade, providing teachers confidence in using CBMSkills as assessment-intervention platform for improving students' performance on easyCBM.

Orientation to Alignment of easyCBM with CBMSkills

This document presents the rationale for and development of CBMSkills as a complement to easyCBM. The primary reason for developing CBMSkills is to both preserve the integrity of easyCBM as a technically adequate measure of achievement but also provide teachers a way to directly intervene with a smart assessment system that directly targets skill development. This document focuses primarily on mathematics measures with a slightly different document provided for reading. First, we focus on the purpose of both assessment systems and then address the technical aspects for development and initial validation of CBMSkills. With outcomes, eventually, we anticipate another edition to this technical manual. Note that easyCBM has scores of technical reports that document its technical adequacy (https://brtprojects.org).

easyCBM (http://easyCBM.org) – A general outcome measurement (GOM) system for (a) determining students at risk of learning problems (using benchmark measures) and (b) following up with students to determine if instructional interventions are successful (using progress monitoring measures). The system is for use by teachers in Grades K through 5 and addresses both reading and math. The reason for referring easyCBM to as a GOM system is that items are sampled from an entire year of a grade level so that any one measure represents both preview and review of skills being taught. This feature allows successive measures to be comparable to each other, scaled with item response theory (IRT), and used to document progress.



CBMSkills (http://cbmskills.com) – A mastering monitoring (MM) system for (a) determining if students are proficient in a specific skill domain represented in a grade level and (b) intervening with practice. The system is for use by teachers in Grades K through 5 and addresses both reading and math. In CBMSkills, mastery is defined as percent proficient which is Bronze (70%-79% of the items correct), Silver (80%-89% of the items correct), or Gold (90% or more of the items correct). Comparability of items is only possible within these domains; otherwise, mastery (and time spent in achieving it) can be used over time. Generally, the different skill sets are presented in sequence by grade but, because students often vary in their mastery, movement through them is best defined individually.

Relationship Between easyCBM and CBMSkills. These two measures are integrated through different focal lengths and depth of fields: A lens set at 28mm or 35mm emphasizes the whole setting (like GOMs) and a lens of 50 to 300mm captures distant objects up close (like MMs). Let's ignore shutter speed for now.

Names and Abbreviated Description of Skills/Modules from CCSS

A total of 12 modules are available in Grades K through 5. All modules are based on variations of Common Core and State Standards that emphasize grade level mathematical skills sans any multiplicity of responses or reflections/judgments to depict the reasoning process. Rather, the problems are skill based with an emphasis on correct and incorrect answers.

- Both *production* and *selection* responses are used in the modules, with the predominant mode being production. When selection responses are used, three options are available.
- The modules contain varying numbers of problems with some more limited because of the construct being assessed (e.g., shapes or adding/subtracting numbers 1 through 5).
- All problems within modules are based on random samples of numbers and operations without replacement (except with limited domains), allowing items to be comparable in the long run. In generating problems, no duplicate problems are present within the module.
- Items were generated with Excel spreadsheets, using various RANDBETWEEN, INDEX arrays, and CONCATENATE statements with parsing and rounding functions.
- A 'read aloud' option is possible in any of the following languages: English, Spanish, Chinese Mandarin, French, Korean, German, Arabic, Russian, Japanese, and Italian.

Grade	**N Items**
Kindergarten	4,964
Grade 1	2,789
Grade 2	1,327
Grade 3	1,087
Grade 4	2,037
Grade 5	1,173
Total	**13,377**

Technical Manual Overview

The remainder of this technical report provides explication and justification for allowing (a) teachers to group students into modules in a more efficient manner and (b) students to independently practice only those skills (modules) in which they are not proficient. Two important notes accompany this purpose. The *first* is that the skill practice includes immediate feedback so that students can better understand not only which items are incorrect but also see the correct option. Because each skill module contains hundreds of items, each set is replenished with alternate items, so that improvement is not stipulated to only a limited range of skills within that module. The *second* important note is that these skills are aligned with easyCBM, which is designed as an important outcome measure. Because the assessment in CBMSkills is intertwined with feedback and potentially targeted instruction, the outcomes cannot be used as a fair reflection of generalized improvement. Furthermore, the skills are constrained to homogeneous items, so that generalization of skills to grade level achievement is limited. However, with easyCBM, containing items that represent a year's worth of skills (providing preview and review), AND with an item sampling plan that provides alternate forms scaled to be equivalent, it can be used as an effective (technically adequate) outcome measure.

In summary, the combination of CBMSkills and easyCBM provides an excellent educational intervention and assessment environment for (a) focusing on specific skills for teaching and learning (an independent variable) and (b) documenting the outcomes from these interventions (a dependent variable). To optimize effective use of these two software platforms, we have coordinated them into a computer adaptive test (CAT) using easyCBM) to target appropriately relevant and related CBMSkills and then provide teachers and students the probability of successful performance on these skills. The CAT is used because it is efficient, presenting students successive items based on the correctness of their responses. All items are scaled from less to more difficult, so that when a student responds correctly to an item, a more difficult item is presented. In contrast, when an incorrect response is made, then an easier item is administered. In the end, the student is placed in what Zygotsky termed 'the zone of proximal development', which is where the student is within reach of their nascent skill level.

Given these important points about the relation of CBMSkills and easyCBM, both in focus on skills and use of a CAT, this manual is organized into a sequence of topics that empirically validate their complementary use. In the remainder of this manual and each grade level chapter, we present two major topics: (a) development of the grade level CBMSkills problems to reflect achievement standards reflecting those adopted by states, and (b) assurance that the CBMSkills modules are reliably aligned with easyCBM items.

Standard Review and Problem Development

We present three major topics in this technical manual for each grade level, in reverse order from what modules are available on the website to how they were developed and aligned: (a) module depictions on the website reflect standards identified with labels, (b) the standards that are highlighted along with their abbreviations, (c) a description of how the initial informal alignment lead to problem development, and (d) a formal alignment used with qualifications and eventually to outcomes with acceptable reliability.

Modules from Website with Labels. The Technical Document for CBMSkills is organized into grade level chapters that begin with a screen shot of all the modules in that grade. The modules have a graphic displaying the skills, a title of the skill, and a very brief phrase depicting that skill. When selected, these modules provide teachers alternate items grouped into sets of 10, after which performance is reported in terms of achievement medals that range from Bronze (70% to 79%) to Silver (80% to 89%), and eventually to Gold (90%+). Note: Students have the option to add an item if they are within 1 of reaching the standard. Behind this system is a rostering-grouping function, in which teachers can organize sets of modules to be assigned to various groups of students, with displays summarizing performance by modules and/or students.

Standards and Abbreviations. The first table, depicting the item label, alignment descriptor, and standard, presents 12 sets of items within the grade level. These labels and descriptors allow teachers to see a more complete depiction of the standards being addressed within the module. An important caveat, however, is that the standard is used as a general frame of reference, not a specific blueprint or item specification. Though the standard is broad and ill-defined, it provides an orientation to the types of skills represented in the domain. All standards are from a review of the common core state standards, selected for their operability. That is, only standards that focus on mathematical operations, rather than conceptual justifications, are selected. Within these standards, priority is given to those that could lead to using production

responses. This latter feature is important so that student responses can be analyzed diagnostically, with an emphasis on error pattern analysis.

Alignment Process Leading Problem Development. Once these standards and descriptors were selected/developed, problem development proceeded by defining the item specifications to ensure: (a) equivalent alternate items of the same construct, and (b) a clean and well-structured presentation. Problem development presented each standard and descriptor in an Excel tab to guide two important elements: The stem (prompt) including various arrays of information to be embedded in the prompt and a correct answer. As noted earlier, we focused on developing problems using production responses for students, rather than selection responses, for use in diagnosing errors (or student misrules in solving a problem). For each grade, 12 tabs were used to provide hundreds of items with correct response options within each skill area. In each grade level, the algorithms have been described for creating these problems and prompts. This feature ensured the equivalence of items within the skill area, which allowed the alignment to proceed by comparing specific items from easyCBM with the module label and descriptor rather than individual CBMSkills items.

Alignment and Outcomes

The alignment process began with some qualifications needing to be considered in the modules and then proceeded to an initial judge making the decision of the importance of the skill modules being beneficial to completion of the easyCBM item. Then a second judgement was made with some items needing to be adjusted (added or deleted). Finally, an adjudication was made and a final count provided of the number of items aligned with each module. In this process, however, it was possible to establish the reliability of the two judges' decisions, which was completed within each module.

Alignment Process. In making alignment decisions, it was also clear that modules themselves were related and/or needed *qualifications* to facilitate the decision. For each module, a series of these qualifications was then developed and presented in a second tab for each grade level spreadsheet. These qualifications have been presented in a table immediately following the description of item development, though they were only explicated as the first step of the alignment process and were not developed as part of prompt development. We have then summarized the pool of easyCBM items that were (eventually) analyzed for alignment. easyCBM items were organized into five domains: (a) Measurement & Data, (b) Number & Operations – Base Ten, (c) Number & Operations - Fractions, (d) Operations & Algebraic Thinking, and (e) Geometry. Some grades, particularly the early ones (K-2), only sampled four of these domains. The total count of easyCBM items has been presented within each domain.

In the initial alignment process, a spreadsheet was developed with all items from easyCBM (item IDs in first column) and then successive CBMSkills module names and descriptors in remaining columns. All easyCBM item IDs were associated with an image that presented the prompt and all graphics. The alignment process proceeded by viewing this image and then locating CBMSkills modules that appeared related by answering the following two questions: *To answer this easyCBM item correctly, is the CBMSkill module needed? Does this skill facilitate performance on easyCBM?* If the answer was 'yes', a '1' was placed in the intersection of that

easyCBM item and CBMSkills module. If the answer was 'no' (the module did not align with the item), then the cell was left 'blank'.

Final Alignment. Once this initial step on alignment was completed, a **second** judge was trained in this process to (a) review the first judge's alignment decision and either agree or disagree by revisiting the essential questions (*to answer this easyCBM item correctly, is the CBMSkill module needed? Does this skill facilitate performance on easyCBM?*). Specifically, the second judge was directed to not change anything and keep the cell 'as is' (either blank or with a '1') to indicate agreement about Judge 1 alignment decision, add a D (= Delete) to replace the '1' in the cell and color the cell blue to indicate disagreement, and add an A (=Add) and color the cell green with a 'blank' to indicate they are aligned, even though Judge 1 indicated they were not aligned. This spreadsheet from Judge 2 was then analyzed by Judge 1 and a decision made to accept or reject these As and Ds. The result was a Q-Matrix reflecting only 1s and blanks, reflecting the number of easyCBM items aligned with CBMSkills modules. We have also noted that some easyCBM items involved no calculation or math operation, but rather required the student to name a shape or unit of measurement. These items were not aligned but left blank and a note listed what classification decision was being asked.

Reliability. To ensure these results alignment results were technically adequate, we took one final step, comparing the two judges decisions (prior to adjudication), and calculated a reliability index using Cohen's Kappa, which is presented in an appendix for each grade level chapter.

Judge 1 \ Judge 2	1	Blank	D	A	RowTot	
1	a	b	c	d	r1	Pobs
Blank	e	f	g	h	r2	(a+f) / N
Column Totals	c1	c2	c3	c4	N	Observed Agreement (Po)

Pexp	K
((r1 * c1) + (r2 * c2)) / N^2	(Pobs - Pexp) / 1 - Pe
Expected Agreement (Pe)	Cohen's Kappa (K)

Original

	Add/Subtract 1.3
D's	20
A's	27
Blank	293
1's	213
Total	553
Cohen's Kappa	0.84

Converted

Add/Subtract 1.3	**1**	**Blank**	**D**	**A**	**Total**
1 (Judge 1)	213	0	0	0	233
blank (Judge 1)	0	293	20	27	320
	213	293	20	27	553

In summary, the results of this alignment process are summarized below, as well as again in each grade level chapter.

Number of and Results from Items Aligned with Four Judgments: easyCBM and CBMSkills

Alignment	Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
1	514	665	1159	1186	1200	1318
0	2008	3757	4838	5417	3661	4804
D	3	17	0	24	25	14
A	7	25	3	14	9	8
Total	2532	4464	6000	6636	4896	6144

Decision Outcomes on Alignment: easyCBM and CBMSkills

Grade	Green A Accept	Green A Reject	Blue D Accept	Blue D Reject	Total
K	7	0	3	0	10
1	25	0	4	13	42
2	3	0	0	0	3
3	13	1	17	7	38
4	7	2	25	0	34
5	7	1	11	3	22

Final Number of and Results from Items Aligned with Two Judgments: easyCBM and CBMSkills

Alignment	Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
1	521	704	1162	1206	1207	1328
0	2011	3760	4838	5430	3689	4816
Total	2532	4464	6000	6636	4896	6144

Summary of Results

With over 13,000 items in CBMSkills modules and over 6,000 easyCBM items, sufficient alignment was documented to support the use of easyCBM as a computer adaptive test for placement of students into skill modules for practice and feedback. Furthermore, this alignment was reliable with virtually all the inter-judge coefficients well over .95 and many (most) 1.0. This means that teachers can be assured that the items in the skill modules were consistently judged as needed or useful in correctly answering the easyCBM item. Therefore, the two software programs can effectively complement each other so that teachers can target specific skills in their instruction until students master them (with CBMSkills serving as a highly relevant independent variable) and then turn to easyCBM to determine the effects of their efforts (with easyCBM serving as the dependent variable).

In the remainder of this technical manual, we first present grade level tables that document the easyCBM items suitably aligned within each module. Then we present, for each grade level, the screen shots and labels for all CBMSkill modules, their association with the common core standards, their item specifications, and finally, the alignment of the modules with easyCBM items along with reliability information for each module.

GRADE K: Number of easyCBM Items aligned with CBMSkills Modules

Compare similarities and differences with two- and three-dimensional shapes	Name shapes irrespective of orientations or size	Describe relative positions of above, below, in front of (left), behind (right)	Compare two groups of objects to identify "more of" or "less of" "least and most")	Compare two numbers between 1 and 10 as < = >	Count forward (backward) from a given number (other than 1) within a sequence
Shapes1.K	Shapes2.K	Position 1.K	Numbers2.K	Numbers2.K	Numbers3.K
26	17	13	6	8	41

Count objects by pairing them with one and only one number name	Count ones/tens with numbers from 10 to 100	Count to 100 by ones and by tens	For numbers 1 to 9, find the number that makes 10 when added to that number	Subtract within 20 (10 in each group).	Add within 10 (in each group) to sum 20
Numbers4.K	Numbers5.K	Numbers6.K	Numbers7.K	Add/Subtract1.K	Add/Subtract2.K
82	77	138	23	26	64

GRADE 1: Number of easyCBM Items aligned with CBMSkills Modules

Add objects from two groups (within 20) to compute the total	Count to 120, starting with 2 and above	Compare two (lines) to determine the difference (in inches and feet)	Compare two-digit numbers with tens and ones as > = <	Represent two-digit numbers as tens and ones	Compose or decompose numbers 10 to 90 to reflect the number of 10s
Count 1.1	Count 2.1	Numbers 1.1	Numbers 2.1	Numbers 3.1	Numbers 4.1
75	158	16	53	30	25

Add/Subtract within 20s	Add 1-digit and 2-digit numbers within 100	Solve unknown addend addition problems (with digits)	Solve unknown subtrahend subtraction problems (with digits)	Determine if equations involving addition and subtraction are true or false	Tell time to the nearest 15-minutes
Add/Subtract1.1	Add/Subtract2.1	Add/Subtract3.1	Add/Subtract4.1	Add/Subtract5.1	Time 1.1
150	67	58	39	23	10

GRADE 2: Number of easyCBM Items aligned with CBMSkills Modules

Skip-**count** within 1000 by 2s, 3s, 4s, 5s, 10s, and 100s.	Compare two- and three-digit numbers as >, =, <	Represent **whole-number** sums and differences within 100 on a **number line**	Classify two numbers (up to 20) as odd or even	Identify hundreds, tens, and ones within three-digit numbers	Interpret numbers to 1000 using base-ten numerals and number names
Count 1.2	Numbers 1.2	Numbers 2.2	Numbers 3.2	Numbers 4.2	Numbers 5.2
104	83	14	7	149	157

Decompose 100s as the number of 10s and 100s	Add or subtract **within 100s** using place value	Add or subtract **within 20**s	Partition shapes into fractions of 2, 3, 4	Tell the **time** to the nearest five minutes	Solve money problems with dollar bills and coins
Numbers 6.2	Add/Subtract 1.2	Add/Subtract 2.2	Fractions 1.2	Time 1.2	Money 1.2
111	278	165	31	35	28

