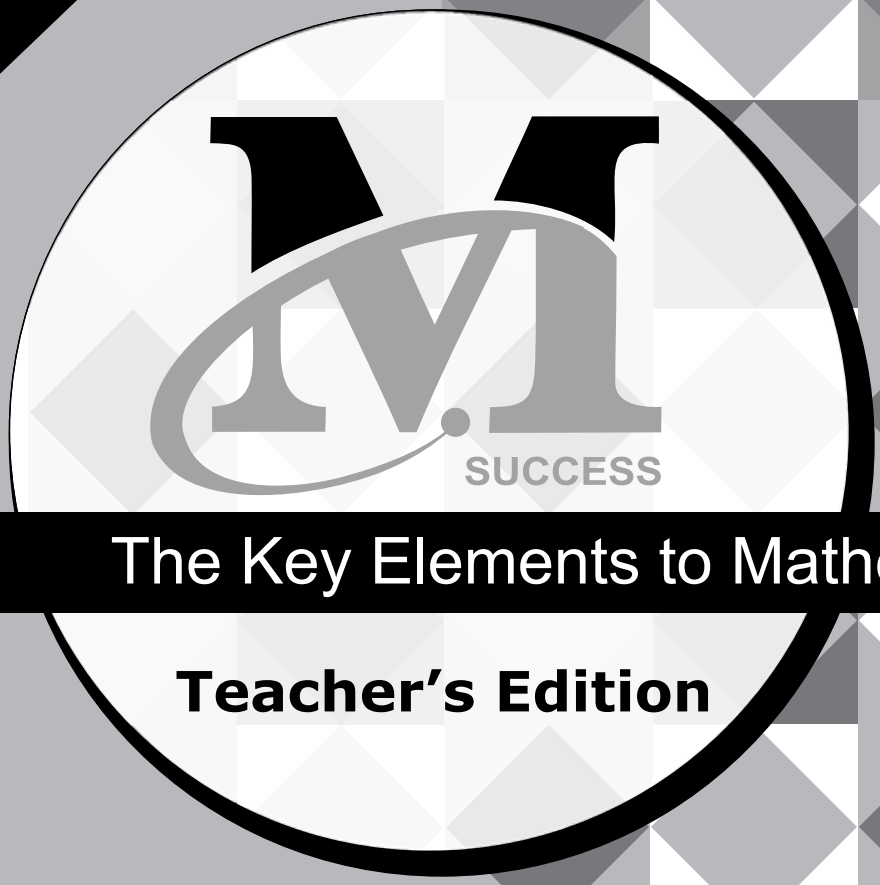
Grade
8



The Key Elements to Mathematics Success

Teacher's Edition

Authors:
Dr. Brian E. Enright
and
Lisa O. Schueren
Wendy S. Maldonado

Cover Design:
Lisa Greenleaf

National Training Network

ISBN#978-1-57290-970-0

Table of Contents

Lessons

Teacher Note: When student pairs are using manipulatives to model concepts, they will need to use both partner books. Many times students need the concrete model to answer questions or bridge to the pictorial model on the following page.

Table of Contents
Lessons

Table of Contents

Lessons

Table of Contents
Lessons

Table of Contents

Lessons

Table of Contents

Lessons

The Key Elements to Mathematics Success Description of Teacher's Guide

Essential Questions are presented at the beginning of each lesson to provide the framework for the lesson and guide the learning process. The Essential Questions are used not only at the beginning of the lesson, but are also an important part of the lesson closure. Each Essential Question ties into a SOLVE problem which is used as an introduction and closure tool in each lesson.

Each lesson concept is bracketed with the SOLVE problem solving method. Along with the Essential Question, the "S" step of SOLVE is introduced at the beginning of the lesson. This helps to guide the learning of the student as they progress through the lesson. At the end of the lesson, the SOLVE problem introduced at the beginning of the lesson is revisited. The student completes the additional steps of SOLVE, applying the lesson concept in a problem solving situation.

LESSON 6: Cube Roots

[Objective]
The student will evaluate perfect cube roots using whole numbers and fractions and use cube root symbols to represent solutions to equations.

[Prerequisite Skills]
square roots, volume, prime factorization

[Materials]
Student pages **S55–S70**
Centimeter cubes (91 per student pair)
Calculator (optional)

[Essential Questions]
1. What is a cube root?
2. How can you determine cube roots of larger numbers?
3. Explain how to solve an equation with a cubed value of *x*.

