

KYAE Skills U 2016-17 *EMPower Plus* Mathematics Pilot Final Report

Purpose

- 1) To test the effectiveness of a commercial math curriculum that has been identified as tightly aligned to the key advances and content set forth in the College and Career Readiness Standards (CCRS)
- 2) To create a crosswalk of the alignment of the KYAE Skills U Employability Standards with each lesson in the *EMPower* series
- 3) To determine whether further use of the *EMPower* series by KYAE Skills U programs should be pursued

Pilot Structure

Through an application process, nineteen programs were accepted to the pilot:

County Program	Instructor	Program Director
Boyd	Karen Poore	Penny Qualls
Boyle*	Gail Jackson	David Sturgill
Carroll	LeAnn Hill	Cristina Marsh
Carter	Vickie Stacy	Tessa Love
Clay	Harlon Williams	Paula Jones
Floyd	Virginia Williamson	Jennifer Leedy
Gallatin	Ruben Berra	Cristina Marsh
Garrard	Carla True/Catherine Beechie	Paula Jones
Hardin	Mitzi Skaggs	Diane Kelley
Henderson	Amanda Ireland	Pamala Wilson
Jefferson	William Vaughn & Susan Carey	Joyce Griffith
Johnson	Phillip Gullett	Jennifer Leedy
Logan*	Carolyn Bell	Pam Morgan
Madison	Michael McClellan	Paula Jones
Martin	Vicki Cline & Donnie Osborn	Tessa Love
Meade*	JoAnn Lucia	Dianne Bratcher
Nelson (replaced Franklin)	Rachel Daugherty	Dianne Bratcher
Oldham*	Katy Gagel	Suzette Ertel
Washington (replaced Carlisle)	Paulette Metcalfe	Dianne Bratcher

*Corrections setting

- Programs were divided into four cohorts: one designated for a corrections setting and the other three sorted by size.
- In Phase 1 (the fall session), instructors were asked to complete two lessons a month from the book *Everyday Number Sense: Mental Math and Visual Models*.
- In Phase 2 (spring), they were asked to teach at their own pace through lesson 14 in *Everyday Number Sense*, and then move into the other books, *Using Benchmarks* and *Split It Up*.
- Cohorts met on Google hangouts bi-weekly during Phase 1, and monthly during Phase 2, to discuss their experiences.
- Participants submitted required forms through Lesson 8 at the conclusion of Phase 1 and forms for Lessons 9 – 14 at the conclusion of Phase 2 in May 2017.

Expectations for Pilot Participants

- Attend two meetings in Frankfort: 1) Phase 1 EMPower orientation meeting in August and, 2) Phase 2 orientation meeting in January
- Teach the full sequence of lessons in *Everyday Number Sense: Mental Math and Visual Model* as outlined in the *Everyday Number Sense* Teacher Book
- Identify the KYAE Skills U Employability Standards which align to each lesson in *Everyday Number Sense*
- Identify career pathways that may align to individual lessons
- Document student engagement and response to each lesson
- Formatively assess student progress toward meeting the CCR standard for each lesson
- Determine which, if any, lessons could be eliminated from the title without affecting the desired student understandings and progress
- Receive credit for 2016-17 professional development requirements upon completion of data submission

Summary of Results

Usefulness of Content: More than 80% of the participants rated all but two (Lessons 5 and 10) of the fourteen lessons as essential mathematics content. The highest rated content is highlighted below:

Lessons	Essential Content	Non-Essential Content
1 Close Enough with Mental Math	100%	
2 Mental Math in the Checkout Line	94%	6%
3 Traveling with Numbers	94%	6%
4 Traveling in Time	89%	11%
5 Meanings and Methods for Subtraction	56%	44%
6 Extending the Line	81%	19%
7 Ups and Downs with Addition	94%	6%
8 Take for Your Winnings	89%	11%
9 Patterns and Order	94%	6%
10 Picture This	75%	25%
11 What Is the Story?	94%	6%
12 Deal Me In	88%	12%
13 String It Along	82%	18%
14 Making Do	76%	24%

Relevance for Real-World Application (a CCRSM Key Shift)

With the exception again of Lessons 5 and 10, all the other lessons were ranked at 80% and higher as relevant or very relevant to students' lives.