GRADE 3: Number of easyCBM Items aligned with CBMSkills Modules

Represent fractions on a number line	Round whole numbers to the nearest 10 or 100	Add and subtract within 1000 based on place value	Solve unknown-factor problems with multiplication and division	Use multiplication and division within 100 to solve problems	Solve problems for total number of objects in groups (sets)
Numbers 1.3	Numbers 2.3	Add/Subtract 1.3	Multiply_Divide 1.3	Multiply_Divide 2.3	Multiply_Divide 3.3
67	24	227	27	270	188

Recognize and generate simple equivalent fractions	Solve fraction problems (1/b) to make a unit and solve for "a" (a/b)	Tell time to the nearest minute	Solve word problems using the four operations	Solve 1- and 2-step “how many more” and "how many less" problems (<=>)	Solve area problems using addition and/or multiplication
Fractions 1.3	Fractions 2.3	Time 1.3	WordProblems 1.3	Graph 1.3	Area 1.3
51	154	4	117	57	20

GRADE 4: Number of easyCBM Items aligned with CBMSkills Modules

Add and subtract mixed numbers with like denominators	Add and subtract multi-digit whole numbers	Multiply and divide to solve problems involving multiplicative comparisons	Solve multiplication and division equations	Compare two fractions with different numerators and denominators	Decompose fractions with the same denominator into a sum
Add_subtract 1.4	Add_subtract 2.4	Multiply_Divide 1.4	Multiply_Divide 2.4	Fractions 1.4	Fractions 2.4
86	121	135	140	111	45

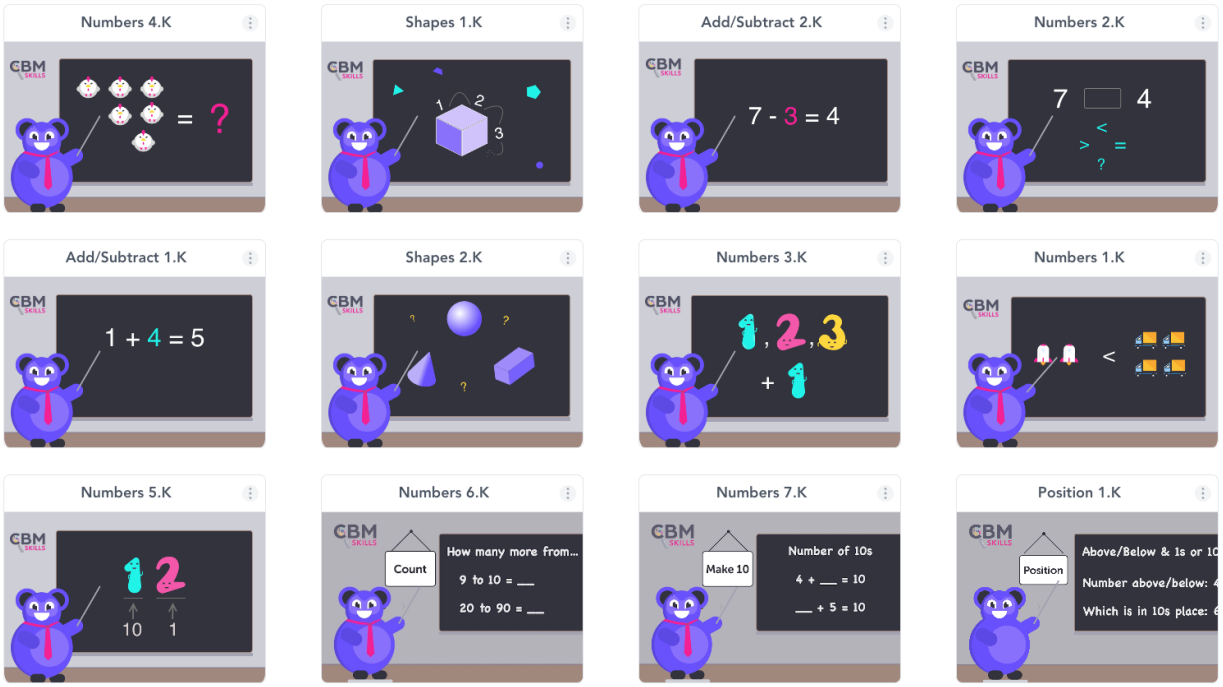
Solve problems involving multiplication of a fraction by a whole number	Express equivalence of fractions with denominators 10 and 100	Solve fraction problems (a/b) as multiples of 1/b	Reduce fractions to whole and mixed numbers	Find all factor pairs for a whole number between 1 and 100	Solve word problems of distances, intervals of time, and money
Fractions 3.4	Fractions 4.4	Fractions 5.4	Numbers 1.4	Factors 1.4	WordProblems 1.4
48	165	163	66	16	111

GRADE 5: Number of easyCBM Items aligned with CBMSkills Modules

Solve multi-digit number problems with tens and hundreds	Add and subtract fractions with like and unlike denominators	Multiply a fraction or whole number by a fraction	Solve problems with multiplication of fractions and mixed numbers	Multiply (divide) multi-digit whole numbers	Solve word problems with whole numbers and fractions
Numbers 1.5	Add_subtract 1.5	Multiply_divide 1.5	Multiply_divide 2.5	Multiply_divide 3.5	Fractions 1.5
181	138	49	44	228	124

Divide a fraction by a whole number and compute quotients	Round decimals to any place with multi-digit numbers	Interpret mixed numbers and decimals for place values	Solve simple expressions with addition and multiplication	Find the area of rectangles and volume of cubes	Express coordinate values on X and Y axes
Fractions 2.5	Decimals 1.5	Decimals 2.5	Expressions 1.5	Area_volume 1.5	Graph 1.5
46	34	25	332	108	19

Kindergarten Modules



Shapes 1.K - 2.K

- Compare similarities and differences with two- and three-dimensional shapes.
- Correctly name shapes irrespective of orientations or size.

Position 1.K

- Describe relative positions of above, below, in front of (left), behind (right).

Numbers 1.K - 7.K

- Compare two groups of objects to identify "more of" or "less of".
- Compare two numbers between 1 and 10 as < = >.
- Count forward from a given number (other than 1) within a sequence
- Count objects by pairing them with one and only one number name.
- Count ones/tens with numbers from 10 to 100.
- Count to 100 by ones and by tens.
- For numbers 1 to 9, find the number that makes 10 when added to that number.

Add/Subtract 1.K & 2.K

- Subtract within 20 (≤ 10 in each group).
- Add within 10 (in each group) to sum ≤ 20.

Grade Kindergarten CBMSkills Modules Alignment with Standards

Student View	Teacher View	Common Core Standard Description
Shapes 1.K	*Compare similarities and differences with two- and three-dimensional shapes.*	1. Analyze and compare two- and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts (e.g., number of sides and vertices/"corners") and other attributes (e.g., having sides of equal length).
Shapes 2.K	*Correctly name shapes irrespective of orientations or size.*	2. Correctly name shapes regardless of their orientations or overall size.
Position 1.K	*Describe relative positions of above, below, in front of (left), behind (right).*	Describe objects in the environment using names of shapes and describe the relative positions of these objects using terms such as *above*, *below*, *beside*, *in front of*, *behind*, and *next to*.
Numbers 1.K	*Compare two groups of objects to identify "more of" or "less of".*	3.1 Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute and describe the difference. For example, directly compare the heights of two children and describe one child as taller/shorter.
Numbers 2.K	*Compare two numbers between 1 and 10 as < = >.*	2. Compare two numbers between 1 and 10 presented as written numerals. 6. Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.1
Numbers 3.K	*Count forward from a given number (other than 1) within a sequence*	4. Count forward beginning from a given number within the known sequence (instead of having to begin at 1).
Numbers 4.K	*Count objects by pairing them with one and only one number name.*	5. When counting objects, say the number names in the standard order, pairing each object with one and only one number name and each number name with one and only one object. 5. Count to answer "how many?" questions about as many as 20 things arranged in a line, a rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1–20, count out that many objects. 3. Classify objects into given categories; count the numbers of objects in each category and sort the categories by count

Numbers 5.K	*Count ones/tens with numbers from 10 to 100.*	9. Compose and decompose numbers from 11 to 19 into ten ones and some further ones, e.g., by using objects or drawings, and record each composition or decomposition by a drawing or equation (e.g., 18 = 10 + 8); understand that these numbers are composed of ten ones and one, two, three, four, five, six, seven, eight, or nine ones.
Numbers 6.K	*Count to 100 by ones and by tens.*	Count to 100 by ones and by tens.
Numbers 7.K	*For numbers 1 to 9, find the number that makes 10 when added to that number.*	For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation.
Add/Subtract 1.K	S*ubtract within 20 (≤ 10 in each group).*	6.7. Fluently add and subtract within 5.
Add/Subtract 2.K	*Add within 10 (in each group) to sum ≤ 20.*	6.7. Fluently add and subtract within 5.

Shapes 1.K: *Compare similarities and differences with two- and three-dimensional shapes.*

- Item Description (15 production problems with replacement): Different shapes are presented with the question: "How many sides are there?" with displays of triangle, diamond, rectangle/square, cube, cone, cylinder, trapezoid, and parallelogram.
- Algorithm: INDEX(A#:A#,RANDBETWEEN(1,8)) to randomly sample eight shapes in A cells.

Shapes 2.K: *Correctly name shapes irrespective of orientations or size.*

- Item Description (846 selection problems): Different shapes are presented. "Click on the …" cone, pentagon, cube, circle, square, rectangle, pyramid, hexagon, sphere, cylinder
- Algorithm: INDEX(A#:A#,RANDBETWEEN(1,10)) to randomly sample any of 10 different shapes from the array in A cells.

Position 1.K: *Describe relative positions of above, below, in front of (left), behind (right).*

- Item Description (87 problems): Numbers (1 to 9) are randomly generated and then placed into math problem statements: "Which number is above•below•first•last?"
- Algorithm: INDEX(A#:A#,RANDBETWEEN(1,9)) 1 to 9 and CONCATENATE("Which number is above•below the / sign? ", D#," / ", E#) CONCATENATE("Which number is first/last (to the left•right)? ", D#, E#).

Numbers 1.K*: Compare two groups of objects to identify "more of" or "less of".*

- Item Description (3,000+ selection problems with infinite loop): Objects are arranged in two groups (A and B): Voice activated questions ask: "Which group has the most/least objects: Group A or Group B?"

- Algorithm: RANDBETWEEN(1,10) to establish a random number of objects in first group, RANDBETWEEN(1,10) to establish a random number of objects in second group.

Numbers 2.K: *Compare two numbers between 1 and 10 as < = >.*

- Item Description (95 problems): Two numbers are presented in a problem sentence: # is >. = < #. Three options are presented below: smaller than…the same as…bigger than with each option voice activated.
- Algorithm: RANDBETWEEN(1,10) to establish a random first and second number, and CONCATENATE(C#," is smaller than, the same as, bigger than ",D#).

Numbers 3.K: *Count forward from a given number (other than 1) within a sequence.*

- Item Description (50 production problems): Two numbers are presented. "If you start counting at # and count # more, what number do you get?"
- Algorithm: RANDBETWEEN(1,20) to establish the first number in Column D and RANDBETWEEN(1,5) in Column E to count forward. The final problem presentation is established with CONCATENATE("If you start counting at", D#," and count", E#," more, what number do you get?").

Numbers 4.K: *Count objects by pairing them with one and only one number name.*

- Item Description (84 production problems): Count the numbers of objects in a group with the prompt "How many objects are there?" with as many as 20 objects arranged in a line of 5 within a rectangular array. The prompt is "How many objects are there?"
- Algorithm: RANDBETWEEN(1,20) to display random numbers of objects (up to 20).

Numbers 5.K*: Count ones/tens with numbers from 10 to 100.*

- Item Description (78 production problems): "For the number #, how many are in the ones/tens place?"
- Algorithm: RANDBETWEEN(11,99) to establish a random 2-digit number and INDEX(A#:A#,RANDBETWEEN(1,2)) for randomly sampling 'ones' and 'tens'.

Numbers 6.K: *Count to 100 by ones and by tens*.

- Item Description (67 production problems): Numbers 1 to 9 and 10 to 100 are randomly sampled and placed into a math problem statement of "How many more to count from two single-digit numbers or How many more tens to count from two whole two-digit numbers"
- Algorithm: INDEX(A#:A#,RANDBETWEEN(1,9)) to randomly generate numbers 1 to 9 in Column D and INDEX(A#:A#,RANDBETWEEN(1,90)) to randomly generate numbers 10 to 90 in Column E. Problem statement: IF(D#<E#,CONCATENATE("How many more (tens) to count from ",D#," to ",E#,"?"), (CONCATENATE("How many more to count from ",E#," to ",D#,"?"))).

Numbers 7.K: *For numbers 1 to 9, find the number that makes 10 when added to that number.*

- Item Description (76 problems): Two types of problems reflect simple counting (adding) single digits to 10 (with three formats of missing values in first number, second number, and answer) and solving word problems to add (sum to 10) or subtract (from 10).

- Algorithm:
  - Counting (addition) problems: INDEX(A#:A#,RANDBETWEEN(1,9)) to randomly generate numbers 1 to 9 in Column D and CONCATENATE(D#," + __ = 10") to randomly generate numbers 10 to 100.
  - Word problems: INDEX(A#:A#,RANDBETWEEN(1,9)) to randomly generate numbers 1 to 9 and INDEX(A#:A# to randomly sample pencils, pens, crackers, beans, berries, gummies, bars, clips with CONCATENATE("I have # ",C#," and will give away ",D#,". How many are left?").

***Add/Subtract 1.K**: Subtract within 20 (≤ 10 in each group).*

- Item Description (440 production problems): Images of differing numbers of objects, arranged in two groups with a minus (–) separating them. Voice activation can be used to state the number of objects in each group: "# – # equals?"
- Algorithm: IF(C#<D#,CONCATENATE(D#,"-",C#),(CONCATENATE(C#,"-",D#))) to establish the number of objects in each group.

***Add/Subtract 2.K**: Add within 10 (in each group) to sum ≤ 20.*

- Item Description (800 production problems): Images of differing numbers of objects arranged in two groups are presented with a plus (+) sign separating them. Voice activation can be used to state the number of objects in each group: "# + # equals?"
- Algorithm: RANDBETWEEN(1,10) to establish a random number of objects in first group, RANDBETWEEN(1,10) to establish a random number of objects in second group.

Grade Kindergarten Modules Alignment with easyCBM

A pool of 209 items from easyCBM were aligned with 521 items in CBMSkills. In easyCBM, the items were organized into four domains: (a) Number & Operations in Base Ten (n = 23 items), and (b) Operations & Algebraic Thinking (n = 52 items), Geometry (n = 41 items), and Counting and Cardinality (n = 93 items). Note that easyCBM items could be (and often were) aligned with more than one CBMSkills module.

A total of 10 items were marked by Judge 2 as needing to be A(dded) or D(eleted), resulting in four outcomes from the two judges: Reliability was calculated on all CBMSkills modules and then a final decision made to Accept A(dded) items (n=7), Reject A(dded) items (n=0), Accept D(eleted) items (n=3), and Reject D(eleted) items (n= 0). After adjudication of all agreements and disagreements, a final count was made of the total number of easyCBM items with each of the CBMSkills modules.

In Table 1, the outcome is presented for each of the CBMSkills modules: Number of easyCBM items aligned. Because some easyCBM items aligned with more than one CBMSkill module, the total count is greater than the 209 easyCBM items. In total, 521 times an easyCBM item was aligned with a CBMSkills module. No easyCBM items were not considered for alignment because they required a classification (not computation) task.