[Words For Word Wall]
three-dimensional figures, radical symbol, cube root, prime factors, prime factorization, factor tree

[Grouping]
Cooperative Pairs (CP), Whole Group (WG), Individual (I)
*For Cooperative Pairs (CP) activities, assign the roles of Partner A and Partner B to students. This allows each student to be responsible for designated tasks within the lesson.

[Levels of Teacher Support]
Modeling (M), Guided Practice (GP), Independent Practice (IP)

[Multiple Representations]
SOLVE, Algebraic Formula, Verbal Description, Pictorial Representation, Concrete Representation, Graphic Organizer

[Warm-Up] (IP, I, WG) S55 (Answers on T134.)
- Have students turn to S55 in their books to begin the Warm-Up. Students will work with area and finding side lengths of figures to review squares and square roots. Monitor students to see if any of them need help during the Warm-Up. Have students complete the problems and review the answers as a class. **{Verbal Description, Pictorial Representation}**

[Homework]
Take time to go over the homework from the previous night.

[Lesson] [4-5 days (1 day = 80 minutes) - (M, GP, WG, CP, IP)]

LESSON 6: Cube Roots

SOLVE Problem **(WG, GP) S56 (Answers on T135.)**

Have students turn to S56 in their books. The first problem is a SOLVE problem. You are only going to complete the S step with students at this point. Tell students that during the lesson they will learn how to find the cube roots of perfect cubes and represent the solution to a cube root equation. They will use this knowledge to complete this SOLVE problem at the end of the lesson. **{SOLVE, Verbal Description, Graphic Organizer}**

Cubes with Whole Numbers Using Volume – Concrete
(M, GP, WG, CP) S56, S57 (Answers on T135, T136.)

M, WG, GP, CP: Have students turn to page S56 in their books. Make sure partners know their designation as Partner A or Partner B. Pass out centimeter cubes. Calculators are optional. **{Concrete Representation, Verbal Description}**

MODELING

Cubes with Whole Numbers Using Volume - Concrete

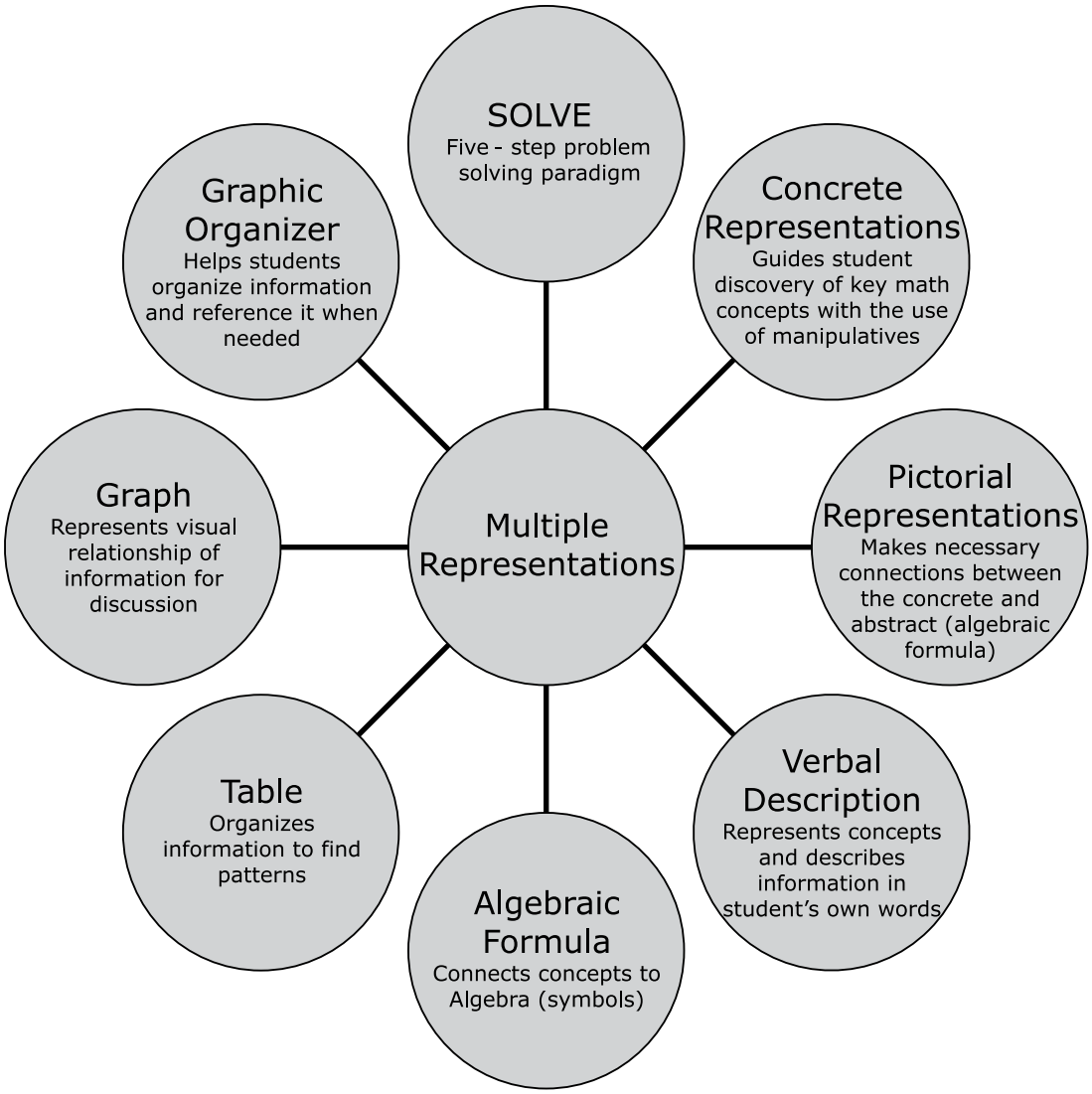
Step 1: Have student pairs answer Questions 1 and 2 and be ready to share answers with the whole group.
- Partner A, how did you find the area of the square in the warm-up? (Multiply the length times the width.) Record.
- Partner B, how did you write the units when finding the area? (units squared) Record.
- Have students discuss and then share with the group why they used units squared. (You use units squared because area tells how many squares cover the shape. Also, area is two-dimensional with length and width.) Record.