Lessons	Very Relevant	Relevant	Somewhat Relevant	Not Relevant
Lesson 1	47%	47%	6%	
Lesson 2	68%	32%		
Lesson 3	75%	19%	6%	
Lesson 4	59%	23%	18%	
Lesson 5	28%	33%	33%	6%
Lesson 6	50%	31%	13%	6%
Lesson 7	65%	35%		
Lesson 8	65%	29%		6%

Lesson 9	53%	40%	7%	
Lesson 10	44%	31%	19%	6%
Lesson 11	56%	38%	6%	
Lesson 12	53%	47%		
Lesson 13	59%	29%	12%	
Lesson 14	53%	29%	18%	

Cross-Discipline Reference to Science or Social Studies

All of the lessons were judged by some of the participants to connect with either Science or Social Studies. The lessons for which a majority of the participants agreed (over 80%) on having a strong connection were Lessons 3, 4, 6, and 13 with Social Studies and Lessons 6 with Science.

Lessons	% who say there is a Science Component	% who say there is a Social Studies Component
Lesson 1	65%	35%
Lesson 2	29%	35%
Lesson 3	12%	82%
Lesson 4	18%	100%
Lesson 5	25%	38%
Lesson 6	100%	88%
Lesson 7	31%	56%
Lesson 8	47%	40%
Lesson 9	33%	7%
Lesson 10	50%	25%
Lesson 11	44%	19%
Lesson 12	31%	50%
Lesson 13	50%	94%
Lesson 14	56%	44%

Top Five Lessons

We know that students don't typically stay with a program long enough to work through all the lessons in an EMPower unit, much less all the lessons in all seven EMPower units. Therefore, participants were asked to choose five lessons from *Everyday Number Sense* that they considered the best lessons of the unit, lessons they will use time after time to teach a particular concept. The five lessons most often cited and in order of preference are:

1. Lesson 3 Traveling with Numbers 67%
2. Lesson 4 Traveling in Time 47%
3. Lesson 13 String It Along 47%
4. Lesson 6 Extending the Line 40%
5. Lesson 10 Picture This 40%

Time Spent per Lesson/ Supplemental Material

On average, instructors spent about two class sessions (1.9 sessions) on each lesson. Very few of the lessons were supplemented with other materials. Only for Lesson 2, Mental Math in the Checkout Line, did nearly half of the participants use supplemental materials.

Employability Standards/Career Clusters

Participants saw a correlation between each of the *Everyday Number Sense* lessons and the KYAE Skills U Employability Standards. The standards most often cited were:

E.7 Accurately analyze information and respond appropriately.

E.6 Identify and effectively use skills and materials needed for a particular task.

E.8 Interact with others in a professional manner.

Due to the interactive nature of the EMPower activities, it is not surprising that these particular E Standards would rise to the top. In addition to these necessary soft skills, the participants found that all of the lessons related to one of the career pathway sectors. The sectors most often cited were:

1. Finance
2. Hospitality and Tourism
3. Architecture and Construction

CCRS Alignment

Participants were given a list of CCR Standards and Mathematical Practices designated by the authors as aligning to the *Everyday Number Sense* unit. Using the CCRS Mathematics Progression document, the instructors were instructed to identify which standards and practices from the list were targeted by each lesson. Of all the expectations, agreement about the CCRS alignment proved the least consistent of all the submissions. In some cases, instructors listed standards not even cited by the authors. The following chart shows the standards and practices from the authors' list most often cited by the pilot instructors:

Lessons	CCR Focus Standard	CCR Supporting Standard	Top 2 cited Mathematical Practices
Lesson 1	2.NBT.9, .NBT.1, 1OA.3	4.NBT.3	MP. 2, MP. 5
Lesson 2	1.NBT.4, 1.OA.3, 2.NBT.9	1.OA.7	MP. 2, MP. 6
Lesson 3	3.NBT.1, 3.NBT.2		MP. 2, MP. 5
Lesson 4	2.NBT.8, 3.NBT.2	4.NBT.2	MP. 2, MP. 5
Lesson 5	2.NBT.9, 1.OA.4	1.OA.7	MP. 2, MP. 6
Lesson 6	1.NBT.6	6.NS.6a, 6.NS.7b	MP. 5, MP. 6
Lesson 7	2.NBT.7, 2.NBT.9, 2.OA.1	6.NS.6a, 6.NS.7b, 7.NS.1a	MP. 2, MP. 7
Lesson 8	5.OA.1,	4.NBT.1, 5.NBT.2	MP. 2, MP. 7
Lesson 9	5.OA.1	3.OA.5, 3.NBT.3, 4.NBT.1	MP. 6, MP. 7
Lesson 10	3.OA.3, 5.OA.1	3.OA.5	MP. 2, MP. 7
Lesson 11	6.EE.1	3.OA.5	MP. 2, MP. 7
Lesson 12	3.OA.3, 3.OA.6	3.OA.5, 3.OA.7	MP. 2, MP. 7
Lesson 13	3.OA.6, 6.EE.1	3.OA.7	MP. 2, MP. 5
Lesson 14	3.OA.3, 3.OA.6, 5.NBT.6	3.OA.5	MP. 2, MP. 6