Table 1.
Number of easyCBM items aligned CBMSkills Modules

Module Name	Module Descriptor	N Items
Shapes 1.K	Analyze Shapes	26
Shapes 2.K	Identify Shapes	17
Position 1.K	Above and Below	13
Numbers 1.K	Compare Concepts	6
Numbers 2.K	Compare Numbers	8
Numbers 3.K	Count Numbers	41
Numbers 4.K	Count Objects	82
Numbers 5.K	Find Place Values	77
Numbers 6.K	How Many More	138
Numbers 7.K	Number of 10s	23
Add/Subtract 1.K	Subtract	26
Add/Subtract 2.K	Add	64

Shapes1.K	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	22	1			23
	B	4	184	1	4	188
	Column Total	26	185	1	4	

Kappa via r	0.87
z	13.7

Excel Pobs	0.98
Excel Pexp	0.79
Kappa via Excel	**0.88**

Shapes2.K	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	16	0			16
	B	1	194	0	0	195
	Column Total	17	194	0	0	

Kappa via r	0.97
z	14.4

Excel Pobs	1.00
Excel Pexp	0.86
Kappa via Excel	**0.97**

Position1.K	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	13	0			13
	B	0	198	0	0	198
	Column Total	13	198	0	0	

Kappa via r	1.00
z	14.5

Excel Pobs	1.00
Excel Pexp	0.88
Kappa via Excel	**1.00**

Numbers1.K	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	6	0			6
	B	0	205	0	0	205
	Column Total	6	205	0	0	

Kappa via r	1.00
z	14.5

Excel Pobs	1.00
Excel Pexp	0.94
Kappa via Excel	**1.00**

Numbers2.K	**Judge 1 /Judge 2**	**1**	**B**	**D**	**A**	**Row Total**
	1	8	0			8
	B	0	203	0	0	203
	Column Total	8	203	0	0	

Kappa via r	**1.00**
z	14.5

Excel Pobs	1.00
Excel Pexp	0.93
Kappa via Excel	**1.00**

Numbers3.K	**Judge 1 /Judge 2**	**1**	**B**	**D**	**A**	**Row Total**
	1	41	0			41
	B	0	170	0	0	170
	Column Total	41	170	0	0	

Kappa via r	1.00
z	14.5

Excel Pobs	1.00
Excel Pexp	0.69
Kappa via Excel	1.00

Numbers4.K	**Judge 1 /Judge 2**	**1**	**B**	**D**	**A**	**Row Total**
	1	82	0			82
	B	0	129	0	0	129
	Column Total	82	129	0	0	

Kappa via r	1.00
z	14.5

Excel Pobs	1.00
Excel Pexp	0.52
Kappa via Excel	**1.00**

Numbers5.K	**Judge 1 /Judge 2**	**1**	**B**	**D**	**A**	**Row Total**
	1	77	0			77
	B	0	134	0	0	134
	Column Total	77	134	0	0	

Kappa via r	**1.00**
z	14.5

Excel Pobs	1.00
Excel Pexp	0.54
Kappa via Excel	**1.00**

Numbers6.K	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	138	0			138
	B	0	73	0	0	73
	Column Total	138	73	0	0	

Kappa via r	1.00
z	14.5

Excel Pobs	1.00
Excel Pexp	0.55
Kappa via Excel	1.00

Numbers7.K	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	21	2			23
	B	2	186	2	2	188
	Column Total	23	188	2	2	

Kappa via r	0.86
z	13.4

Excel Pobs	0.98
Excel Pexp	0.81
Kappa via Excel	0.90

Add/Subtract1.K	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	26	0			26
	B	0	185	0	0	185
	Column Total	26	185	0	0	

Kappa via r	1.00
z	14.5

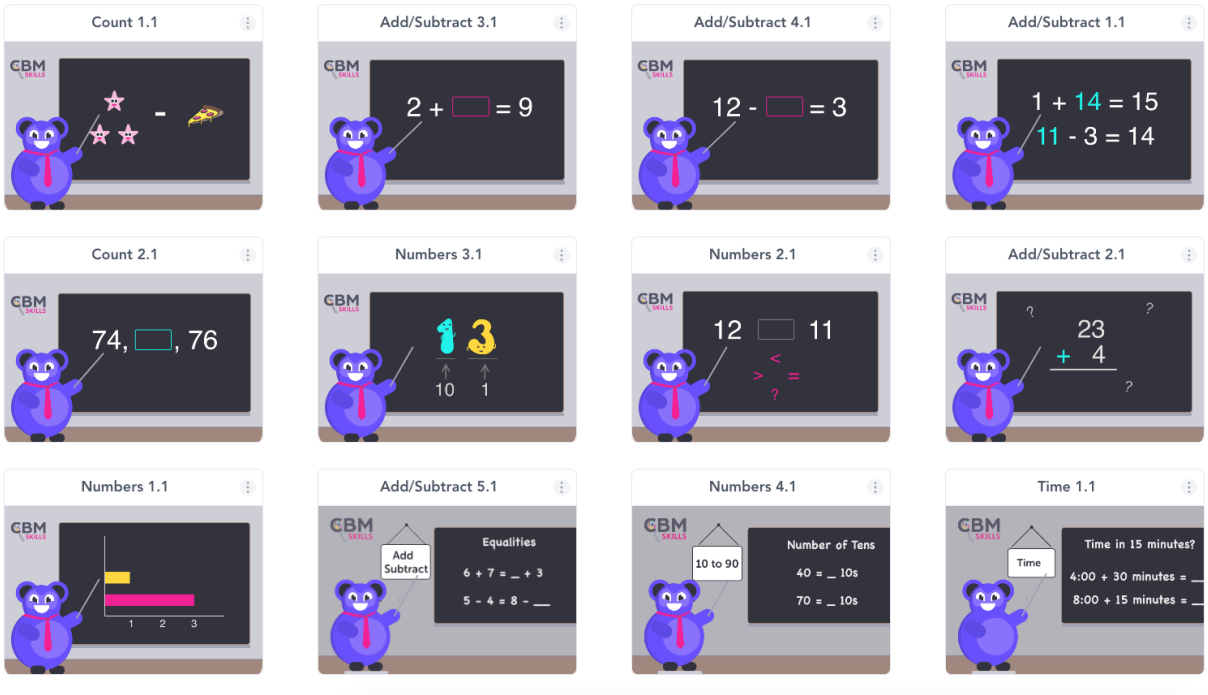
Excel Pobs	1.00
Excel Pexp	0.78
Kappa via Excel	**1.00**

Add/Subtract2.K	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	64	0			64
	B	0	147	0	0	147
	Column Total	64	147	0	0	

Kappa via r	1.00
z	14.5

Excel Pobs	1.00
Excel Pexp	0.58
Kappa via Excel	**1.00**

Grade One Modules



Count 1.1 & 2.1

- Add objects from two groups (within 20) to compute the total.
- Count to 120, starting with 2 and above.

Numbers 1.1 - 4.1

- Compare two lines to determine the difference in inches and feet.
- Compare two-digit numbers with tens and ones as > = <.
- Represent two-digit numbers as tens and ones.
- Compose or decompose numbers 10 to 90 to reflect the number of 10s.

Add/Subtract 1.1 - 5.1

- Add and subtract within 20.
- Add 1-digit and 2-digit numbers within 100.
- Solve unknown addend addition problems.
- Solve unknown subtrahend subtraction problems.
- Determine if equations involving addition and subtraction are true or false.

Time 1.1

Grade One CBMSkills Modules Alignment with Standards

Module	Abbreviated Standard	Common Core Standard Description
Count 1.1	*Add objects from two groups (within 20) to compute the total.*	Relate counting to addition and subtraction (e.g., by counting on 2 to add 2).
Count 2.1	*Count to 120, starting with 2 and above.*	Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral.
Numbers 1.1	*Compare two lines to determine the difference in inches and feet.*	Order three objects by length; compare the lengths of two objects indirectly by using a third object.
Numbers 2.1	*Compare two-digit numbers with tens and ones as > = <.*	Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, and <.
Numbers 3.1	*Represent two-digit numbers as tens and ones.*	Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases: 10 can be thought of as a bundle of ten ones — called a “ten.” The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.
Numbers 4.1	*Compose or decompose numbers 10 to 90 to reflect the number of 10s.*	The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones).
Add/Subtract 1.1	*Add or subtract within 100 to using place value.*	Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting on; making ten (e.g., 8 + 6 = 8 + 2 + 4 = 10 + 4 = 14); decomposing a number leading to a ten (e.g., 13 – 4 = 13 – 3 – 1 = 10 – 1 = 9); using the relationship between addition and subtraction (e.g., knowing that 8 + 4 = 12, one knows 12 – 8 = 4); and creating equivalent but easier or known sums (e.g., adding 6 + 7 by creating the known equivalent 6 + 6 + 1 = 12 + 1 = 13).
Add/Subtract 2.1	*Add or subtract within 20.*	Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten.
Add/Subtract 3.1	*Represent two-digit numbers as tens and ones.*	Understand subtraction as an unknown-addend problem. For example, subtract 10 – 8 by finding the number that makes 10 when added to 8.
Add/Subtract 4.1	*Solve unknown subtrahend subtraction problems.*	Understand subtraction as an unknown-addend problem. For example, subtract 10 – 8 by finding the number that makes 10 when added to 8.
Add/Subtract 5.1	*Determine if equations involving addition and subtraction are true or false*	Understand the meaning of the equal sign and determine if equations involving addition and subtraction are true or false. For example, which of the following equations are true and which are false? 6 = 6, 7 = 8 – 1, 5 + 2 = 2 + 5, 4 + 1 = 5 + 2.
Time 1.1	*Tell time to the nearest 15-minutes.*	Tell and write time in hours and half-hours using analog and digital clocks.

Grade One Module Item Development – Descriptions and Algorithms

Count 1.1: *Add objects from two groups (within 20) to compute the total.*

- Item Description (2,000+ production problems): Images of objects in two groups with the question "How many objects are in both groups (Group1 and Group 2)?"
- Algorithm: INDEX(A#:A#,RANDBETWEEN(1,19)) to generate random numbers of objects in Group 1 and again in Group 2.

Count 2.1: *Count to 120, starting with 2 and above.*

- Item Description (100 production problems): Three to six numbers displayed in a sequence (incrementing by 1) with a number missing and the question "What is the missing number?"
- Algorithm: RANDBETWEEN(1,120) to generate a random number to start counting and RANDBETWEEN(1,5) to generate a random number to count forward.

Numbers 1.1: *Compare two lines to determine the difference in inches and feet.*

- Item Description (92 production problems): Two horizontal lines of differing lengths with inches/feet scale at the bottom and the question "What is the difference in the length of these two lines?" __ inches/feet.
- Algorithm: INDEX(A#:A#,RANDBETWEEN(1,28)) to randomly generate varying lengths for Group A and Group B, and finally CONCATENATE("What is the difference in the length of these two lines?").

Numbers 2.1: *Compare two-digit numbers with tens and ones as > = <.*

- Item Description (86 production problems): Two numbers separated by a box and the symbols < = > displayed (and voice activation symbols) with the statement "Tap the correct symbol".
- Algorithm: RANDBETWEEN(1,20) to generate a random number in Column C, RANDBETWEEN(1,20) to generate a random number in Column D, @INDEX($A$3:$A$5,RANDBETWEEN(1,3)) to randomly sample <, =, > and finally CONCATENATE(C#, "< = > ",D#).

Numbers 3.1: *Represent two-digit numbers as tens and ones.*

- Item Description (79 production problems): 1- and 2-digit numbers displayed with the question "What number is the ones/tens place?"
- Algorithm: RANDBETWEEN(1,99) to generate random two-digit numbers and INDEX(a#:A#,RANDBETWEEN(1,2)) to randomly sample ones or tens.

Numbers 4.1: *Compose or decompose numbers 10 to 90 to reflect the number of 10s.*

- Item Description (100 production problems): "How many 10s are in; __ + 10 = 30, 10 is _ * 10; How many ones are 10, 10 + 10 = __ ; 10 has how many 10s, 10 + 20 = __; If I take 10 away from 10, how many 10s are left; For the number 10, what number is in the 10s place; How many 10s are there in 2-digit #."
- Algorithm: INDEX(A#:A#,RANDBETWEEN(1,9)) to generate random numbers 10 to 90 in Column D and then vary presentations with CONCATENATE("How many 10s are

there in ",D#,"?"), CONCATENATE("__ + ",D#," = ",D14), CONCATENATE(D#," is __ *10"), CONCATENATE(" How many ones are in ",D#), CONCATENATE(D#," + ",D#," = ___"), CONCATENATE(D#, " has how many 10's"), CONCATENATE(D#," + 20 = __"), CONCATENATE("If I take 10 away from ",D#," how many 10s are left?"), CONCATENATE("For the number ",D#,", what number is in the 10's place?"), and CONCATENATE("How many 10s are there in ",D#,"?").

Add and Subtract 1.1: *Add and subtract within 20.*

- Item Description (74 production problems): Two numbers displayed horizontally in an equation with a missing answer.
- Algorithm: RANDBETWEEN(1,20) to generate a random number in Column C and RANDBETWEEN(1,20) to generate a random number in Column D, then IF(C#<D#,CONCATENATE(D#,"-",C2#),(CONCATENATE(C#,"-",D#))).

Add/Subtract 2.1: *Add 1-digit and 2-digit numbers within 100.*

- Item Description (99 production problems): Numbers displayed horizontally in an equation with + sign and a missing answer.
- Algorithm: RANDBETWEEN(11,100) to generate a random number in Column C, RANDBETWEEN(11,100) to generate a random number in Column D, and CONCATENATE(C#," + ", D#," = ___").

Add/Subtract 3.1: *Solve unknown addend addition problems*.

- Item Description (43 production problems): Two numbers displayed horizontally in an equation with an answer and either the first or second number missing (for example, # + __ = # or __ + # = #) and the question “What's the missing number?”
- Algorithm: RANDBETWEEN(1,10) to generate a random number in Column C and RANDBETWEEN(1,10) to generate a random number in Column D, and then CONCATENATE(C#," + ___ =",F#) or CONCATENATE(“ ___ +”,C#,” = ",F#).

Add/Subtract 4.1: *Solve unknown subtrahend subtraction problems.*

- Item Description (42 production problems): Two numbers displayed horizontally in an equation with an answer and either the first or second number missing and the question “What's the missing number?”
- Algorithm: RANDBETWEEN(1,10) to generate a random number in Column C and RANDBETWEEN(1,10) to generate a random number in Column D, then IF(C#<D#,CONCATENATE(D#," – ",C#),(CONCATENATE(C#," – ",D#))), and finally CONCATENATE(C#," – ___ =",F#) or CONCATENATE(" ___ – “,C#,” = ",F#) or CONCATENATE(D#," – “ __ “= ",F#)).

Add/Subtract 5.1: *Determine if equations involving addition and subtraction are true or false.*

- Item Description (92 production problems): # + or – # = # is the same as # + or – __.
- Algorithm: INDEX(A#:A#,RANDBETWEEN(1,10)) to generate a random number in Columns D and F and INDEX(A#:A#,RANDBETWEEN(1,2)) to generate random operation (+ or –), then CONCATENATE(I#," + or – __") to generate an answer; add or subtract random number less than answer in I# to display second problem with

CONCATENATE(I#," + or – __"); CONCATENATE(G#," = ",H#," is the same as ",J#) to present the problem.

Time 1.1: *Tell time to the nearest 15-minutes.*
• Item Description (63 production problems): "The time is #. In 15/30/45 minutes, the time will be__?"
• Algorithm: INDEX($A$4:$A$13,RANDBETWEEN(1,10)) to generate random hour from 12 to 11, INDEX(A#:A#,RANDBETWEEN(1,3)) to generate random intervals of 15, 30, 45 minutes, and CONCATENATE("The time is ", D#,". In # minutes, the time will be __").

Grade One Modules Alignment with easyCBM

A pool of 372 items from easyCBM were aligned with modules in CBMSkills. In easyCBM, the items were organized into four domains: (a) Number & Operations in Base Ten (n=166 items), (b) Geometry (n=55 items), (c) Operations & Algebraic Thinking (n=104 items), and (e) Measurement & Data (n=47 items). Note that easyCBM items could be (and often were) aligned with more than one CBMSkills module. In the alignment process, some qualifications were made in the interpretations of the CBMSkills modules. See Table 1.

Table 1.
Qualifications for Alignment

Target	Module	Qualification 1	Qualification 2	Qualification 3
Add objects from two groups (within 20) to compute the total	Count 1.1	Included shaded and unshaded shapes	Required objects in prompt or options	Included objects organized within groups of 10s and 1s
Count to 120, starting with 2 and above	Count 2.1	Included shaded and unshaded shapes	Included missing number sequences and number lines	
Compare two (lines) to determine the difference (in inches and feet)	Numbers 1.1	Required the presence of objects only		
Compare two-digit numbers with tens and ones as > = <	Numbers 2.1	Required digits only	Included most and least	Explicit use of < = >
Represent two-digit numbers as tens and ones	Numbers 3.1			
Compose or decompose numbers 10 to 90 to reflect the number of 10s	Numbers 4.1			
Add/Subtract within 20	Add/Subtract 1.1	Numbers not needed		
Add 1-digit and 2-digit numbers within 100	Add/Subtract 2.1	Required digits	Included 2 digits in the answer	

Solve unknown addend addition problems (with digits)	Add/Subtract 3.1	Required digits	Any digits added	Not only addend
Solve unknown subtrahend subtraction problems (with digits)	Add/Subtract 4.1	Requires digits	Any digits subtracted	Not only subtrahend
Determine if equations involving addition and subtraction are true or false	Add/Subtract 5.1	Included items requiring calculation		
Tell time to the nearest 15-minutes	Time 1.1	Required clock (digital or analogue)		
Geometry				

A total of 42 items were marked by Judge 2 as needing to be A(dded) or D(eleted), resulting in four outcomes from the two judges: Reliability was calculated on all CBMSkills modules and then a final decision made to Accept A(dded) items (n=25), Reject A(dded) items (n=0), Accept D(eleted) items (n=4), and Reject D(eleted) items (n= 13). After adjudication of all agreements and disagreements, a final count was made of the total number of easyCBM items with each of the CBMSkills modules.

In Table 2, the outcome is presented for each of the CBMSkills modules: Number of easyCBM items aligned. Because some easyCBM items aligned with more than one CBMSkill module, the total count is greater than the 372 easyCBM items. In total, 704 times an easyCBM item was aligned with a CBMSkills module. Also note that 36 easyCBM items were not considered for alignment because they required a classification (not computation) task as shapes.

Table 2.
Number of easyCBM items aligned with CBMSkills Modules

Module Name	**Module Descriptor**	**N Items**
Count 1.1	Add objects from two groups (within 20) to compute the total	75
Count 2.1	Count to 120, starting with 2 and above	158
Numbers 1.1	Compare two (lines) to determine the difference (in inches and feet)	16
Numbers 2.1	Compare two-digit numbers with tens and ones as > = <	53
Numbers 3.1	Represent two-digit numbers as tens and ones	30
Numbers 4.1	Compose or decompose numbers 10 to 90 to reflect the number of 10s	25
Add/Subtract 1.1	Add/Subtract within 20s	150
Add/Subtract 2.1	Add 1-digit and 2-digit numbers within 100	67
Add/Subtract 3.1	Solve unknown addend addition problems (with digits)	58
Add/Subtract 4.1	Solve unknown subtrahend subtraction problems (with digits)	39
Add/Subtract 5.1	Determine if equations involving addition and subtraction are true or false	23
Time 1.1	Tell time to the nearest 15-minutes	10

Count 1.1	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	69	0			69
	B	6	297	0	6	303
	Column Total	75	297	0	6	

Kappa via r	0.95
z	19

Excel Pobs	0.98
Excel Pexp	0.69
Kappa via Excel	**0.95**

Count 2.1	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	153	0			153
	B	5	214	0	5	219
	Column Total	158	214	0	5	

Kappa via r	0.97
z	19.2

Excel Pobs	0.99
Excel Pexp	0.51
Kappa via Excel	**0.97**

Numbers 1.1	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	16	0			16
	B	0	356	0	0	356
	Column Total	16	356	0	0	

Kappa via r	1.00
z	19.3

Excel Pobs	1.00
Excel Pexp	0.92
Kappa via Excel	**1.00**

Numbers 2.1	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	40	15			55
	B	0	317	15	0	317
	Column Total	40	332	15	0	

Kappa via r	0.82
z	18

Excel Pobs	0.96
Excel Pexp	0.78
Kappa via Excel	**0.82**

Numbers 3.1	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	30	0			30
	B	0	342	0	0	342
	Column Total	30	342	0	0	

Kappa via r	1.00
z	19.3

Excel Pobs	1.00
Excel Pexp	0.85
Kappa via Excel	**1.00**

Numbers 4.1	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	21	0			21
	B	4	347	0	4	351
	Column Total	25	347	0	4	

Kappa via r	0.91
z	18.8

Excel Pobs	0.99
Excel Pexp	0.88
Kappa via Excel	**0.91**

Add/Subtract1.1	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	144	1			145
	B	6	221	1	6	227
	Column Total	150	222	1	6	

Kappa via r	0.96
z	19

Excel Pobs	0.98
Excel Pexp	0.52
Kappa via Excel	**0.96**

Add/Subtract2.1	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	62	1			63
	B	4	305	1	4	309
	Column Total	66	306	1	4	

Kappa via r	0.95
z	18.9

Excel Pobs	0.99
Excel Pexp	0.71
Kappa via Excel	**0.95**

Add/Subtract3.1	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	58	0			58
	B	0	314	0	0	314
	Column Total	58	314	0	0	

Kappa via r	1.00
z	19.3

Excel Pobs	1.00
Excel Pexp	0.74
Kappa via Excel	**1.00**

Add/Subtract4.1	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	39	0			39
	B	0	333	0	0	333
	Column Total	39	333	0	0	

Kappa via r	1.00
z	19.3

Excel Pobs	1.00
Excel Pexp	0.81
Kappa via Excel	**1.00**

Add/Subtract5.1	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	23	0			23
	B	0	349	0	0	349
	Column Total	23	349	0	0	

Kappa via r	1.00
z	19.3

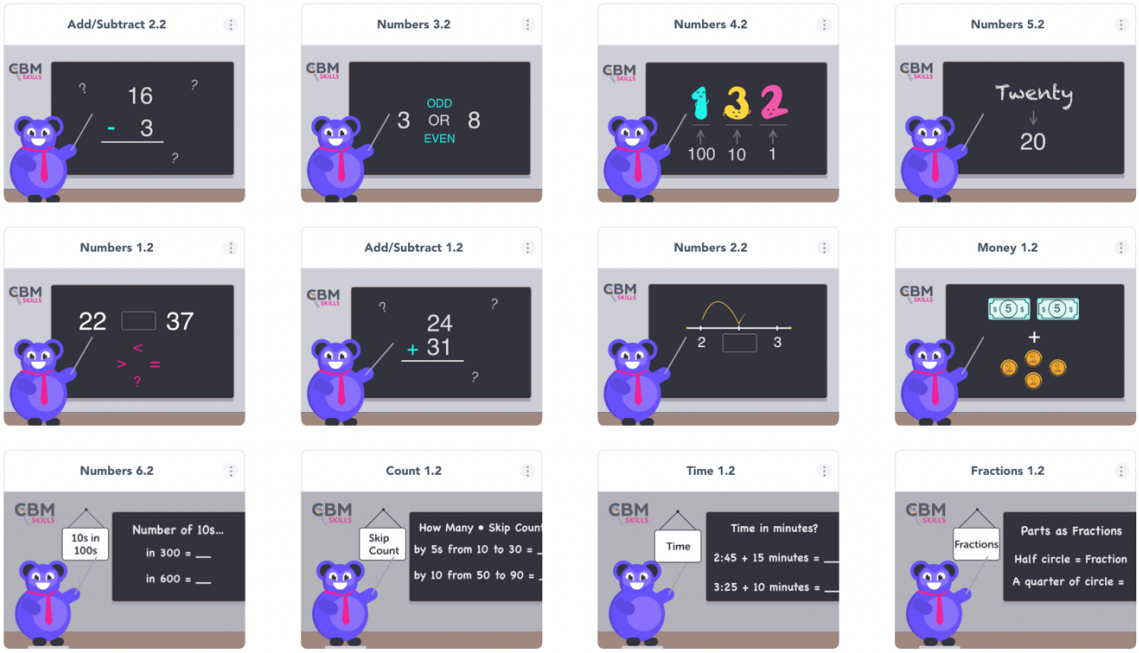
Excel Pobs	1.00
Excel Pexp	0.88
Kappa via Excel	**1.00**

Time 1.1	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	10	0			10
	B	0	362	0	0	362
	Column Total	10	362	0	0	

Kappa via r	1.00
z	19.3

Excel Pobs	1.00
Excel Pexp	0.95
Kappa via Excel	**1.00**

Grade Two Modules



Count 1.2

- Skip-count within 1000 by 2s, 3s, 4s, 5s, 10s, and 100s.

Numbers 1.2 - 6.2

- Compare two- and three-digit numbers as >, =, <.
- Represent whole-number sums and differences within 100 on a number line.
- Classify two numbers (up to 20) as odd or even.
- Identify hundreds, tens, and ones within three-digit numbers.
- Interpret numbers to 1000 using base-ten numerals and number names.
- Decompose 100s as the number of 10s and 100s.

Add/Subtract 1.2 & 2.2

- Add or subtract within 100 to using place value.
- Add or subtract within 20.

Fractions 1.2

- Partition shapes into fractions of 2, 3, 4.

Time 1.2

- Tell the time to the nearest five minutes.

Money 1.2

- Solve money problems with dollar bills and coins.

Grade Two CBMSkills Modules Alignment with Standards

Module	Abbreviated Standard	Common Core Standard Description
Count 1.2	*Skip-count within 1000 by 2s, 3s, 4s, 5s, 10s, and 100s.*	Count within 1000; skip-count by 5s, 10s, and 100s.
Numbers 1.2	*Compare two- and three-digit numbers as >, =, <.*	Compare two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using >, =, and < symbols to record the results of comparisons.
Numbers 2.2	*Represent whole-number sums and differences within 100 on a number line.*	Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, 2, ..., and represent whole-number sums and differences within 100 on a number line diagram.
Numbers 3.2	*Classify two numbers (up to 20) as odd or even.*	Determine whether a group of objects (up to 20) has an odd or even number of members, e.g., by pairing objects or counting them by 2s; write an equation to express an even number as a sum of two equal addends.
Numbers 4.2	*Identify hundreds, tens, and ones within three-digit numbers.*	Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. Understand the following as special cases:
Numbers 5.2	*Interpret numbers to 1000 using base-ten numerals and number names.*	Read and write numbers to 1000 using base-ten numerals, number names, and expanded form.
Numbers 6.2	*Decompose 100s as the number of 10s and 100s.*	The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones).
Add/Subtract 1.2	*Add or subtract within 100 to using place value.*	Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.
Add/Subtract 2.2	*Add or subtract within 20.*	Fluently add and subtract within 20 using mental strategies. By end of Grade 2, know from memory all sums of two one-digit numbers.
Fractions 1.2	*Partition shapes into fractions of 2, 3, 4.*	Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words *halves*, *thirds*, *half of*, *a third of*, etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape.
Time 1.2	*Tell time to the nearest five minutes.*	Tell and write time from analog and digital clocks to the nearest five minutes, using a.m. and p.m.
Money 1.2	*Solve money problems with dollar bills and coins.*	Solve word problems involving dollar bills, quarters, dimes, nickels, and pennies, using $ and ¢ symbols appropriately. *Example: If you have 2 dimes and 3 pennies, how many cents do you have?*

Grade Two Module Item Development – Descriptions and Algorithms

Count 1.2: *Skip-count within 1000 by 2s, 3s, 4s, 5s, 10s, and 100s*.

• Item Description (65 production problems): "If you skip-count by # from # to #, how many #s are there?"

• Algorithm: INDEX(A#:A#,RANDBETWEEN(1,9)) to generate random numbers 1 to 9 and then INDEX(A#:A#,RANDBETWEEN(1,9))*2 (for multiples of 2 and change to *5, *3, * 4, *5, *10, *100 for remaining multiples). Finally, CONCATENATE("If you skip-count by # from # to ",H#,", how many 2s are there?" and change to 3, 4, 5, 10, and 100.

Numbers 1.2: *Compare two- and three-digit numbers as >, =, <.*

• Item Description (104 production problems): Two- and three-digit numbers separated with a blank box and the symbols <, =, > presented below (with a voice symbol) and the directive to "Tap the correct symbol."

• Algorithm: RANDBETWEEN(1,100) to generate a random number in Column C and RANDBETWEEN(1,100) to generate a random number in Column D; INDEX(A#:A#,RANDBETWEEN(1,3)) to randomly sample <, =, > and Use EXACT(C#, D#) and (IF(EXACT(C# ,D#) for "Exactly equal", "Not equal").

Numbers 2.2: *Represent whole-number sums and differences within 100 on a number line.*

• Item Description (81 production problems): Four numbers are presented on a number line with one number missing (in any one of the four positions) and the question "If we start at #, what is the missing number?"

• Algorithm: RANDBETWEEN(1,100) to generate a random number in Column C and RANDBETWEEN(1,4) to generate a random number in Column D to count forward.

Numbers 3.2: *Classify two numbers (up to 20) as odd or even.*

• Item Description (158 selection problems): Two one- and two-digit numbers presented beside each other and the question above them "Which number is ODD/EVEN? (Tap the number).

• Algorithm: RANDBETWEEN(1,20) to generate a random number in Column C and RANDBETWEEN(1,20) to generate a random number in Column D; then generate an even or an odd number with EVEN(C#) or ODD(C#).

Numbers 4.2: *Identify hundreds, tens, and ones within three-digit numbers.*

• Item Description (98 production problems): Two and three-digit numbers presented with a blank to represent # hundreds + # tens + # ones with only one of these (represented by a blank box) to be completed.

• Algorithm: RANDBETWEEN(1,100) to generate a random one-, two-, or three-digit number; number; INDEX(A#:A#,RANDBETWEEN(1,3)) to generate random sample of ones, tens, and hundreds to identify.

Numbers 5.2: *Interpret numbers to 1000 using base-ten numerals and number names.*

• Item Description (96 production problems): "Write the (two- and three-digit) number spelled out (in the box below)".

• Algorithm: RANDBETWEEN(1,1000) to generate a random (two- and three-digit) number to serve as the answer key; translate the number into text.

Numbers 6.2: *Decompose 100s as the number of 10s and 100s.*

• Item Description (89 production problems): "How many 10s or 100s are there in 100 (to 1000)?

• Algorithm: INDEX(A#:A#,RANDBETWEEN(1,9)) to generate a random 100s number in Column C; INDEX(A#:A#,RANDBETWEEN(1,9)) to generate a random 10s number in Column D; sum Columns C + D; and CONCATENATE("How many 10s or 100s are there in ",E#,"?").

Add/Subtract 1.2: *Add or subtract within 100 to using place value.*

• Item Description (100 production problems): One- and two-digit addition and subtraction problems presented in a traditional vertical manner (right aligned with tens and ones).

• Algorithm: RANDBETWEEN(1,100) to generate a random number in Column C and RANDBETWEEN(1,100) to generate a random number in Column D, then INDEX(A#:A#,RANDBETWEEN(1,2)) to randomly sample the operation (addition or subtraction); finally, for subtraction problems, IF(C#<D#,CONCATENATE(D#,"-",C#),(CONCATENATE(C#,"-",D#))).

Add/Subtract 2.2: *Add or subtract within 20.*

• Item Description (143 production problems): One- and two-digit addition and subtraction problems presented in a traditional vertical manner (right aligned with tens and ones).

• Algorithm: RANDBETWEEN(1,20) to generate a random number in Column C and RANDBETWEEN(1,20) to generate a random number in Column D, then INDEX(A#:A#,RANDBETWEEN(1,2)) to randomly sample the operation (addition or subtraction); finally, for subtraction problems, IF(C#<D#,CONCATENATE(D#,"-",C#),(CONCATENATE(C#,"-",D#))).

Fractions 1.2: *Partition shapes into fractions of 2, 3, 4.*

• Item Description (50 production problems): "If a circle or square is split in half (thirds, or quarters), what fraction have you taken?"

• Algorithm: INDEX(A#:A#,RANDBETWEEN(1,3)) to randomly generate 2, 3, 4 as the denominator in Column C and INDEX(A#:A#,RANDBETWEEN(1,3)) randomly sample half, third, and quarter in Column D; finally, CONCATENATE("if a circle or square is split in ",E#,", how many pieces are there?").

Time 1.2: *Tell time to the nearest five minutes.*

• Item Description (98 production problems): "The time is #. In # minutes, the time will be__?" Note: The hour is a random sample from 1 to 12 and # minutes is random sample of 5 minutes from 5 to 55.

• Algorithm: INDEX(A#:A#,RANDBETWEEN(1,10)) to generate random hour from 12 to 11 in Column C, INDEX(A#:A#,RANDBETWEEN(1,11)) to generate random 5-minute intervals from 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, and 55 minutes in Column D; CONCATENATE(C#,," :",D#) in Column E and CONCATENATE("The time is ", E#,". In # minutes, the time will be __").

Money 1.2: *Solve money problems with dollar bills and coins.*

• Item Description (193 production problems): Two groups of varying coins and bills with the question above them asking "What is the total value of the money below?" and the unit (cents and dollars) to the right of the blank box.

• Algorithm: RANDBETWEEN(1,20) to generate a random number in Column C and RANDBETWEEN(1,20) to generate a random number in Column D; use INDEX(A#:A#,RANDBETWEEN(1,9)) to randomly sample nine types of money (pennies, nickels, dimes, quarters, half dollars, dollars, and 5-, 10-, and 20-dollar bills).

Grade Two Modules Alignment with easyCBM

A pool of 500 items from easyCBM were aligned with modules in CBMSkills. In easyCBM, the items were organized into four domains: (a) Number & Operations in Base Ten (n=196 items), (b) Geometry (n=34 items), (c) Operations & Algebraic Thinking (n=109 items), and (e) Measurement & Data (n=161 items). Note that easyCBM items could be (and often were) aligned with more than one CBMSkills module. In the alignment process, some qualifications were made in the interpretations of the CBMSkills modules. See Table 1.

Table 1.
Qualifications for Alignment

Module	Target	Qualification 1	Qualification 2	Qualification 3
Count 1.2	Skip-count within 1000 by 1s, 2s, 3s, 4s, 5s, 10s, and 100s.	Includes number line counting	Includes "What # goes here?"	Includes measuring ...
Numbers 1.2	Compare two- and three-digit numbers as >, =, <	Includes "Which is greatest/least?"	Include time units	
Numbers 2.2	Represent whole-number sums and differences within 100 on a number line	Requires number line (counting)		
Numbers 3.2	Classify two numbers (up to 20) as odd or even			
Numbers 4.2	Identify hundreds, tens, and ones within three-digit numbers	Considers number values		
Numbers 5.2	Interpret numbers to 1000 using base-ten numerals and number names	Includes "Which is greatest/least?"	Considers number values	
Numbers 6.2	Decompose 100s as the number of 10s and 100s	Considers number values		
Add/Subtract 1.2	Add or subtract within 100 using place value	Includes number line counting	Includes measuring ...	
Add/Subtract 2.2	Add or subtract within 20	Includes number line counting	Includes measuring ...	

Fractions 1.2	Partition shapes into fractions of 2, 3, 4	No requirements for fractions limits		
Time 1.2	Tell the time to the nearest five minutes	Requires clocks (analogue or digital)	No requirement for "within 5 minutes"	
Money 1.2	Solve money problems with dollar bills and coins	Requires money		

A total of 3 items were marked by Judge 2 as needing to be A(dded) or D(eleted), resulting in four outcomes from the two judges: Reliability was calculated on all CBMSkills modules and then a final decision made to Accept A(dded) items (n=3), Reject A(dded) items (n=0), Accept D(eleted) items (n=0), and Reject D(eleted) items (n= 0). After adjudication of all agreements and disagreements, a final count was made of the total number of easyCBM items with each of the CBMSkills modules.

In Table 2, the outcome is presented for each of the CBMSkills modules: Number of easyCBM items aligned. Because some easyCBM items aligned with more than one CBMSkill module, the total count is greater than the 500 easyCBM items. In total, 1,162 times an easyCBM item was aligned with a CBMSkills module. Also note that 14 easyCBM items were not considered for alignment because they required a classification (not computation) task as shapes (n= 4 items) or measures (n=10 items).

Table 2.
Number of easyCBM items aligned with CBMSkills Modules

Module Name	**Module Descriptor**	**N Items**
Count 1.2	Skip-count within 1000 by 1s, 2s, 3s, 4s, 5s, 10s, and 100s.	104
Numbers 1.2	Compare two- and three-digit numbers as >, =, <	83
Numbers 2.2	Represent whole-number sums and differences within 100 on a number line	14
Numbers 3.2	Classify two numbers (up to 20) as odd or even	7
Numbers 4.2	Identify hundreds, tens, and ones within three-digit numbers	149
Numbers 5.2	Interpret numbers to 1000 using base-ten numerals and number names	157
Numbers 6.2	Decompose 100s as the number of 10s and 100s	111
Add/Subtract 1.2	Add or subtract within 100s using place value	278
Add/Subtract 2.2	Add or subtract within 20s	165
Fractions 1.2	Partition shapes into fractions of 2, 3, 4	31
Time 1.2	Tell the time to the nearest five minutes	35
Money 1.2	Solve money problems with dollar bills and coins	28

Count 1.2	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	104	0			104
	B	0	396	0	0	396
	Column Total	104	396	0	0	

Kappa via r	1.00
z	22.4

Excel Pobs	1.00
Excel Pexp	0.67
Kappa via Excel	**1.00**

Numbers 1.2	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	81	0			81
	B	2	417	0	2	419
	Column Total	83	417	0	2	

Kappa via r	0.99
z	22.3

Excel Pobs	1.00
Excel Pexp	0.73
Kappa via Excel	**0.99**

Numbers 2.2	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	14	0			14
	B	0	486	0	0	486
	Column Total	14	486	0	0	

Kappa via r	1.00
z	23.5

Excel Pobs	1.00
Excel Pexp	0.95
Kappa via Excel	**1.00**

Numbers 3.2	**Judge 1 /Judge 2**	**1**	**B**	**D**	**A**	Row Total
	1	7	0			7
	B	0	493	0	0	493
	Column Total	7	493	0	0	

Kappa via r	**1.00**
z	22.4

Excel Pobs	1.00
Excel Pexp	0.97
Kappa via Excel	**1.00**

Numbers 4.2	**Judge 1 /Judge 2**	**1**	**B**	**D**	**A**	**Row Total**
	1	149	0			149
	B	0	351	0	0	351
	Column Total	149	351	0	0	

Kappa via r	**1.00**
z	22.4

Excel Pobs	1.00
Excel Pexp	0.58
Kappa via Excel	**1.00**

Numbers 5.2	**Judge 1 /Judge 2**	**1**	**B**	**D**	**A**	**Row Total**
	1	157	0			157
	B	0	343	0	0	343
	Column Total	157	343	0	0	

Kappa via r	**1.00**
z	22.4

Excel Pobs	1.00
Excel Pexp	0.57
Kappa via Excel	**1.00**

Numbers 6.2	**Judge 1 /Judge 2**	**1**	**B**	**D**	**A**	**Row Total**
	1	111	0			111
	B	0	389	0	0	389
	Column Total	111	389	0	0	

Kappa via r	**1.00**
z	22.4

Excel Pobs	1.00
Excel Pexp	0.65
Kappa via Excel	**1.00**

Add/Subtract 1.2	**Judge 1 /Judge 2**	**1**	**B**	**D**	**A**	**Row Total**
	1	277	0			277
	B	1	222	0	1	223
	Column Total	278	222	0	1	

Kappa via r	**0.99**
z	22.2

Excel Pobs	0.998
Excel Pexp	0.506048
Kappa via Excel	**1.00**

Add/Subtract 2.2	**Judge 1 /Judge 2**	**1**	**B**	**D**	**A**	**Row Total**
	1	165	0			165
	B	0	335	0	0	335
	Column Total	165	335	0	0	

Kappa via r	**1.00**
z	22.4

Excel Pobs	1
Excel Pexp	0.5578
Kappa via Excel	**1.00**

Fractions 1.2	**Judge 1 /Judge 2**	**1**	**B**	**D**	**A**	**Row Total**
	1	31	0			31
	B	0	469	0	0	469
	Column Total	31	469	0	0	
		Kappa via r	**1.00**		Excel Pobs	1.00
		z	22.4		Excel Pexp	0.88
					Kappa via Excel	**1.00**

Time 1.2	**Judge 1 /Judge 2**	**1**	**B**	**D**	**A**	**Row Total**
	1	35	0			35
	B	0	465	0	0	465
	Column Total	35	465	0	0	
		Kappa via r	**1.00**		Excel Pobs	1.00
		z	23.5		Excel Pexp	0.87
					Kappa via Excel	**1.00**

Money 1.2	**Judge 1 /Judge 2**	**1**	**B**	**D**	**A**	**Row Total**
	1	28	0			28
	B	0	472	0	0	472
	Column Total	28	472	0	0	

Kappa via r	**1.00**
z	22.4

Excel Pobs	1.00
Excel Pexp	0.89
Kappa via Excel	**1.00**

Grade Three Modules

Grade Three Module Descriptors

Numbers 1.3 & 2.3

- Represent fractions on a number line.
- Round whole numbers to the nearest 10 or 100.

Add/Subtract 1.3

- Add and subtract within 1000 based on place value.

Multiply Divide 1.3 - 3.3

- Solve unknown-factor problems with multiplication and division.
- Use multiplication and division within 100 to solve problems.
- Solve problems for total number of objects in groups (sets).

Fractions 1.3 & 2.3

- Recognize and generate simple equivalent fractions.
- Solve fraction problems (1/b) to make a unit and solve for "a" (a/b).

Time 1.3

- Tell time to the nearest minute

Word Problems 1.3

- Solve word problems using the four operations.

Graph 1.3

- Solve 1- and 2-step “how many more” and "how many less" problems.

Area 1.3

- Solve area problems using addition and/or multiplication.

Grade Three CBMSkills Modules Alignment with Standards

Module	Abbreviated Standard	Common Core Standard Description
Numbers 1.3	*Represent fractions on a number line.*	2. Understand a fraction as a number on the number line; represent fractions on a number line diagram.
Numbers 2.3	*Round whole numbers to the nearest 10 or 100.*	1. Use place value understanding to round whole numbers to the nearest 10 or 100.
Add/Subtract 1.3	*Add and subtract within 1000 based on place value*	Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.
Multiply/Divide 1.3	*Solve unknown-factor problems with multiplication and division*.	Understand division as an unknown-factor problem. For example, find 32 ÷ 8 by finding the number that makes 32 when multiplied by 8.
Multiply/Divide 2.3	*Use multiplication and division within 100 to solve problems*.	Use multiplication and division within 100 to solve word problems (not) in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.
Multiply/Divide 3.3	*Solve problems for total number of objects in groups (sets).*	Interpret products of whole numbers, e.g., interpret 5 × 7 as the total number of objects in 5 groups of 7 objects each. For example, describe a context in which a total number of objects can be expressed as 5 × 7.
Fractions 1.3	*Recognize and generate simple equivalent fractions*.	Recognize and generate simple equivalent fractions, e.g., 1/2 = 2/4, 4/6 = 2/3. Explain why the fractions are equivalent, e.g., by using a visual fraction model.
Fractions 2.3	*Solve fraction problems (1/b) to make a unit and solve for 'a' (a/b).*	Understand a fraction 1/b as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size 1/b.
Time 1.3	*Tell time to the nearest minute*	Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram.
Word Problems 1.3	*Solve word problems using the four operations*.	Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.
Graph 1.3	*Solve 1- and 2-step "how many more" and "how many less" problems*.	Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. For example, draw a bar graph in which each square in the bar graph might represent 5 pets.
Area 1.3	*Solve area problems using addition and/or multiplication.*	Relate area to the operations of multiplication and addition.

Grade Three Module Item Development – Descriptions and Algorithms

Numbers 1.3: *Represent fractions on a number line.*

- Item Description (24 problems) sample: "Here is a fraction 5/6 along a number line from 1 to 6. How many more units do you need, to get to the end of the number line?" with varying fractions displayed. Note: The number line is displayed with the numerator as a colored dot and the denominator as the end value.
- Algorithm: RANDBETWEEN(1,5) to generate a random number as numerator in Column C and a plotted value RANDBETWEEN(6,10) to generate a random number as the denominator in Column D and a scale end point, CONCATENATE(C#," / ", D#) to generate a fraction in Column E, and CONCATENATE("Here is a fraction ",E#, " along a number line from 1 to ", D#,". How many more units do you need, to get to the end of the number line?").

Numbers 2.3: *Round whole numbers to the nearest 10 or 100.*

- Item Description (71 production problems): Two- and three-digit (whole) numbers as well as numbers with decimals (to hundredths and thousandths) with directive to "Round to the nearest…ten, hundred, or whole number."
- Algorithm: RANDBETWEEN(0,100) to generate a random integer in Column C and RAND() to generate a random real value in Column D and finally C#+D# to establish a two-digit decimal (10^{ths} and 100^{ths}) in Column E#, INDEX(A#:A#,RANDBETWEEN(1,2)) to randomly sample 10^{ths} and 100^{ths} and ROUND(E#,1) to establish answer.

Add/ Subtract 1.3: *Add and subtract within 1000 based on place value.*

- Item Description (202 production problems): One-, two-, and three-digit addition and subtraction problems with whole numbers (with and without carrying/borrowing) presented in a traditional vertical manner (right aligned with hundreds, tens, and ones) with missing answer. The first 110 problems are addition and remaining subtraction problems.
- Algorithm: RANDBETWEEN(0,100) to generate a random first integer in Column C, RANDBETWEEN(0,100) to generate a random second integer in Column D, CONCATENATE(C#," + ",D#," = "," ___") for addition problems and with subtraction problems, IF(C#<D#,CONCATENATE(D#,"-",C#),(CONCATENATE(C#,"-",D#))).

Multiply/Divide 1.3: *Solve unknown-factor problems with multiplication and division*.

- Item Description (37 production problems): Multiplication and division problems presented in a (horizontal) sentence with a number, operation (x or ÷), missing value, and number.• Algorithm: RANDBETWEEN(1,20) to generate a random first integer in Column C, RANDBETWEEN(1,9) to generate a random second integer in Column D, and CONCATENATE(C#," x ", D#, " = ", " ___"). C#*D# to establish multiplied value in Column F with CONCATENATE(F#, " ÷ ", C#, " = ", "___") to make a division problm.

Multiply/Divide 2.3: *Use multiplication and division within 100 to solve problems*.

- Item Description (168 production problems): Multiplication and division problems are presented in a (horizontal) sentence with two whole numbers, operation (x or ÷), and missing value. The first 90 problems are multiplication and remaining division problems.

- Algorithm: RANDBETWEEN(1,10) to generate a random first integer in Column C, RANDBETWEEN(1,10) to generate a random second integer in Column D, and CONCATENATE(C#," x ", D#, " = ", " ___"). C#*D# to establish a multiplied value in Column F with CONCATENATE(C#, " x ", "___", " = ", F#) and CONCATENATE(F#, " ÷ ", C#, " = ", "___") to establish a division problem.

Multiply/Divide 3.3: *Solve problems for total number of objects in groups (sets).*

- Item Description (100 production problems) sample: "You have 3 boxes with 7 buttons in each box. How many buttons do you have in total?" Note: The sets (e.g., boxes) and the units or objects (e.g., buttons) are randomly sampled; all number values are randomly sampled from 1 to 9.
- Algorithm: INDEX(A#:A#,RANDBETWEEN(1,14)) to randomly sample groups (sets) and objects (units) in Columns E, F, G, respectively and INDEX(a#:a#,RANDBETWEEN(1,9)) in Column D to generate random number from 1 to 9 and CONCATENATE("You have ",F#," ",E#,"s with ",G#," ",D#," in each ",E#,". How many ",D#," do you have in total?").

Fractions 1.3**:** *Recognize and generate simple equivalent fractions*.

- Item Description (24 production problems): An initial fraction is presented with = a fraction (numerator missing and denominator a multiple of the initial fraction) with the question "How can we make these fractions equal?"
- Algorithm: RANDBETWEEN(1,5) to generate a random first integer in Column C, RANDBETWEEN(6,10) to generate a random second integer in Column D, D2*2 or 3 or 4 for multiplied values in Columns E, E, G respectively and CONCATENATE(C#," / ",D#, " = ", "___", " / ",E# or F# or G# respectively).

Fractions 2.3: *Solve fraction problems (1/b) to make a unit and solve for 'a' (a/b).*

- Item Description (88 production problems): Initial fraction presented with + and incomplete fraction with missing numerator = 1.
  Note: Incomplete fraction is always with same denominator as initial fraction.
- Algorithm: RANDBETWEEN(1,19) generate a random number in the numerator in Column C, RANDBETWEEN(20,50) to generate a random number in the denominator in Column D, CONCATENATE(C#," / ",D#), D#-C# in Column H, CONCATENATE(H#," / ",D#) and CONCATENATE("What number would make this fraction 1?").

Time 1.3: *Tell time to the nearest minute*.

- Item Description (101 production problems) sample: "The time is #. In # minutes, what time will it be?" Note: The hour is a random sample from 1 to 12 and # minutes is random sample of 1-minute values from 1 to 59.
- Algorithm: INDEX(A#:A#,RANDBETWEEN(1,12)) to generate a random hour in Column J and INDEX(A#:A#,RANDBETWEEN(1,59)) to generate random minutes in Columns G and I, CONCATENATE(J#,":",I#) to generate time in Column L, CONCATENATE("The time is ",L#,". In ",G#," minutes, what time will it be?").

Word Problems 1.3: *Solve word problems using the four operations*.

- Item Description (68 production problems) sample: "Jack had 16 pens and gave away 6 of them. How many remained?" Note: Problems varied with names, objects, operations (addition/subtraction) and numbers (in transfer and total).
- Algorithm: INDEX(A#:A#,RANDBETWEEN(1,5)) to randomly generate names, objects, and verbal terms for operations. CONCATENATE(C#," had ",D#," ",E#," and ", F#," ",G#, " ",E#,". How many ",E#," did ",C#," have?").

Graphs 1.3: *Solve 1- and 2-step "how many more" and "how many less" problems*.

- Item Description (101 production problems): Stacked histograms in four groups and the question "What is the difference in count (random number between 1 and 25) between Group # and Group #?" with the group #s (1-4) randomly compared with each other.
- Algorithm: RANDBETWEEN(1,10) to generate random numbers in Groups 1 and 2 in Columns C and D, respectively, and RANDBETWEEN(10,20)) to generate random numbers in Groups 3 and 4 in Columns E and F, respectively. INDEX(A#:A#,RANDBETWEEN(1,4)) to randomly sample comparisons between two groups in Columns H and I. CONCATENATE("What is the difference in count between ",H#, " and ",I#,"?")

Area 1.3: *Solve area problems using addition and/or multiplication*.

- Item Description (101 production problems).
  Sample 1: "A rectangle is 2 inches by 2 inches. What is the area?"
  Sample 2: "If two sides of a rectangle are 4 inches, and the area is 16 square inches, how long are the other sides?"
  Note: Problems also require converting area in square feet to square inches.
- Algorithm: INDEX(A#:A#,RANDBETWEEN(1,25)) to generate random number for sides in Columns C and D, respectively, and CONCATENATE("A rectangle is ",C#," inches by ",D#," inches. What is the area?"), with D#*E# in Column F to establish the area, and CONCATENATE("If two sides of a rectangle are ",C#, " inches, and the area is ",F#," square inches, how long are the other sides?"), CONCATENATE("If two sides of a rectangle are ",D#, " inches, and the area is ",F#," square inches, how long are the other sides?"), and CONCATENATE("if a rectangle is ", F#, " square feet , what is the area in square inches?").

Grade Three Modules Alignment with easyCBM

A pool of 553 items from easyCBM were aligned with modules in CBMSkills. In easyCBM, the items were organized into five domains: (a) Number & Operations in Base Ten (n=30 items), (b) Number & Operations - Fractions (201 items) (c) Geometry (n=93 items), (d) Operations & Algebraic Thinking (n=198 items), and (e) Measurement & Data (n=31 items). Note that easyCBM items could be (and often were) aligned with more than one CBMSkills module. In the alignment process, some qualifications were made in the interpretations of the CBMSkills modules. See Table 1.

Table 1.
Qualifications for Alignment

Target	Module	Qual 1	Qual 2	Qual 3	Qual 4	Qual 5
Numbers 1.3	Represent fractions on a number line	Order fractions in size	Fractions on number line			
Numbers 2.3	Round whole numbers to the nearest 10 or 100	About…Estimate				
Add/Subtract 1.3	Add and subtract within 1000 based on place value	Gray Boxes	Angles and sides	Add and subtract fractions with objects		
Multiply_Divide 1.3	Solve unknown-factor problems with multiplication and division	Missing multihend/dividend				
Multiply_Divide 2.3	Use multiplication and division within 100 to solve problems	Includes area problems	No multihend/dividend problems			
Multiply_Divide 3.3	Solve problems for total number of objects in groups (sets)	Requires objects	Gray boxes	Angles and sides		
Fractions 1.3	Recognize and generate simple equivalent fractions (CHECK)	Add fractions	Fractions in stem and options	Which show the same?	Not when count of objects to represent fractions	
Fractions 2.3	Solve fraction problems (1/b) to make a unit and solve for "a" (a/b)	Count gray shapes=fraction	Fraction = 1	Order fractions greatest to least	Explicit presence of fractions in either prompt or options	Which is here?
Time 1.3	Tell time to the nearest minute					
WordProblems 1.3	Solve word problems using the four operations	Requires situation	Includes only objects			

Graph 1.3	Solve 1- and 2-step “how many more” and "how many less" problems (<=>)	Most and least in question or as an expression	Choose < = >			
Area 1.3	Solve area problems using addition and/or multiplication	Also in multiplication/often in addition				

A total of 38 items were marked by Judge 2 as needing to be A(dded) or D(eleted), resulting in four outcomes from the two judges: Reliability was calculated on all CBMSkills modules and then a final decision made to Accept A(dded) items (n=13), Reject A(dded) items (n=1), Accept D(eleted) items (n=17), and Reject D(eleted) items (n= 7). After adjudication of all agreements and disagreements, a final count was made of the total number of easyCBM items with each of the CBMSkills modules.

In Table 2, the outcome is presented for each of the CBMSkills modules: Number of easyCBM items aligned. Because some easyCBM items aligned with more than one CBMSkill module, the total count is greater than the 553 easyCBM items. In total, 1,206 times an easyCBM item was aligned with a CBMSkills module. Also note that 52 easyCBM items were not considered for alignment because they required a classification (not computation) task as shapes.

Table 2.
Number of easyCBM items aligned with CBMSkills Modules

Module Name	**Module Descriptor**	**N Items**
Numbers 1.3	Represent fractions on a number line	67
Numbers 2.3	Round whole numbers to the nearest 10 or 100	24
Add/Subtract 1.3	Add and subtract within 1000 based on place value	227
Multiply_Divide 1.3	Solve unknown-factor problems with multiplication and division	27
Multiply_Divide 2.3	Use multiplication and division within 100 to solve problems	270
Multiply_Divide 3.3	Solve problems for total number of objects in groups (sets)	188
Fractions 1.3	Recognize and generate simple equivalent fractions (CHECK)	51
Fractions 2.3	Solve fraction problems (1/b) to make a unit and solve for "a" (a/b)	154
Time 1.3	Tell time to the nearest minute	4
WordProblems 1.3	Solve word problems using the four operations	117
Graph 1.3	Solve 1- and 2-step “how many more” and "how many less" problems (<=>)	57
Area 1.3	Solve area problems using addition and/or multiplication	20

Numbers 1.3	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	63	0			63
	B	4	486	0	4	490
	Column Total	**67**	**486**	**0**	**4**	

Kappa via r	**0.97**
z	23.3

Excel Pobs	0.99
Excel Pexp	0.79
Kappa via Excel	**0.97**

Numbers 2.3	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	24	0			24
	B	0	529	0	0	529
	Column Total	**24**	**529**	**0**	**0**	

Kappa via r	**1.00**
z	23.5

Excel Pobs	1.00
Excel Pexp	0.92
Kappa via Excel	**1.00**

Add/Subtract 1.3	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	225	0			225
	B	0	325	3	0	325
	Column Total	**225**	**325**	**3**	**0**	

Kappa via r	**0.99**
z	23.4

Excel Pobs	0.99
Excel Pexp	0.51
Kappa via Excel	**0.99**

Multiply_Divide 1.3	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	24	1			25
	B	2	526	1	2	528
	Column Total	**26**	**527**	**1**	**2**	

Kappa via r	**0.90**
z	22.2

Excel Pobs	0.99
Excel Pexp	0.91
Kappa via Excel	**0.94**

Multiply_Divide 2.3	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	265	3			268
	B	2	283	3	2	285
	Column Total	**267**	**286**	**3**	**2**	

Kappa via r	**0.98**
z	23.1

Excel Pobs	0.99
Excel Pexp	0.50
Kappa via Excel	**0.98**

Multiply_Divide 3.3	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	183	10			193
	B	6	354	10	6	360
	Column Total	**189**	**364**	**10**	**6**	

Kappa via r	**0.91**
z	22.2

Excel Pobs	0.97
Excel Pexp	0.55
Kappa via Excel	**0.94**

Fractions 1.3	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	51	1			52
	B	0	501	1	0	501
	Column Total	**51**	**502**	**1**	**0**	

Kappa via r	**0.99**
z	23.4

Excel Pobs	1.00
Excel Pexp	0.83
Kappa via Excel	**0.99**

Fractions 2.3	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	154	0			154
	B	0	399	0	0	399
	Column Total	**154**	**399**	**0**	**0**	

Kappa via r	**1.00**
z	23.5

Excel Pobs	1.00
Excel Pexp	0.60
Kappa via Excel	**1.00**

Time 1.3	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	4	0			4
	B	0	549	0	0	549
	Column Total	**4**	**549**	**0**	**0**	

Kappa via r	**1.00**
z	23.5

Excel Pobs	1.00
Excel Pexp	0.99
Kappa via Excel	**1.00**

WordProblems 1.3	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	116	1			117
	B	0	436	1	0	436
	Column Total	**116**	**437**	**1**	**0**	

Kappa via r	**0.99**
z	23.4

Excel Pobs	1.00
Excel Pexp	0.67
Kappa via Excel	**0.99**

Graph 1.3	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	57	0			57
	B	0	496	0	0	496
	Column Total	**57**	**496**	**0**	**0**	

Kappa via r	**1.00**
z	23.5

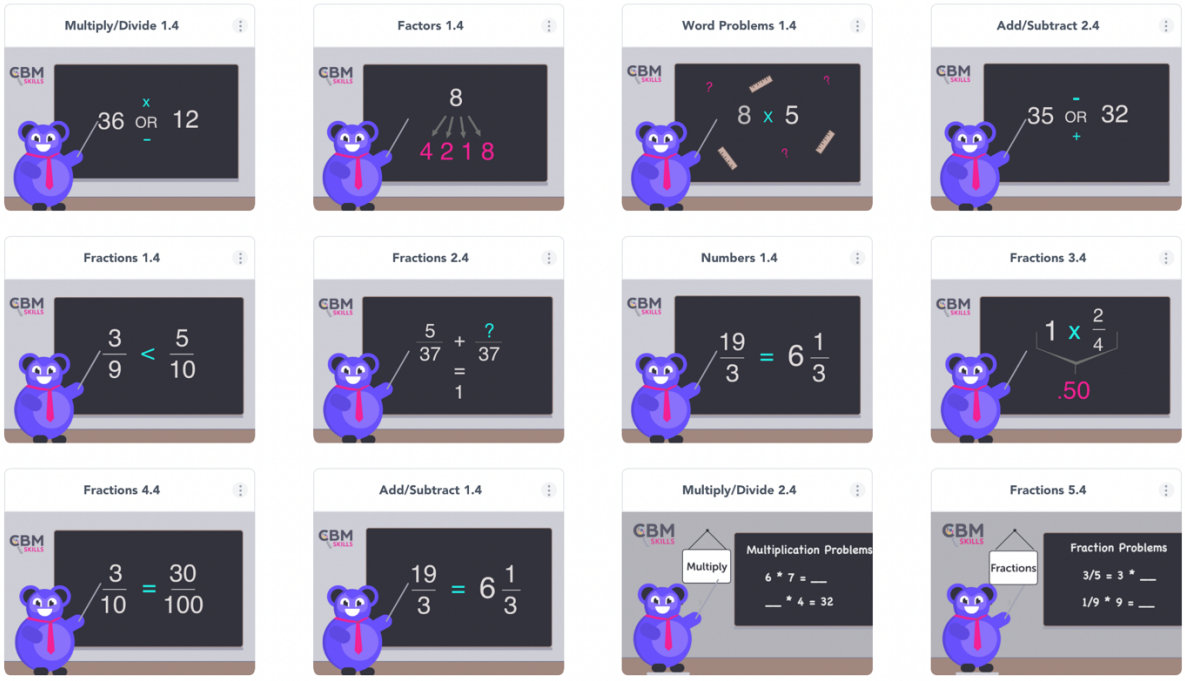
Excel Pobs	1.00
Excel Pexp	0.82
Kappa via Excel	**1.00**

Area 1.3	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	20	0			20
	B	0	533	0	0	533
	Column Total	**20**	**533**	**0**	**0**	

Kappa via r	**1.00**
z	23.9

Excel Pobs	1.00
Excel Pexp	0.93
Kappa via Excel	**1.00**

Grade Four Modules



Grade Four Module Descriptors

Add/Subtract 1.4 & 2.4

- Add and subtract mixed numbers with like denominators.
- Add and subtract multi-digit whole numbers.

Multiply/Divide 1.4 & 2.4

- Multiply and divide to solve problems involving multiplicative comparisons.
- Solve multiplication equations.

Fractions 1.4 - 5.4

- Compare two fractions with different numerators and denominators.
- Decompose fractions with the same denominator into a sum.
- Solve problems involving multiplication of a fraction by a whole number.
- Express equivalence of fractions with denominators 10 and 100.
- Solve fraction problems (a/b) as multiples of 1/b.

Numbers 1.4

- Reduce fractions to whole and mixed numbers.

Factors 1.4

- Find all factor pairs for a whole number between 1 and 100.

Word Problems 1.4

- Solve word problems of distances, intervals of time, and money.

Grade Four CBMSkills Modules Alignment with Standards

Module	Abbreviated Standard	Common Core Standard Description
Add/Subtract 1.4	*Add and subtract mixed numbers with like denominators*.	Add and subtract mixed numbers with like denominators, e.g., by replacing each mixed number with an equivalent fraction, and/or by using properties of operations and the relationship between addition and subtraction.
Add/Subtract 2.4	*Add and subtract multi-digit whole numbers.*	Fluently add and subtract multi-digit whole numbers using the standard algorithm.
Multiply/Divide 1.4	*Multiply and divide to solve problems involving multiplicative comparisons.*	Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.1
Multiply/Divide 2.4	*Solve multiplication equations*.	Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.
Fractions 1.4	*Compare two fractions with different numerators and denominators*.	Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as 1/2. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.
Fractions 2.4	*Decompose fractions with the same denominator into a sum*.	Decompose a fraction into a sum of fractions with thesame denominator in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model. Examples: 3/8 = 1/8 + 1/8 + 1/8 ; 3/8 = 1/8 + 2/8 ; 2 1/8 = 1 + 1 + 1/8 = 8/8 + 8/8 + 1/8.
Fractions 3.4	*Solve problems involving multiplication of a fraction by a whole number.*	Solve word problems involving multiplication of a fraction by a whole number, e.g., by using visual fraction models and equations to represent the problem. For example, if each person at a party will eat 3/8 of a pound of roast beef, and there will be 5 people at the party, how many pounds of roast beef will be needed? Between what two whole numbers does your answer lie?
Fractions 4.4	*Express equivalence of fractions with denominators 10 and 100.*	Express a fraction with denominator 10 as an equivalent fraction with denominator 100, and use this technique to add two fractions with respective denominators 10 and 100.4 For example, express 3/10 as 30/100, and add 3/10 + 4/100 = 34/100.
Fractions 5.4	*Solve fraction problems (a/b) as multiples of 1/b.*	Understand a fraction a/b as a multiple of 1/b. For example, use a visual fraction model to represent 5/4 as the product 5 × (1/4), recording the conclusion by the equation 5/4 = 5 × (1/4).
Numbers 1.4	*Solve multi-digit problems for count of ones, tens, and hundreds.*	Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right. For example, recognize that 700 ÷ 70 = 10 by applying concepts of place value and division. 6. Use decimal notation for fractions with denominators 10 or 100. For example, rewrite 0.62 as 62/100; describe a length as 0.62 meters; locate 0.62 on a number line diagram. Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual model.
Factors 1.4	*Find all factor pairs for a whole number between 1 and 100.*	Find all factor pairs for a whole number in the range 1–100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1–100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1–100 is prime or composite.
Word Problems 1.4	*Solve word problems of distances, intervals of time, and money.*	Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

Grade Four Module Item Development – Descriptions and Algorithms

Add & Subtract 1.4: *Add and subtract mixed numbers with like denominators*.

- Item Description (101 production problems): Two mixed fractions are added or subtracted with a missing answer (to be either a proper or mixed fraction).
- Algorithm: RANDBETWEEN(1,10) to generate random number in Column C, RANDBETWEEN(1,E#) to generate random number in Column D as the numerator, INDEX(A#:A#,RANDBETWEEN(1,9)) to generate a random numbers (1-6, 8, 10, 12, and 100) in Column E, CONCATENATE(D#,"/",E#) to generate a fraction in Column F, CONCATENATE(C#," ",F#) to generate a mixed fraction in Column G. Repeat these steps to create another mixed fraction in Column L. CONCATENATE(G#," + ",L#," = _")

Add/Subtract 2.4: *Add and subtract multi-digit whole numbers.*

- Item Description (199 production problems): One-, two-, and three-digit addition and subtraction problems with whole numbers (with and without carrying/borrowing) presented in a traditional vertical manner (right aligned hundreds, tens, and ones) & missing answer.
- Algorithm: RANDBETWEEN(1,999) to generate a random number in Column C, RANDBETWEEN(1,999) to generate a random number in Column D, CONCATENATE(C2," + ",D2," = "," ___") for addition problems and with subtraction problems, IF(C#<D#,CONCATENATE(D#,"-",C#),(CONCATENATE(C#,"-",D#))).

Multiply/Divide 1.4: *Multiply and divide to solve problems involving multiplicative comparisons.*

- Item Description (132 production problems): One- and two-digit (whole) numbers presented in a (horizontal) sentence with an initial number, operation (x or ÷), missing number = answer (whole number).
- Algorithm: RANDBETWEEN(1,99) to generate random numbers in Columns C and D, CONCATENATE(C#," x ","___", " = ",E#) for multiplication problems and CONCATENATE(E#," ÷ ", "___", " = ",D#) for division problems.

Multiply/Divide 2.4 *Solve multiplication equations*.

- Item Description (91 production problems): Two randomly sampled one- and two-digit whole numbers multiplied and randomly displayed with first number, second number, and answer (value) missing.
- Algorithm: INDEX(a4:a12,RANDBETWEEN(1,9)) to generate random numbers in Columns D and E; D3*E3 to multiply these numbers in Column F; CONCATENATE(F#," = __ * ",D#) and CONCATENATE(E#," * ",D#," = __") and CONCATENATE("__ * ",E#," = ",F#) and CONCATENATE(E#," * __ = ",F#).

Fractions 1.4: *Compare two fractions with different numerators and denominators*.

- Item Description (100 production problems): Two fractions placed side-by-side and the directive is to “Select the larger fraction” which is placed above the fractions.
- Algorithm: RANDBETWEEN (1,9) to generate a random number for numerator in Column C, RANDBETWEEN (10,20) to generate a random number for denominator in Column D, CONCATENATE(C#," / ",D#). Repeat these steps for generating another fraction in Columns E and F with CONCATENATE(E#," / ",F2).

Fractions 2.4: *Decompose fractions with the same denominator into a sum.*

- Item Description (42 production problems): An initial fraction is presented with addition operation (+) and missing fraction (no value in numerator or denominator) = 1.
  Note: "Reduce your answer to the lowest common denominator" at the top is not read.
- Algorithm: RANDBETWEEN(1,(D2-1)) to generate a random number as the numerator in Column C, INDEX(A#:A#,RANDBETWEEN(1,9)) to generate random numbers (2-6, 8, 10, 12, and 100) as the denominator in Column D and CONCATENATE(C2," / ",D2) to generate a fraction, CONCATENATE("The sum of ",C#,"/ ",D#, " + ___ = 1. Reduce your answer to the lowest common denominator.").

Fractions 3.4: *Solve problems involving multiplication of a fraction by a whole number.*

- Item Description (71 production problems): An initial whole number x a proper fraction = missing value (to be expressed as a decimal).
  Note: Solve this problem (Round answer to 2 decimal digits is not read).
- Algorithm: RANDBETWEEN (1,99) to generate a random number in Column C, RANDBETWEEN (1, 5) to generate a random number in Column D (as numerator), RANDBETWEEN (6, 10) to generate a random number in Column E (as denominator), CONCATENATE(D#," /",E#) in Column F to generate a fraction, CONCATENATE(C#," x",E#," = ___") in Column G to generate the problem.

Fractions 4.4: *Express equivalence of fractions with denominators 10 and 100.*

- Item Description (1,000+ production problems): Two proper fractions are added with denominators expressed as either 10^{ths} or 100^{ths} and answer is in 100^{ths}.
  Note: "Express this fraction with hundreds in the denominator" is not read.
- Algorithm: RANDBETWEEN(1,10) to generate random numbers in Column C and Column D, set Column D to 10 in Column E, CONCATENATE(C#," /",E#) in Column F and CONCATENATE(D#," /",E#) in Column G, and CONCATENATE(F#," + ",G#,"= __/100"," + ___/100").

Fraction 5.4: *Solve fraction problems (a/b) as multiples of 1/b.*

- Item Description (73 production problems): Random sample of proper and improper fractions multiplied by a random sample of whole numbers 1-9 with both missing answer (value) and fraction (proper and improper) equal to a whole number multiplied by a fraction with a missing denominator.
- Algorithm: RANDBETWEEN(1,9)) to generate random numbers 1 through 9 in Columns D and E; CONCATENATE(D#,"/",E#," = ",D#," * 1/__") and CONCATENATE(E#,"/",D#," * ",D#," = __").

Numbers 1.4: *Reduce fractions to whole and mixed numbers.*

- Item Description (68 production problems): An initial fraction is presented = missing values (whole numbers with and without remainders expressed as proper fractions).
- Algorithm: RANDBETWEEN (1,99) to generate a random number in Column C, RANDBETWEEN (1, 5) to generate a random number in Column D as numerator, RANDBETWEEN (6, 10) to generate a random number in Column E as denominator,

CONCATENATE(D#," /",E#) in Column F to generate a fraction. CONCATENATE(F# ," + ___ = " C#,F#).

Factors 1.4: *Find all factor pairs for a whole number between 1 and 100.*

- Item Description (64 production problems): An initial number is presented and a blank with the question 'A factor pair for # is?". Note the # is a factor pair for the initial number.
- Algorithm: Create an array of 1-9 (columns and rows), fill in multiples for each column * each row, sample all values in Column C, fix factor pairs 2, 3, 5, and 7 in row D1-G1, CONCATENATE("A factor pair for ",C#," is: ",$D or $F or $G$1, " and ___").

Word Problems 1.4: *Solve word problems of distances, intervals of time, and money.*

- Item Description (97 production problems) sample: Dalene covered 37 miles every day for 8 days. How far did Dalene travel? Note: The names, units (miles, cups, dollars, etc.), and amount (every day, 3 days, etc.) are randomly sampled to equal varying totals.
- Algorithm: INDEX(A#:A#,RANDBETWEEN(1,4)) to randomly sample behavior, units (of distance), names, or fractions of amounts. RANDBETWEEN(2,100) to generate random sample of distance, time, money in Columns C, D, and E respectively. Equate these values in Columns H, I, J, K, and L and CONCATENATE(H#," ",I#, " ",J#, " miles every day for ",L#, " days. How far did ",H#," travel?").

Grade Four easyCBM Items Alignment with CBMSkills Modules

A pool of 409 items from easyCBM were aligned with modules in CBMSkills. In easyCBM, the items were organized into five domains: (a) Measurement & Data (125 = items), (b) Number & Operations – Fractions (176 = items), (c) Number & Operations in Base Ten (29 = items), (d) Operations & Algebraic Thinking (47 = items), and (e) Geometry (32 = items). Note that easyCBM items could be (and often were) aligned with more than one CBMSkills module. In the alignment process, some qualifications were made in the interpretations of the CBMSkills modules. See Table 1.

Table 1.
Qualifications for Alignment

Target	Module	Qual 1	Qual 2	Qual 3	Qual 4	Qual 5
Add_subtract 1.4	Add and subtract mixed numbers with like denominators	Place in number line	Dollars & Cents OR mixed fractions	Becomes a mixed number		
Add_subtract 2.4	Add and subtract multi-digit whole numbers	Calculate area	Dollars only	Includes area problems		
Multiply_Divide 1.4	Multiply and divide to solve problems involving multiplicative comparisons	"Which is closest to…"	Compare (e.g., to figures) Round numbers	Place value in number line or multi-digit number	Number between	"Is about…"
Multiply_Divide 2.4	Solve multiplication equations	Find area	Also divide			
Fractions 1.4	Compare two fractions with different numerators and denominators	Number between	Is about…	Compare in answers	Includes decimals	
Fractions 2.4	Decompose fractions with the same denominator into a sum	Includes decimals	Uses = fraction and decimal			
Fractions 3.4	Solve problems involving multiplication of a fraction by a whole number	Includes decimal ($)	Requires both fraction & whole #			
Fractions 4.4	Express equivalence of fractions with denominators 10 and 100	Fraction vs. decimal	Includes decimals	Place values		
Fractions 5.4	Solve fraction problems (a/b) as multiples of 1/b					
Numbers 1.4	Reduce fractions to whole and mixed numbers	Includes # between -- and --	Add/subtract whole number	Between values		
Factors 1.4	Find all factor pairs for a whole number between 1 and 100	Includes prime and composite numbers				
WordProblems 1.4	Solve word problems of distances, intervals of time, and money	Units of objects	Includes money problems			

A total of 34 items were marked by Judge 2 as needing to be A(dded) or D(eleted), resulting in four outcomes from the two judges: Reliability was calculated on all CBMSkills modules and then a final decision made to Accept A(dded) items (n=7), Reject A(dded) items (n=2), Accept D(eleted) items (n=25), and Reject D(eleted) items (n= 0). After adjudication of all agreements and disagreements, a final count was made of the total number of easyCBM items with each of the CBMSkills modules.

In Table 2, the outcome is presented for each of the CBMSkills modules: Number of easyCBM items aligned. Because some easyCBM items aligned with more than one CBMSkill module, the total count is greater than the 409 easyCBM items. In total, 1,207 times an easyCBM item was aligned with a CBMSkills module. Also note that 28 easyCBM items were not considered for alignment because they required a classification (not computation) task as shapes (n=22), Angles (n=1) or Area (n= 5).

Table 2.
Number of easyCBM items aligned CBMSkills Modules

Module Name	Module Descriptor	N Items
Add_subtract 1.4	Add and subtract mixed numbers with like denominators	86
Add_subtract 2.4	Add and subtract multi-digit whole numbers	121
Multiply_Divide 1.4	Multiply and divide to solve problems involving multiplicative comparisons	135
Multiply_Divide 2.4	Solve multiplication and division equations	140
Fractions 1.4	Compare two fractions with different numerators and denominators	111
Fractions 2.4	Decompose fractions with the same denominator into a sum	45
Fractions 3.4	Solve problems involving multiplication of a fraction by a whole number	48
Fractions 4.4	Express equivalence of fractions with denominators 10 and 100	165
Fractions 5.4	Solve fraction problems (a/b) as multiples of 1/b	163
Numbers 1.4	Reduce fractions to whole and mixed numbers	66
Factors 1.4	Find all factor pairs for a whole number between 1 and 100	16
WordProblems 1.4	Solve word problems of distances, intervals of time, and money	111

Add_subtract 1.4	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	85	0			85
	B	3	320	0	3	323
	Column Total	88	320	0	3	

Kappa via r	0.96
z	19.6

Excel Pobs	0.99
Excel Pexp	0.67
Kappa via Excel	**0.98**

Add_subtract 2.4	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	121	3			124
	B	0	284	3	0	284
	Column Total	121	287	3	0	

Kappa via r	0.98
z	20

Excel Pobs	0.99
Excel Pexp	0.58
Kappa via Excel	**0.98**

Multiply_Divide 1.4	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	134	0			134
	B	1	273	0	1	274
	Column Total	135	273	0	1	

Kappa via r	0.99
z	20

Excel Pobs	1.00
Excel Pexp	0.56
Kappa via Excel	**0.99**

Multiply_Divide 2.4	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	140	1			141
	B	0	267	1	0	267
	Column Total	140	268	1	0	

Kappa via r	1.00
z	20.1

Excel Pobs	1.00
Excel Pexp	0.55
Kappa via Excel	**0.99**

Fractions 1.4	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	111	0			111
	B	0	297	0	0	297
	Column Total	111	297	0	0	

Kappa via r	1.00
z	20.2

Excel Pobs	1.00
Excel Pexp	0.60
Kappa via Excel	**1.00**

Fractions 2.4	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	42	0			42
	B	3	363	0	3	366
	Column Total	45	363	0	3	

Kappa via r	0.96
z	19.9

Excel Pobs	0.99
Excel Pexp	0.81
Kappa via Excel	**0.96**

Fractions 3.4	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	47	17			64
	B	1	343	17	1	344
	Column Total	48	360	17	1	

Kappa via r	0.81
z	18.5

Excel Pobs	0.96
Excel Pexp	0.76
Kappa via Excel	**0.81**

Fractions 4.4	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	164	0			164
	B	1	243	0	1	244
	Column Total	165	243	0	1	

Kappa via r	0.99
z	20

Excel Pobs	1.00
Excel Pexp	0.52
Kappa via Excel	**0.99**

Fractions 5.4	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	163	1			164
	B	0	244	1	0	244
	Column Total	163	245	1	0	

Kappa via r	1.00
z	20.1

Excel Pobs	1.00
Excel Pexp	0.52
Kappa via Excel	**0.99**

Numbers 1.4	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	66	1			67
	B	0	341	1	0	341
	Column Total	66	342	1	0	

Kappa via r	0.99
z	20.1

Excel Pobs	1.00
Excel Pexp	0.73
Kappa via Excel	**0.99**

Factors 1.4	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	16	0			16
	B	0	392	0	0	392
	Column Total	16	392	0	0	

Kappa via r	1.00
z	20.2

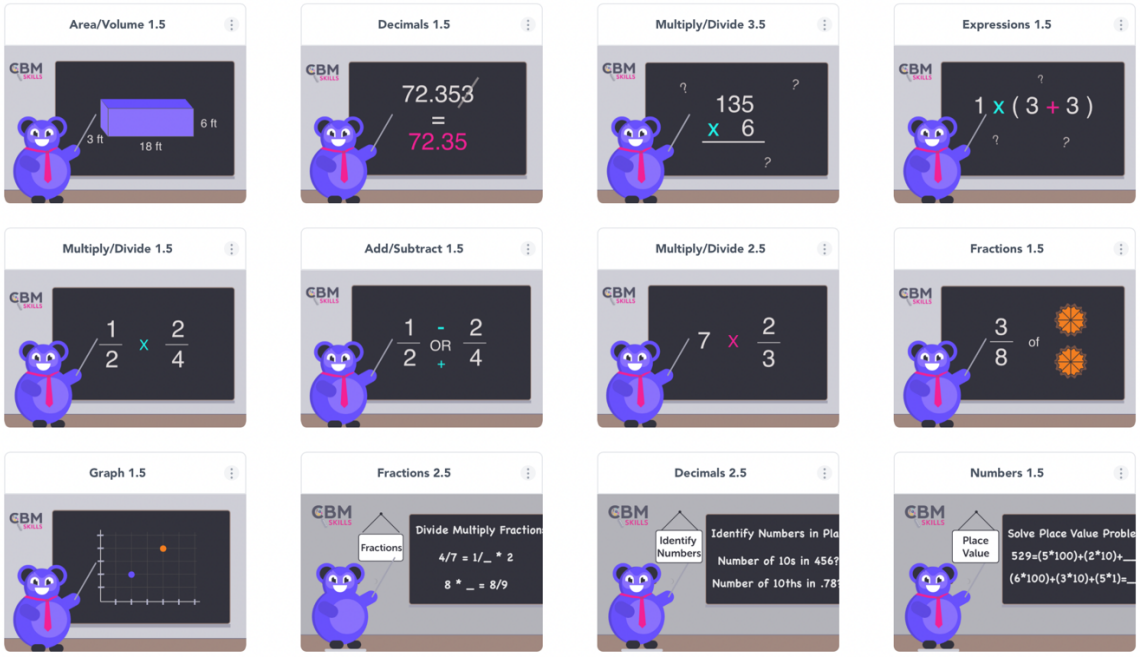
Excel Pobs	1.00
Excel Pexp	0.92
Kappa via Excel	**1.00**

WordProblems 1.4	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	111	0			111
	B	2	295	2	0	297
	Column Total	113	295	2	0	

Kappa via r	0.99
z	20.1

Excel Pobs	1.00
Excel Pexp	0.60
Kappa via Excel	**0.99**

Grade Five Modules



Grade Five Module Descriptors

Numbers 1.5

- Solve multi-digit number problems with tens and hundreds.

Add/Subtract 1.5

- Add and subtract fractions with like and unlike denominators.

Multiply/Divide 1.5, 2.5, & 3.5

- Multiply a fraction or whole number by a fraction.
- Solve problems with multiplication of fractions and mixed numbers.
- Multiply multi-digit whole numbers.

Fractions 1.5 & 2.5

- Solve word problems with whole numbers and fractions.
- Divide a fraction by a whole number and compute quotients.

Decimals 1.5 & 2.5

- Round decimals to any place with multi-digit numbers.
- Interpret mixed numbers and decimals for place values.

Expressions 1.5

- Solve simple expressions with addition and multiplication.

Area/Volume 1.5

- Find the area of rectangles and volume of cubes.

Graph 1.5

- Express coordinate values on X and Y axes.

Grade Five CBMSkills Modules Alignment with Standards

Module	Abbreviated Standard	Common Core Standard Description
Numbers 1.5	*Solve multi-digit number problems with tens and hundreds.*	Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.
Add/Subtract 1.5	*Add and subtract fractions with like and unlike denominators*.	Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. For example, 2/3 + 5/4 = 8/12 + 15/12 = 23/12. (In general, a/b + c/d = (ad + bc)/bd.)
Multiply/Divide 1.5	*Multiply a fraction or whole number by a fraction.*	Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.
Multiply/Divide 2.5	*Solve problems with multiplication of fractions and mixed numbers.*	Solve real world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.
Multiply/Divide 3.5	*Multiply multi-digit whole numbers.*	Fluently multiply multi-digit whole numbers using the standard algorithm.
Fractions 1.5	*Solve word problems with whole numbers and fractions.*	Solve real world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem. For example, how much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 1/3-cup servings are in 2 cups of raisins?
Fractions 2.5	*Divide a fraction by a whole number and compute quotients*.	Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. For example, create a story context for (1/3) ÷ 4, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that (1/3) ÷ 4 = 1/12 because (1/12) × 4 = 1/3.
Decimals 1.5	*Round decimals to any place with multi-digit numbers.*	Use place value understanding to round decimals to any place. Perform operations with multi-digit whole numbers and with decimals to hundredths.
Decimals 2.5	*Interpret mixed numbers and decimals for place values.*	Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g., 347.392 = 3 × 100 + 4 × 10 + 7 × 1 + 3 × (1/10) + 9 × (1/100) + 2 × (1/1000).
Expressions 1.5	*Solve simple expressions with addition and multiplication*	Write simple expressions that record calculations with numbers and interpret numerical expressions without evaluating them. For example, express the calculation “add 8 and 7, then multiply by 2” as 2 × (8 + 7). Recognize that 3 × (18932 + 921) is three times as large as 18932 + 921, without having to calculate the indicated sum or product.
Area/Volume 1.5	*Find area of rectangles and volume of cubes*	Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles and represent fraction products as rectangular areas. 3. Recognize volume as an attribute of solid figures and understand concepts of volume measurement.

Graph 1.5	*Express coordinate values on X and Y axes.*	Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate).

Grade Five Module Item Development – Descriptors and Algorithms

Numbers 1.5: *Solve multi-digit number problems with tens and hundreds.*

- Item Description (99 production problems): "How many ones/tens/hundreds are in __ (three-digit #)?"
- Algorithm: RANDBETWEEN(100,1000) to generate a random three-digit number in Column C; Left(C#, 1) to parse 100s in Column D#, MID(C#,2,1) to parse 10s in Column E#, Right(C#,1) to parse 1s in Column F#; CONCATENATE(C#, "= (" ",D#," x 100) + (__* 10) +", E#, "x", F#) with variations of missing values and 1s, 10s, and 100s used

Add/Subtract 1.5: *Add and subtract fractions with like and unlike denominators*.

- Item Description (90 production problems): Two proper fractions (with common and uncommon denominators) added and subtracted to equal a missing answer (value) expressed as a proper fraction or mixed number.
- Algorithm: RANDBETWEEN(2,4) to generate a random number in Column C, RANDBETWEEN(6,12) to generate a random number in Column D; CONCATENATE(C2," / ",D2); CONCATENATE("__ / ",D2," + ",C2, " / ",D2," = 1. Reduce your answer to the lowest common denominator.") and CONCATENATE(C27, " / ",D26," + __ / ",D26, " = 1. Fill in the missing numerator. Reduce your answer to the lowest common denominator.") and CONCATENATE(" 1 - ",C51," / ",D51," = ___/ ",D51,". Reduce your answer to the lowest common denominator.").

Multiply/Divide 1.5: *Multiply a fraction or whole number by a fraction.*

- Item Description (90 production problems): Whole numbers multiplied by fractions (both proper and improper) to equal a missing value expressed as a whole number, proper fraction, or mixed number.
- Algorithm: RANDBETWEEN(1,9) to generate random 1-digit numbers in Columns C, D, E, and F; CONCATENATE(C#," / ",D#) to generate first fraction in Column G and CONCATENATE(E#," / ",F#) to generate second fraction in Column H; CONCATENATE(G#," x ",H#, " =___") to generate the problems for two fractions times each other and CONCATENATE(C#," x ",H#, " =___") to multiply a whole number by a fraction.

Multiply/Divide 2.5: *Solve problems with multiplication of fractions and mixed numbers.*

- Item Description (100 production problems): Two proper and improper fractions (with common and uncommon denominators) multiplied to equal a missing answer (value) expressed as proper fraction or mixed number.
- Algorithm: Algorithm: RANDBETWEEN(1,10) to generate random number in Column C, RANDBETWEEN(1,E#) to generate random number in Column D (numerator), INDEX(A#:A#,RANDBETWEEN(1,9)) to generate a random number (1-6, 8, 10, 12, and 100) in Column E, CONCATENATE(D#,"/",E#) to generate a fraction in Column F, CONCATENATE(C#," ",F#) to generate a mixed fraction in Column G. Repeat these steps to create another mixed fraction in Column L. CONCATENATE(G#," x ",L#,"= __").

Multiply/Divide 3.5: *Multiply multi-digit whole numbers.*

- Item Description (100 production problems) sample: One-, two-, and three-digit numbers multiplied (with larger numbers always on top).
- Algorithm: RANDBETWEEN(1,9) to generate a random one-digit number in Column C, RANDBETWEEN(10,99) to generate a random two-digit number in Column D, RANDBETWEEN(100,999) to generate a random three-digit number in Column E; CONCATENATE(C#, " * ",D#) for a 1 x 2 digit problem, CONCATENATE(C#, " * ",E# to generate) for a 1 x 3 digit problem, and CONCATENATE(D70, " * ",E70) for a 2 x 3 digit problem.

Fractions 1.5: *Solve word problems with whole numbers and fractions.*

- Item Description (95 production problems).
  Sample 1: "Lorna had 9 sandwiches and Vanetta had 4/7 of this amount. How much did Vanetta have? Express your answer with decimal notation to the nearest hundredths place."
  Sample 2: Joni had 7 apples and Romeo had 2 apples. If they combined them and split them into 2 equal amounts for friends, how many would each friend get? Express your answer as a fraction.
  Note: Names, objects, and all numbers (whole numbers and proper fractions) are randomly sampled.
- Algorithm: RANDBETWEEN (1,9). To generate random one-digit numbers in Columns C and D; CONCATENATE(C#, "/ "D#) to generate a fraction; INDEX(A#:A#,RANDBETWEEN(1,20)) to generate random sample of names, INDEX(A#:A#,RANDBETWEEN(1,6)) to generate random sample of objects, INDEX(A#:A#,RANDBETWEEN(1,13)) to generate random sample of numbers (fractions), and INDEX(A#:A#,RANDBETWEEN(1,8)) to generate a random sample of splits in Columns I, J, L, and M; CONCATENATE(I2," had ",L#, " ", M#, " ","and ",J#," had ",C#,"/",D#, " of this amount. How much did ",J#," have? Express your answer with decimal notation.") and CONCATENATE("The ",D#," ",H#," earned a total of ",E#," dollars in tips and split it evenly. How much did each person make?").

Fractions 2.5: *Divide a fraction by a whole number and compute quotients*.

- Item Description (73 production problems): "What is the numerator/denominator of #/# (proper fraction)? and fraction = whole number x 1/# with missing denominator."
- Algorithm: RANDBETWEEN(1,9) to generate random numbers in Columns D and E; IF(D#<E#,D#,E#) for the numerator and IF(D#>E#,D#,E#) for the denominator and

CONCATENATE("What is the numerator of ",F#,"/",G#,"?") or CONCATENATE("What is the denominator of ",F#,"/",G#,"?") and CONCATENATE(F#,"/",G#," = ","1/__ *",F#) or CONCATENATE(F#," * __ = ",F#,"/",G#).

Decimals 1.5: *Round decimals to any place with multi-digit numbers.*

- Item Description (101 production problems) sample: "Round 639.1665 to the nearest thousandth." Note: Decimal values are in 10^{ths}, 100^{ths}, and 1000^{ths}
- Algorithm: RANDBETWEEN(100,1000) to generate a random number in Column E; ROUND(RAND(),3) to generate a random number expressed as a three-digit decimal in Column I; CONCATENATE("Round ",I#," to the nearest ones place") with ones replaced by tens and hundreds; LEFT(E#,1) to parse 100s, LEFT(E#,2) to parse 10s, and LEFT(E#,3) to parse 1s in generating answers.

Decimals 2.5: *Interpret mixed numbers and decimals for place values.*

- Item Description (101 production problems): "How many 1s/10s/100s are in three-digit number? and How many 10^{ths}, 100^{ths}, 1000^{ths} are in two- and three-digit decimal?"
- Algorithm: RANDBETWEEN(100,1000) to generate a random 3-digit number in Column E; CONCATENATE("How many 100s or 10s or 1s in ", E#) with answers in Columns F# (Left(E#, 1) to parse 100s in Column F#, MID(E#,2,1) to parse 10s in Column G# or Right(E#,1) to parse 1s in Column H#.
  RAND() to generate random decimal in Column I; ROUND(I#,3) to create a 3-digit decimal in Column J; RANDBETWEEN (1,9) to generate random number in Column K; sum (J#+K#) for mixed number in Column L#, and CONCATENATE("How many 1000^{ths}, 100^{ths} or 10^{ths} or 1s in ", L#," ?); answers use parsing algorithms in Columns M, N, O, P.

Expressions 1.5: *Solve simple expressions with addition and multiplication*.

- Item Description (98 production problems): Algebraic equations with three numbers (two grouped within parentheses that are added and multiplied to equal a missing answer (value) or a missing number within the algebraic equation entered to solve the problem with an expressed answer.
- Algorithm: RANDBETWEEN(1,9) to generate random 1-digit numbers in Columns D, E, and F; CONCATENATE("(",D#," + ",E#,") x ",F#," = __") with different combinations where the parentheses appear using different operations (x and +).

Area/Volume 1.5: *Find area of rectangles and volume of cubes.*

- Item Description (99 production problems)
  Sample 1: "A rectangle has one side that is 3 feet long, and another side that is 9 feet long. What is the area?
  Sample 2: A cube has one side that is 3 foot long, and another side that is 7 feet long, and it is 18 feet deep. What is the volume?
  Note: Figures (rectangles and cubes) are in inches, feet, and yards (square or cubic)
- Algorithm: RANDBETWEEN(2,20) to generate random numbers in Columns D, E, and F; INDEX(A#:A#,RANDBETWEEN(1,3)) to randomly sample inches, feet, and yards in Columns G and H; CONCATENATE("A rectangle has one side that is ",D3," ",G3," long and another side that is ",E3," ",G3," long. What is the area?"); CONCATENATE("A rectangle has one side that is ",D67," ",G67," long and another side that is ",E67," ",H67,"

long. What is the area?") and CONCATENATE("A cuboid has one side that is ",D34," ",G34," long and another side that is ",E34," ",G34," wide. It is ",F34," ", H34," high. What is the volume?").

Graph 1.5: *Express coordinate values on X and Y axes.*

- Item Description (101 production problems): A graph with a data point (value) placed at an X-Y coordinate position (from 1 to 10) and the question "What are the coordinates for X and Y? X = __ and Y = __.
- Algorithm: RANDBETWEEN(1,10) to generate a random number in Column C, RANDBETWEEN(11,25) to generate a random number in Column D; CONCATENATE("What are the coordinates for X"," (",C2,") and Y (",F2,")?").

Grade Five easyCBM Items Alignment with CBMSkills Modules

A pool of 512 items from easyCBM were aligned with modules in CBMSkills. In easyCBM, the items were organized into five domains: (a) Number & Operations in Base Ten (n= 98 items), (b) Number & Operations – Fractions (n=92 items), (c) Operations & Algebraic Thinking (n=136 items), (d) Measurement & Data (n=101 items), and (e) Geometry (n=85 items). In the alignment process, some qualifications were made in the interpretations of the CBMSkills modules. See Table 1.

Table 1.
Qualifications for Alignment

Target	Module	Qual 1	Qual 2	Qual 3	Qual 4
Numbers 1.5	Solve multi-digit number problems with tens and hundreds	Any operation with decimals	Greater than ones/tens (includes 10ths AND 100ths)	Not simple conversions	Not story, only number problems
Add_subtract 1.5	Add and subtract fractions with like and unlike denominators	No subtraction	With fractions and decimals	Included area if calculation needed	
Multiply_divide 1.5	Multiply a fraction or whole number by a fraction	Whole number with fractions or decimals	Division also included		
Multiply_divide 2.5	Solve problems with multiplication of fractions and mixed numbers				
Multiply_divide 3.5	Multiply (divide) multi-digit whole numbers	Whole numbers	Associated with area/volume		
Fractions 1.5	Solve word problems with whole numbers and fractions	Context needed not just objects/numbers			

Fractions 2.5	Divide a fraction by a whole number and compute quotients	Multiply and divide also	Multiply and divide also		
Decimals 1.5	Round decimals to any place with multi-digit numbers	Estimate / About…	Place value		
Decimals 2.5	Interpret mixed numbers and decimals for place values	Which are equal			
Expressions 1.5	Solve simple expressions with addition and multiplication	Number lines	W & W/O fractions		
Area_volume 1.5	Find the area of rectangles and volume of cubes	Explicit term of area/volume	Included formulae only		
Graph 1.5	Express coordinate values on X and Y axes	Graphs and coordinates			

A total of 22 items were marked by Judge 2 as needing to be A(dded) or D(eleted), resulting in four outcomes from the two judges: Reliability was calculated on all CBMSkills modules and then a final decision made to Accept A(dded) items (n=7), Reject A(dded) items (n=1), Accept D(eleted) items (n=11), and Reject D(eleted) items (n= 3). After adjudication of all agreements and disagreements, a final count was made of the total number of easyCBM items with each of the CBMSkills modules.

In Table 2, the outcome is presented for each of the CBMSkills modules: Number of easyCBM items aligned. Because some easyCBM items aligned with more than one CBMSkill module, the total count is greater than the 512 easyCBM items. In total, 1,328 times, an easyCBM item was aligned with a CBMSkills module. Also note that 39 easyCBM items were not considered for alignment because they required a classification (not computation) task as shapes (36) or units of measurement (3). Furthermore, division problems were included in "multiply multi-digit whole numbers" (because multiplication was required in their solution).

Table 2.
Number of easyCBM items aligned CBMSkills Modules

Module Name	Module Descriptor	N Items
Numbers 1.5	Solve multi-digit number problems with tens and hundreds	181
Add_subtract 1.5	Add and subtract fractions with like and unlike denominators	138
Multiply_divide 1.5	Multiply a fraction or whole number by a fraction	49
Multiply_divide 2.5	Solve problems with multiplication of fractions and mixed numbers	44
Multiply_divide 3.5	Multiply (divide) multi-digit whole numbers	228
Fractions 1.5	Solve word problems with whole numbers and fractions	124
Fractions 2.5	Divide a fraction by a whole number and compute quotients	46
Decimals 1.5	Round decimals to any place with multi-digit numbers	34
Decimals 2.5	Interpret mixed numbers and decimals for place values	25
Expressions 1.5	Solve simple expressions with addition and multiplication	332
Area_volume 1.5	Find the area of rectangles and volume of cubes	108
Graph 1.5	Express coordinate values on X and Y axes	19

Appendix A – Reliability of Alignment for each of the CBMSkills Module

Numbers 1.5	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	181	0			181
	B	0	331	0	0	331
	Column Total	181	331	0	0	

Kappa via r	1.00
z	22.6

Excel Pobs	1.00
Excel Pexp	0.54
Kappa via Excel	**1.00**

Add_subtract 1.5	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	138	2			140
	B	0	372	2	0	372
	Column Total	138	374	2	0	

Kappa via r	0.99
z	22.5

Excel Pobs	1.00
Excel Pexp	0.60
Kappa via Excel	**0.99**

Multiply_divide 1.5	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	49	0			49
	B	1	462	1	0	463
	Column Total	50	462	1	0	

Kappa via r	0.99
z	22.5

Excel Pobs	1.00
Excel Pexp	0.83
Kappa via Excel	**0.99**

Multiply_divide 2.5	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	44	0			44
	B	0	468	0	0	468
	Column Total	44	468	0	0	

Kappa via r	1.00
z	22.6

Excel Pobs	1.00
Excel Pexp	0.84
Kappa via Excel	**1.00**

Multiply_divide 3.5	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	226	0			226
	B	2	284	0	2	286
	Column Total	228	284	0	2	

Kappa via r	0.99
z	22.5

Excel Pobs	1.00
Excel Pexp	0.51
Kappa via Excel	**0.99**

Fractions 1.5	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	123	0			123
	B	1	388	0	1	389
	Column Total	124	388	0	1	

Kappa via r	1.00
z	22.6

Excel Pobs	1.00
Excel Pexp	0.63
Kappa via Excel	**0.99**

Fractions 2.5	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	46	3	0	0	49
	B	0	463	3	0	463
	Column Total	46	466	3	0	

Kappa via r	0.97
z	22.5

Excel Pobs	0.99
Excel Pexp	0.83
Kappa via Excel	**0.97**

Decimals 1.5	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	34	4			38
	B	0	474	4	0	474
	Column Total	34	478	4	0	

Kappa via r	0.94
z	22.2

Excel Pobs	0.99
Excel Pexp	0.87
Kappa via Excel	**0.94**

Decimals 2.5	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	25	0			25
	B	0	487	0	0	487
	Column Total	25	487	0	0	

Kappa via r	1.00
z	22.6

Excel Pobs	1.00
Excel Pexp	0.91
Kappa via Excel	**1.00**

Expressions 1.5	**Judge 1 /Judge 2**	**1**	**B**	**D**	**A**	**Row Total**
	1	329	4			333
	B	0	179	4	0	179
	Column Total	329	183	4	0	

Kappa via r	**0.98**
z	22.4

Excel Pobs	0.99
Excel Pexp	0.54
Kappa via Excel	**0.98**

Area_volume 1.5	**Judge 1 /Judge 2**	**1**	**B**	**D**	**A**	**Row Total**
	1	104	0			104
	B	5	403	0	5	408
	Column Total	109	403	0	5	

Kappa via r	**0.94**
z	21.7

Excel Pobs	0.99
Excel Pexp	0.67
Kappa via Excel	**0.97**

Graph 1.5	Judge 1 /Judge 2	1	B	D	A	Row Total
	1	19	0	0	0	19
	B	0	493	0	0	493
	Column Total	19	493	0	0	

Kappa via r	**1.00**
z	22.6

Excel Pobs	1.00
Excel Pexp	0.93
Kappa via Excel	**1.00**