Step 2: Have student pairs place 1 centimeter cube in the space below Question 3.
- Have students discuss the attributes of the cube. (bottom or base of the cube is a square, all sides are equal, has six faces, has 3 dimensions, is a **three-dimensional figure**) Record any correct observations as they record on S56.
- Have student pairs discuss how a cube is different from other rectangular prisms. (A cube is a 3-dimensional figure with all side lengths congruent.) Record.
- Partner A, what is the third dimension of a cube besides length and width? (height) Record.
- Partner B, what is the length of the cube? (1 unit) Record.
- Partner A, what is the width of the cube? (1 unit) Record.
- Partner B, what is the height of the cube? (1 unit) Record.

Each lesson begins with a warm up activity which connects previously learned skills and concepts to the current topic. The warm-up sets the stage for new concepts being introduced in each lesson.

Multiple representations of the concept are incorporated in each lesson. These representations include concrete, pictorial, algebraic formula, verbal descriptions, graphs, graphic organizers and SOLVE – a problem solving paradigm. The multiple representations provide students with different learning styles and abilities the opportunity to acquire and apply knowledge of the lessson concept.

Each lesson contains "modeling boxes" which contain step by step instructions on how to model each concept. Modeling steps are provided for concrete, pictorial and procedural steps of the lesson.


SOLVE
Five - step problem solving paradigm
Graphic Organizer
Helps students organize information and reference it when needed
Concrete Representations
Guides student discovery of key math concepts with the use of manipulatives
Graph
Represents visual relationship of information for discussion
Multiple Representations
Pictorial Representations
Makes necessary connections between the concrete and abstract (algebraic formula)
Table
Organizes information to find patterns
Algebraic Formula
Connects concepts to Algebra (symbols)
Verbal Description
Represents concepts and describes information in student's own words

SOLVE

SOLVE is a 5-step problem-solving paradigm taught in the first three lessons of *The Key Elements to Mathematics Success* and throughout the program. SOLVE is an acronym which gives students step-by-step strategies for finding the solutions to word problems. The ultimate goal of teaching SOLVE is to provide students with a problem-solving strategy that can be applied to any concept they will encounter in mathematics. The steps are as follows:

Study the Problem
Underline the question.
This problem is asking me to find _____.

Organize the Facts
Identify the facts.
Eliminate the unnecessary facts.
List the necessary facts.

Line up a Plan
Write in words what your plan of action will be.
Choose an operation or operations.

Verify Your Plan with Action
Estimate your answer.
Carry out your plan.

Examine Your Results
Does your answer make sense? (Compare your answer to the question.)
Is your answer reasonable? (Compare your answer to the estimate.)
Is your answer accurate? (Check your work.)
Write your answer in a complete sentence.