An interesting observation about the EMPower unit, *Everyday Number Sense*, is the range of concepts targeted throughout this one unit, by level (from Level A through Level D) and by topic (Number Base Ten, Operations and Algebra). The EMPower curriculum is designed for use with Pre-GED® students; this unit on number sense took students from mental addition and subtraction through an introduction to mathematical properties, integers, exponents and order of operations, all of which lay a solid foundation for algebra. And, it does so while balancing conceptual understanding, and procedural skill and fluency, in the context of real-world situations.

Student Survey Responses

Following each lesson, students were asked to rate the degree to which they agreed with each of the statements presented below. Over all the lessons there was an average of 55 responses per lesson. All but the last statement received quite high ratings. The two statements receiving the highest levels of agreement were, “Working with others helps me learn,” and “I actively participated in the discussion, answering questions, and asking about items I did not understand.” The EMPower curriculum is designed to encourage discussion about the concepts and working with others to solve problems, strategies that relate well to the math practices and employability skills.

KEY: 1= Strongly Disagree 2=Disagree 3= Undecided 4=Agree 5= Strongly Agree

Statements	L. 1	L. 2	L. 3	L. 4	L. 5	L. 6	L. 7	L. 8	L. 9	L. 10	L. 11	L. 12	L. 13	L. 14
After this lesson, I have a better understanding of the math topics covered.	4.8	4.2	3.6	4.4	3.9	4.1	4.3	4.4	4.3	4.3	4.2	4.3	4	4
This lesson helped me to better understand how math is a part of my everyday life.	4.4	4.2	4.3	4.3	3.9	4.1	4.2	4.2	4.3	4.3	4.2	4.3	4.1	4.3
The material covered in the lesson was useful.	4.3	4.2	4.3	4.1	3.8	4.2	4.3	4.3	4.3	4.2	4.2	4.3	3.9	4.2
I can solve math problems based on this lesson.	4	4.1	4.2	4.1	3.8	4	4.1	4.2	4.4	4.3	4.3	4.2	4	4
I actively participated in the discussion, answering questions, and asking about items I did not understand.	4.3	4.3	4.4	4.2	4	4.2	4.5	4.4	4.3	4.4	4.2	4.2	4	4.2
Working with others helps me learn.	4.3	4.1	4.2	4.2	4.2	4.4	4.4	4.3	4.4	4.2	4.1	4.3	4	4.5
I have a clear understanding of the purpose of this lesson.	4.2	4.2	4.2	4.1	3.7	4	4.2	4.4	4.2	4.4	4.2	4.1	4	4
I can explain the lesson content to someone else.	3.5	3.9	3.8	4	3.3	3.6	4	4.2	4	3.9	3.8	3.9	3.7	4

Student TABE Results

Results of a data match with KAERS shows that students participating in the EMPower lessons had a high rate of math level gains. Other factors likely led to the gains, as well. Still, the rate of level gains for these students was higher than the state average.

TABE Conclusions for Phase 1 (Fall) EMPOWER Plus: *Everyday Number Sense*

129 students participated in the EMPOWER lessons across 20 programs

94 students post-tested Reading, Language or Math

68 of 94 saw a level gain = 72%

52% of all pilot students made a level gain

- 63 post-tested for math
- **47 of 63 saw a level gain in math= 75%**

TABE Conclusions for Phase 2 (Spring) EMPOWER Plus: *Everyday Number Sense*

135 students participated in the EMPOWER lessons across 20 programs

107 students post-tested in Reading, Language or Math

87 of 107 saw a level gain = 81%

64% of all pilot students made a level gain in either Reading, Language or Math

- 58 post-tested for math
- **47 of 58 saw a level gain in math = 81%**

Sample Reactions to Specific Lessons

In cohorts of 4-6 members, instructors met bi-weekly via google hangouts or conference call with Dr. Patricia Erwin and Gayle Box during Phase 1 (through Lesson 8) and monthly during Phase 2 (lessons 9 -14). In Phase 1, participants were sent Guiding Questions for each lesson that asked about specific activities in the lesson. During Phase 2, instructors were given more flexibility to implement the lessons as they determined best for their students. The questions asked were more general because not everyone was reporting on the same lesson. Phase 2 centered more on instructor reactions to each lesson, as well as their students' reaction to the content. Selected samples are presented below.

Lesson	Instructor Reaction	Student Reaction
1 Close Enough with Mental Math	The most useful elements of the lesson were the Icebreaker Number of the Day activity, its real life application, and using manipulatives. The teacher edition is a great guide. <i>Paulette Metcalfe, Washington Co.</i>	Very positive. One student commented that they are using mental math much more after the lesson and it is helping in the grocery store. They like estimating. They liked giving feedback on the form. <i>Paulette Metcalfe, Washington Co.</i>
2 Mental Math in the Checkout Line	The lesson was challenging for some, but like the use of cooking and measuring; grocery shopping; bills and budgeting - real life. <i>LeAnn Hill, Carroll Co.</i>	Mixed levels - lower level felt that it challenged them; the higher think they use mental math all the time; liked that it was applicable to their lives. <i>LeAnn Hill, Carroll Co.</i>
3 Traveling with Numbers	Instructors used a variety of books for this activity. These included: a dictionary, a test prep book, a Bible. All instructors created a number line	All instructors said that their students liked the planning a trip activity. There were some questions among their students about geography.

	<p>based on the instructions in the teacher book. <i>Vickie Stacy, Carter Co.</i></p>	<p>Specifically, there was some confusion about the abbreviations of 1 or 2 states. There was also a student in one of the classes who is a truck driver and shared a lot about the distance of the trip and the sizes of different cities. <i>Vickie Stacy, Carter Co.</i></p>
4 Traveling in Time	<p>We used examples of thermometer, clock, speedometer, etc. as number lines. Discussed metric vs. standard, etc., got into negatives somewhat; understood the different scales for number lines <i>Katy Gagle, Oldham Co.</i></p>	<p>Good discussion around events, different groups picked different events and talked about all of them. Very good history discussion. <i>Katy Gagle, Oldham Co.</i></p>
5 Meanings and Methods for Subtraction	<p>This lesson helped them understand what they were actually borrowing from in a subtraction problem. <i>Carolyn Bell, Logan Co.</i></p>	<p>Writing is getting easier for some; they are starting to see the benefit of mental math. Starting to trust their answers more. <i>Carolyn Bell, Logan Co.</i></p>
6 Extending the Line	<p>Students did well, the terms were familiar. They have more life experience so they liked this lesson. They still struggle with rounding up or down with numbers other than those ending in zero. <i>JoAnn Lucia, Meade Co.</i></p>	<p>The Planting Zones activity was foreign. Most of her students have ADD and are overwhelmed by the amount of material. The "What's the Range" and "Ordering Numbers" activities went well. The "Sorry, Account Overdrawn" activity was good. It was a good combination of numbers and words. <i>JoAnn Lucia, Meade Co.</i></p>
7 Ups and Downs with Addition	<p>Activity 1 had lots of students so paired them up and they wrote their sequence on the white board. Looked for patterns. Activity 2 used the red and yellow chips, they knew "in the red" but not "in the black". They really liked the cards. It was a fun lesson. <i>Amanda Ireland, Henderson Co.</i></p>	<p>They are comfortable with the number line; half the students were new to integers. They prefer the number line. They draw it in the air. <i>Amanda Ireland, Henderson Co.</i></p>
8 Take for Your Winnings	<p>Did not do Activity 3 or 4 yet; did not use calculators; once they could see the unfriendly numbers, they did OK; they are understanding place value better because of the EMPower activities. <i>Mitzi Skaggs, Hardin Co.</i></p>	<p>Absolutely loved the concentration game- will use it with other concepts; fluency - they got better with it on the second try. Mystery Numbers went pretty well - it lends itself well to algebra. <i>Mitzi Skaggs, Hardin Co.</i></p>
9 Patterns and Order	<p>Liked it; lots of useful information and exercises; related well to real-life; multiplying by 10s, 100s and 1,000s was useful; first exposure to order of operations</p>	<p>Liked it; enjoyed the mental math; shopping mentally; liked learning the order of the operations; responded well to the activities <i>William Vaughn, Jefferson Co.</i></p>