Cooperative Pairs

Working in cooperative pairs is a vital part of *The Key Elements to Mathematics Success*. Cooperative learning allows students at various performance levels to work together, using a variety of learning activities, to improve their understanding. Communication about the learning process is an essential element of working in cooperative pairs. This dialogue enhances student learning and creates a sense of responsibility on the part of the students. Cooperative learning can be a catalyst in creating an atmosphere of achievement and a sense of accomplishment on the part of the students when the task is successfully completed.

Levels of Teacher Support

The lessons are carefully designed with opportunities for modeling, guided practice, and independent practice.

Modeling:
Each lesson contains "modeling boxes" which list step by step instructions on how to model each concept. Modeling steps are provided for concrete, pictorial, and procedural steps of the lesson.

Guided Practice:
Detailed instructions about how to structure guided practice are given in each lesson. Guided practice is led and closely monitored by the teacher. Students may work individually or in pairs during the guided practice.

Independent Practice:
Independent practice is provided through practice problems and homework in each lesson. Independent practice is structured to take place in the lesson following modeling and guided practice sections. Teachers can use the independent practice as a tool for informal formative assessment.

Word Problem Closure

At the end of the lesson, the SOLVE problem introduced at the beginning of the lesson is revisited. The student completes the additional steps of SOLVE, applying the lesson concept in a problem-solving situation.

Closure

Closure is a crucial part of every lesson and provides the teacher an opportunity to evaluate if the lesson objectives have been met. Teachers use the essential questions to reinforce the concept from the lesson, help organize the learning, and bring the lesson to its conclusion. A brief discussion of the essential questions will allow the teacher to informally assess student understanding of the material.

Homework

Homework is provided at the end of each lesson to give students ample opportunity to practice the lesson concept.

Quizzes

The lesson quizzes consist of 10 multiple-choice questions. These 10 questions cover the material taught in the lesson. The quizzes can also be used as homework, class work, review for a test, or as warm-ups.

Review Activities

Review activities are provided for many lessons. There are a variety of engaging activities including scavenger hunts and chain reactions. The activities are designed to provide multiple practice opportunities for the students in puzzle and game formats. The review activities incorporate the essential elements of cooperative learning and communication about the concepts.

The Key Elements to Mathematics Success – English Language Learner (ELL)

- **SOLVE** – A step-by-step procedure to attack word problems, dissecting the English language by identifying key words needed to solve the problem, and mapping out a plan with pictures and phrases to ultimately arrive at a well thought out answer. Steps can be written in students' native language while they are still becoming familiar with the process of SOLVE and gradually transitioning to English only. The steps of SOLVE have been modified slightly for use with ELL students. The modified steps provide additional support and involve verbal communication about the process, which is a vital link for the ELL student.

  S - Underline the question. TPIAMTF (this problem is asking me to find) – **THE** _____ . The students cannot just restate the question if they are made to start a sentence with *the*.

  O - Circle the necessary facts. When writing out the necessary facts, be as brief as possible and teach the students abbreviations right away ($, #, lb, cm, pkg. etc.).

  L - Choose an operation and discuss a plan out loud. – +, •, ÷

  number of nuts + number of bolts = total

  total • number of boxes = answer

  V - Estimate the answer out loud. Then use the set-up created in the L step to carry out the plan.

  E - Choose your answer.

- **Cooperative Pairs** – Working, questioning, and communicating with others regarding mathematics at all stages of learning. Activities are completed in an interactive setting, encouraging language and mathematical development. This includes the pairing of ELL students who speak the same language(s) with others who may be at varying stages of their English language development.
- **Modeling with Manipulatives** – Students participate in activities leading to the discovery of on-grade-level mathematical concepts. Through this process, they develop mathematical understanding while exploring ways of expressing their discoveries in English. Manipulative use is consistent throughout the program. The appearance of each manipulative, its meaning, as well as the language used to describe the actions of these manipulatives remain the same throughout.
- **Word Walls** – Updated through the use of KEMS lessons, new math vocabulary words (and their meaning/pictorial representation) are added for every new concept as it is discovered. The Word Wall is an interactive tool for all learners and provides an additional language resource for ELL students. Additionally an Operation Word Wall is created by each class and used for solving word problems throughout the year. As an added resource, words can be written in both English and the native language of the learner. Pictures/descriptions are also encouraged next to words wherever appropriate.
- **Video Clips of Each Lesson** – Available for use in class at www.KEMSmath.com, the video clips can help overcome the significant classroom language barriers ELL students face. These video clips, though in English, show key vocabulary words as a way of familiarizing students with appropriate vocabulary used to build a concept.