	<i>William Vaughn, Jefferson Co.</i>	
10 Picture This	Liked it overall; the lower students like it better than higher level ones <i>Donnie Osborn/Vicki Cline, Martin Co.</i>	Students who don't see multiplication as groups found it helpful. By seeing the array examples, they were able to understand it. <i>Donnie Osborn/Vicki Cline, Martin Co.</i>
11 What is the Story?	Activity 1 where they drew pictures was useful and good that they got to see different ways to approach the problem really liked how the perfect squares and exponents <i>Virginia Williamson, Floyd Co.</i>	Did not like drawing the pictures; warmed up to it after they got used to making drawings; understood better after drawing; really liked the exponents and perfect squares <i>Virginia Williamson, Floyd Co.</i>
12 Deal Me In	Really liked this lesson- short, easy to understand, good real world content, useful. <i>Gail Jackson, Boyle Co.</i>	Sparked good discussion about salaries; the activities working with 10s, 100s, etc. were very worthwhile. Some students have no experience with loans or payments. They saw the patterns. <i>Gail Jackson, Boyle Co.</i>
13 String It Along	Good use of teaching map scale reading, also commutative property was good. Only has 1.5 hrs. to teach each lesson; spent a lot of time on Activity 2 <i>JoAnn Lucia, Meade Co.</i>	Students enjoyed it. They liked the trip. Activity 1 done with paper rather than strings; it didn't take very long; Activity 2 will need more work. This is a good intro to ratio/proportion <i>JoAnn Lucia, Meade Co.</i>
14 Making Do	"The activities were challenging. When I did the problem in Activity 3 using real values (p. 180 teacher's book) with no explanation, they were completely lost. They'd never seen that before. After I explained it and compared it to using real values in a multiplication problem, it made sense. No one had ever explained the algorithm in detail like that." Thought it was really good; liked the explanation of division. <i>Michael McClellan, Madison Co.</i>	"They said they liked the lesson and seeing the "why we do this" of long division explained to them. They liked the situations used in the activities. Answers varied a bit on some of them in regards to dividing the remainders or leaving them (gum, Life Savers, rope, wire, etc.). Challenging to the students; Activity 3; they really liked this way of learning division <i>Michael McClellan, Madison Co.</i>

General Comments by Instructors about the Everyday Number Sense

"I have a male student who is struggling with the basic concepts and he saw the Empower Math books. He picked it up and looked through it and then asked if he could work from it. He has brought it back to class with questions and is actively using it for learning. This was done without any pressure from me to use it." *Email from JoAnn Lucia, Meade Co. (Corrections Setting)*

"Very positive; mother and daughter returning students asked for the EMPOWER lessons." *Harlon Williams, Clay Co.*

"I am on lesson 1. So far the most useful elements for have been: 1) to realize that math is present in different activities of our daily life, 2) to take away the "seriousness and fear" to math making it more friendly to them, 3) to help them

work as a team in a positive way, and 4) to develop the process of reasoning in different ways in the solving of problems.” *Ruben Berra, Gallatin Co.*

Pilot Conclusions

- Instructor content knowledge of mathematics improved.
- Instructors utilized new strategies to teach math concepts.
- Use of EMPower lessons encourages formative assessment.
- It is imperative that instructors follow the teacher book to initially teach any EMPower lesson.
- Instructors struggle to apply the CCR Standards for Mathematics to a lesson.
- EMPower lessons especially work well in the corrections setting.
- Students enjoyed the lessons due to their real-life scenario context and increased their math reasoning skills.
- Students learned math concepts at a deeper level with these lessons.
- Students beyond the Pre-GED® level also benefitted from the lessons, but need higher level supplementation.
- Students did not have to attend each lesson to benefit from content.
- KYAE Skills U should continue to explore the use of the EMPower series with interested programs through professional development opportunities.
- The structure of the pilot worked well and should be replicated with slight adaptations for professional development.
- Once instructors are familiar with all the lessons in an EMPower unit, they should be encouraged to utilize the lessons in whatever manner they see fit.