SOLVE Rubric

Solve	Considerations
S Underline the question(s). (1 pt) Answered the question "What is the problem asking me to find?" (2 pt) Total of 3 points	
O All math facts are identified. (2 pts) Unnecessary facts are eliminated. (2 pts) Necessary facts are listed. (1 pt) Total of 5 points	All facts get 2 points. Majority of facts get 1 point.
L No numbers used. (1 pt) Written as a phrase or sentence. (2 pts) Explained in a logical, sequential order. (2 pts) Use of correct operation(s). (2 pts) Total of 7 points	Logical, sequential order would include correct order of operations.
V Make estimation. (2 pts) Number sentence matches plan from L. (2 pts) Computation is correct. (2 pts) Total of 6 points	
E Sentence matches S. (1 pt) Estimate was reasonable for the answer. (1 pt) Answer is correct. (1 pt) Written in a complete sentence. (1 pt) Total of 4 points	Credit is given for writing the answer in a complete sentence, even if it is not the correct answer.

PROBLEM - SOLVING STORY FRAME

Characters _____

_____

Setting _____

Action

Fact # 1 _____

Fact # 2 _____

Other Facts _____

_____

Outcome (Main Question)

_____

_____

The Problem:

_____

_____

_____

_____

_____

_____

_____

_____

Problem Writing Rubric

		Points
Characters	1 point: Has a character 2 points: Has characters and uses them in problem	_____
Scene	1 point: Has a general scene 2 points: Has a scene in which the action takes place	_____
Action (Facts)	1 point: Has basic needed facts (min 2) 2 points: Includes more than 2 facts 3 points: Also includes unnecessary facts	_____
Outcome (Question)	1 point: Has very simple question 2 points: Has more complex 1 step question 3 points: Has a multi-step question	_____
	Total (max 10)	_____

Problem Writing Rubric

		Points
Characters	1 point: Has a character 2 points: Has characters and uses them in problem	_____
Scene	1 point: Has a general scene 2 points: Has a scene in which the action takes place	_____
Action (Facts)	1 point: Has basic needed facts (min 2) 2 points: Includes more than 2 facts 3 points: Also includes unnecessary facts	_____
Outcome (Question)	1 point: Has very simple question 2 points: Has more complex 1 step question 3 points: Has a multi-step question	_____
	Total (max 10)	_____

Planning for your Key Elements to Mathematics Success Class

Materials Needed: materials needed for both the teacher and the students including items from the manipulative kit, activities to prepare for pairs on cardstock, and/or pages to copy for class
Objective: (from teacher lesson notes)
Essential Questions: (from teacher lesson notes)
Word Wall Words: (from teacher lesson notes)
Agenda: Consider the following when planning each component of the lesson.

Activity	Time Frame	Notes/Details
Environment	N/A	• Groupings used today - seating arrangements needed? • Word Wall updates for this lesson? • Agenda, Objective & Essential Questions posted? • Needed technology set up?
Warm-up	_____ minutes	• What are some great questions to ask during the warm-up? • How does this warm–up relate to the lesson?

Lesson	_____ minutes	• What is the goal for today's lesson?
		• What materials are needed?
		• Is there an activity from the activities section of my TE that I will use to support this lesson?
		• How does the flow of this lesson encourage student discovery of the concept being covered? What questions need to be asked to guide the discovery of today's concept?
		• How does this lesson fit in with my district pacing guide?
		• How will this concept be enhanced with the traditional textbook?
		• How will I instruct partners to work?
		• Pages being covered today…
		• Complete SOLVE Problem
		ASK: What is the question asking me to find? (beginning of class)
		What are my facts?
		What is my plan? What operation is needed?
		Estimate an answer.
		Work out the answer.
		Check over work, choose answer.
		• What graphic organizer/foldable will be made/referenced?
		• <u>If time permits…</u>
		  • Will this section be used today?
		  • If so, how?
		• How will I use the quiz for this lesson?

Closure	_____ minutes	• Essential Questions • Homework assigned

Notes:

Planning for your Key Elements to Mathematics Success Class

Materials Needed:

Objective:
Essential Questions:
Word Wall Words:
Agenda:

Activity	Time Frame	Notes/Details
Environment	N/A	
Warm-up	_____ minutes	
Lesson	_____ minutes	
Closure	_____ minutes	

Notes: