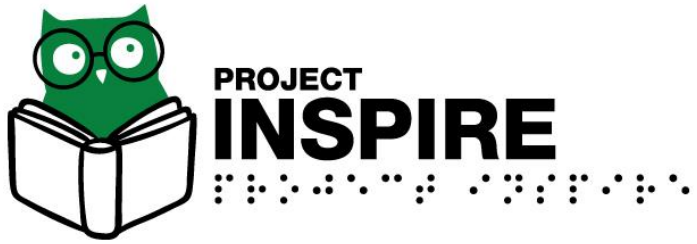
Grades 2 to 5: Nemeth Code Symbols for Fractions and Spatial Problems, Instructional Tools, Materials, and Technology

Lesson 6: Developing Students' Abacus Skills



University of South Carolina Upstate, Summer 2020

Lesson 6 Objectives

Participants will be able to:

1. Identify the different types of abaci available
2. Recognize pre-requisite skills students need prior to abacus instruction
3. Name the parts of the Cranmer abacus
4. Describe the different methods for using the abacus including the counting method, logic or partner method, and paper compatible method.

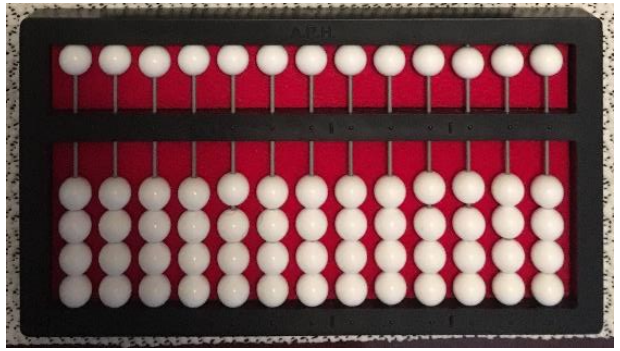
Activity 6A

What are the names of the 4 abaci?

A

B

C



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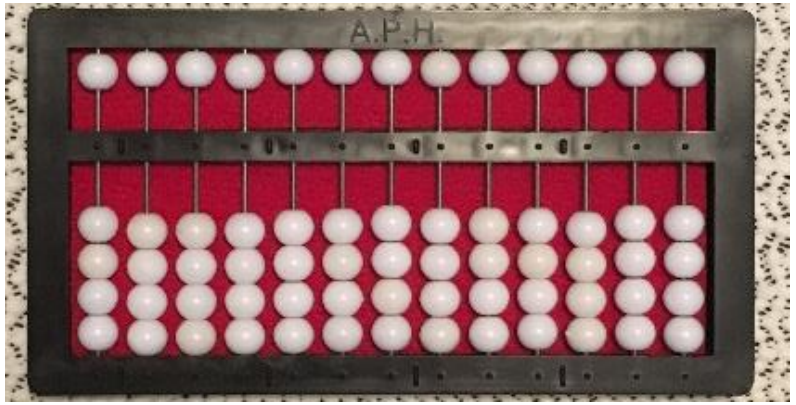


Activity 6A, Answer Key

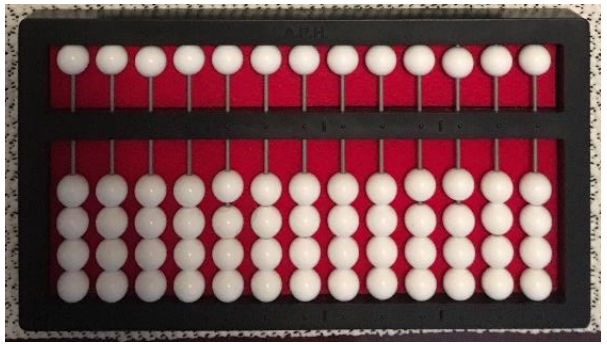
A

Beginner Abacus

B

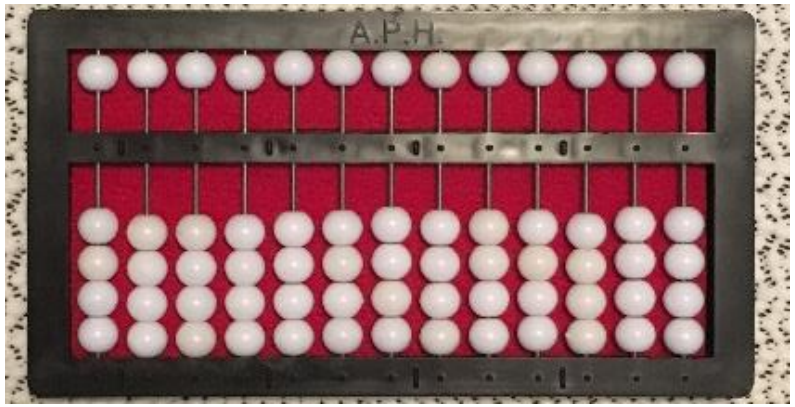
Expanded Beginner Abacus

C



Cranmer Abacus

D



Large Abacus

Activity 6B

Do you know the real names?

1. Those cute little white spherical things
2. That bumpy black bar about a third of the way down from the top of the abacus
3. What you do when you push one of those cute little white spherical things towards that bumpy black bar
4. What you do when you push one of those cute little white spherical things away from that bumpy black bar

Activity 6B, Answer Key

1. Those cute little white spherical things

   Beads

1. That bumpy black bar about a third of the way down from the top of the abacus

   Separation bar

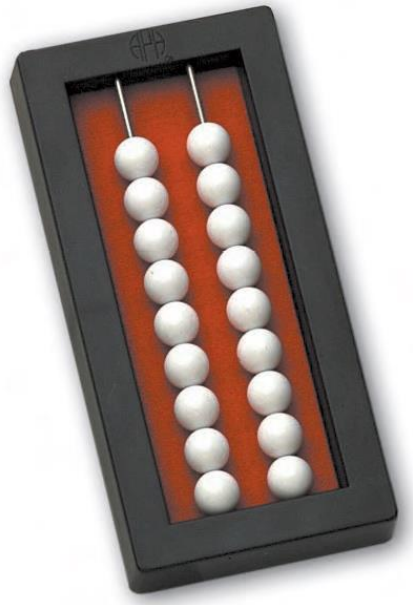
1. What you do when you push one of those cute little white spherical things towards that bumpy black bar

   Set

1. What you do when you push one of those cute little white spherical things away from that bumpy black bar

   Clear

In the Beginning…
Two Abaci to Choose From



The Beginner Abacus

- Set numbers through 99
- Place value for ones and tens

The Expanded Beginner Abacus

- Set numbers through 999
- Place value for ones, tens, and hundreds
- Set money

An idea: Put graphic tape on the middle (5^{th}) bead to mark as a benchmark number.

Beginning Skills Introduced with the Beginner Abacus

- Common abacus terminology
- One-to-one correspondence
- Rote counting
- Cardinality - connecting counting to the number of objects
- Place value
  - Setting/counting numbers in the ones column
  - Setting/counting numbers in the tens column
  - Setting/counting numbers in the hundreds column (if your abacus has 3 columns!)
  - Using multiple columns to set/count numbers

Introducing Computation with the Beginner Abacus

Number and operations

- Direct addition
- Regrouping or indirect addition
- Direct subtraction
- Regrouping or indirect subtraction

Common Core – Kindergarten – 2nd Grade

- Domains
  - Counting and Cardinality
  - Operations and Algebraic Thinking
  - Numbers and Operations in Base Ten
- Standards for Mathematical Practice

  1. Make sense of problems and persevere in solving them.
  2. Reason abstractly and quantitatively.
  3. Construct viable arguments and critique the reasoning of others.
  4. Model with mathematics.
  5. Use appropriate tools strategically.
  6. Attend to precision.

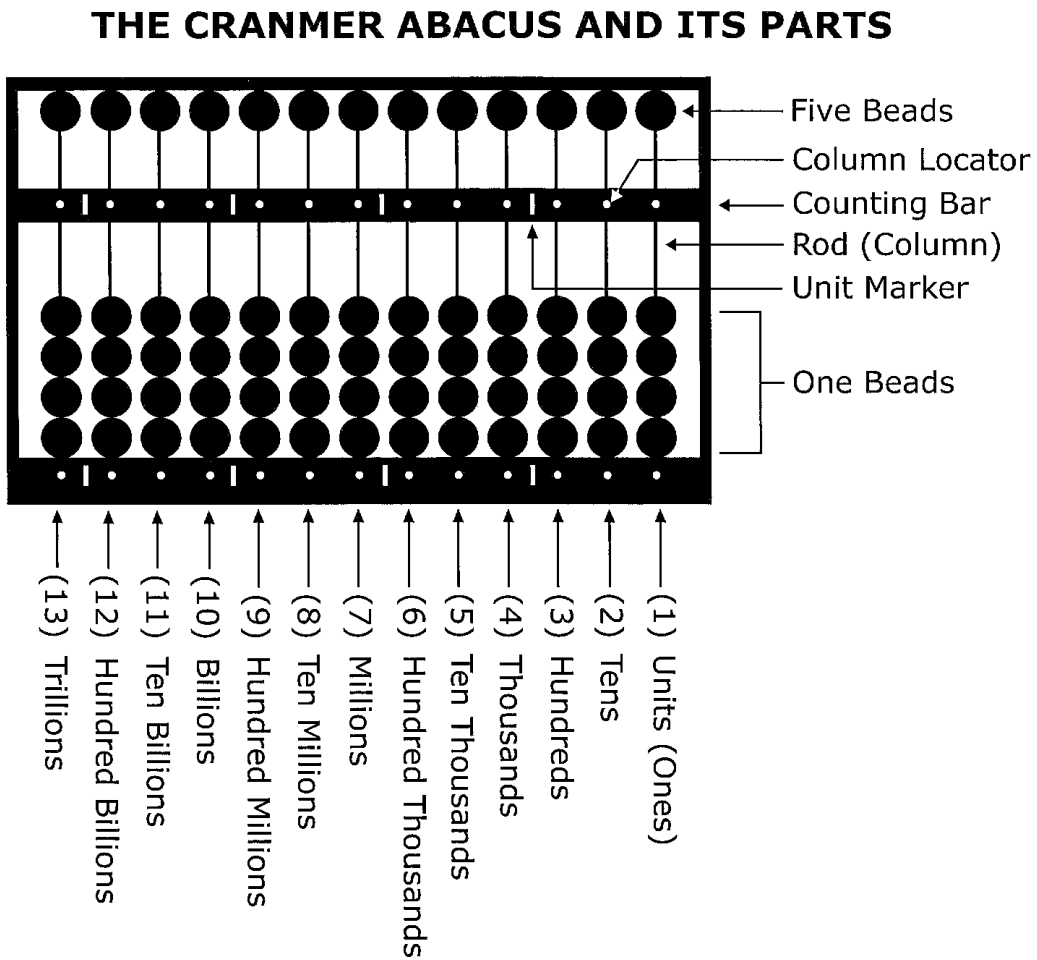
Fun Things to Do with the Beginner or Expanded Beginner Abacus

- Name the four seasons and set a bead for each
- Set a bead for every sound heard within a specified time
- Set a bead for each family member or each student at a school table
- Set a bead for each goal, basket, run, out, etc. in sports
- Set the total number of days until a special event and clear a bead each day until the event occurs

The Cranmer Abacus

- Invented by Tim V. Cranmer
- Design is based on the Japanese Soroban
- Regular and Large sizes
- Modifications
  - Tactile markings
  - Beads do not easily slide
- The abacus allows for:
  - Speed
  - Accuracy
  - Concept development
  - Portability

Parts of the Cranmer Abacus and Values of the Columns



Considerations for Abacus Instruction

- Student’s age
- Teach the parts of the abacus and their proper names.
- Teach terms such as “set” and “clear.”
- Teach proper fingering techniques.
- Teach students to clear before the next problem.
- Students need to have experience both with the abacus and braillewriter so they can show the “steps” to give evidence they understand the concepts.
- Don’t get caught up on one method, focus on the student’s learning style and individuality.

Promoting Student Success with the Abacus

- Place the abacus flat on a hard surface
- Consider using a nonskid mat (i.e. Dycem, rubber shelf liner, Grip-It shelf liner, Velcro)
- Place the abacus approximately 6 inches from the student
- Place the abacus with the single row of beads away from the student and parallel to the student
- Adults should have an abacus and work alongside their students.
- Sit beside the student, rather than facing them, to avoid reversal confusion.

Counting Method

- *Abacus Basic Competency: A Counting Method* by Susan M. Millaway
- *The Counting Method for the Cranmer Abacus* by Debra Sewell and John Rose
- Method of counting is comparable to method used with young sighted children.
- Method focuses on “exchanges” which is similar to “regrouping.”
- Students can build speed with the counting method.

TSBVI has a series of videos demonstrating the counting method.
http://www.tsbvi.edu/distance/sewell_abacus.html

The Logic or Partner Method

- *Use of the Cranmer Abacus* by Rita Livingston
- Focus is on the value of the beads.
- The logic/partner method:
  - Does not parallel what is taught in the general education classroom
  - Uses “synthesis” or “partners” of numbers
  - Allows students to develop shortcuts once they understand number concepts.

Preparing Students to Use the Logic or Partner Method

- Knowing compliments or partners that make up numbers through 10

  0+7 = 7
  1+6 = 7
  2+5 = 7
  3+4 = 7
  4+3 = 7
  5+2 = 7
  6+1 = 7
  7+0 = 7

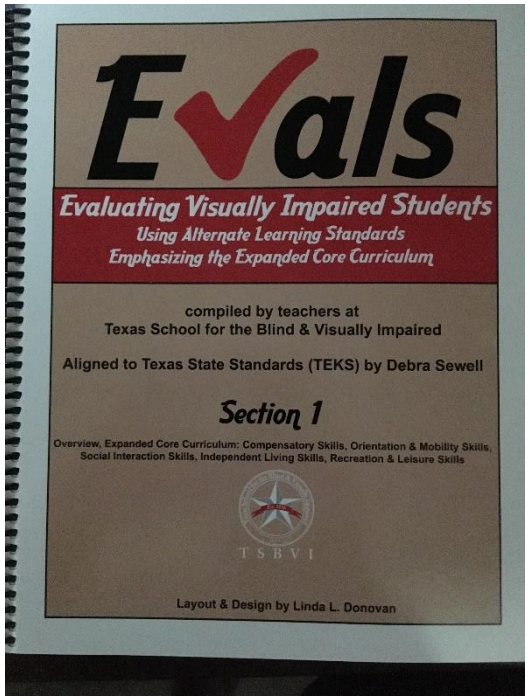
Paper Compatible Method

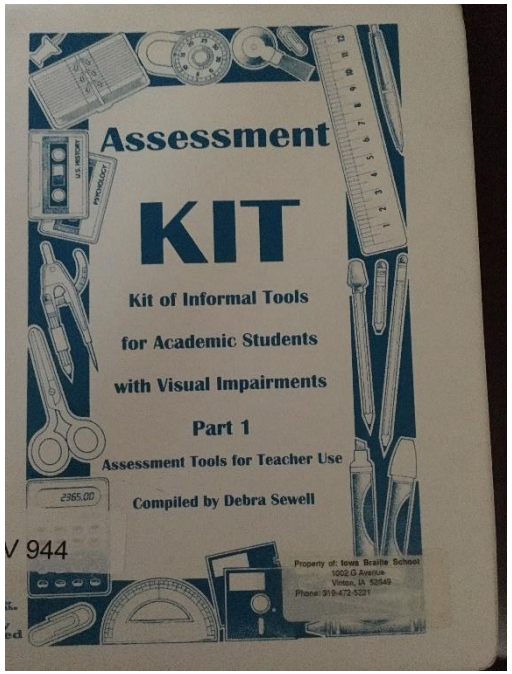
- *Handbook for Itinerant and Resource Teachers of Blind and Visually Impaired Students* by Doris M. Willoughby and Sharon Duffy
- Similar to paper and pencil method or algorithm method used in the classroom.
- Requires students to already have basic facts memorized.
- This method is not used as often as the counting or logic method.
- This method works well for students who are strong with mental math.

Skills Checklists

- *EVALS - Evaluating Visually Impaired Students* compiled by teachers at TSBVI

- *Assessment Kit: Kit of Informal Tools for Academic students with Visual Impairments, Part 1*





Prerequisite for Multiply and Dividing Using the Cranmer Abacus

The student must be able to demonstrate:

- Knowledge of the multiplication tables
- The ability to set and read numbers

For multiplication ×

- Knowledge of terms used in multiplication
- Knowledge of the rules of addition

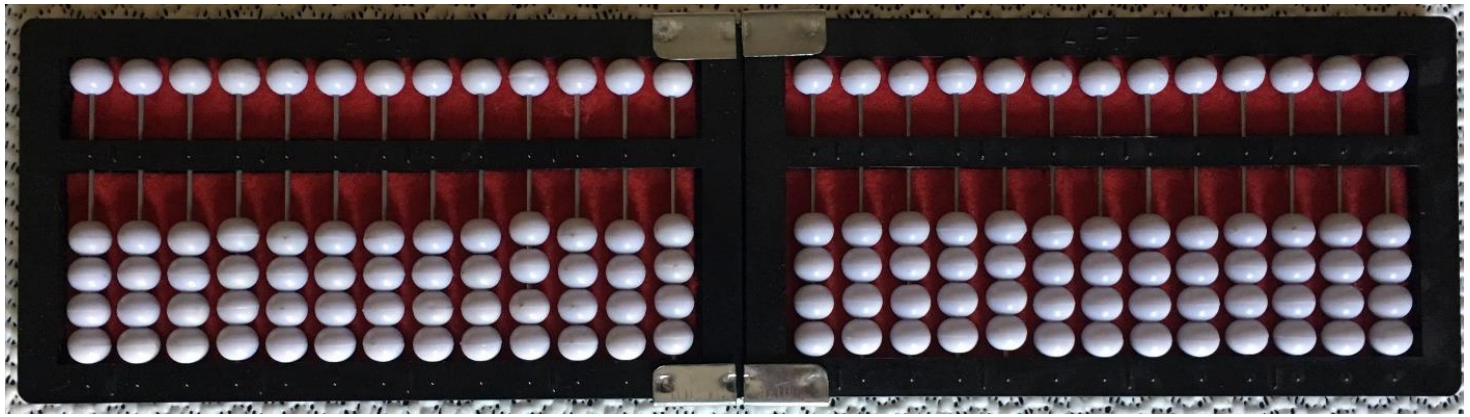
For division ÷

- Knowledge of terms used in division
- Knowledge of the rules of subtraction

See Sara Larkin's page for videos on how to multiply and divide using the Cranmer abacus.
https://www.iowa-braille.k12.ia.us/vnews/display.v/ART/55d61df71b7a4

Couplar

- Link two Cranmer abaci together.
- Used to
  - Work with larger numbers
  - Extend the number of decimal places in which the division can be carried out



From Beginning to End: What Can Be Done on the Abacus?

- Counting
- Addition, Subtraction, Multiplication, Division
- Decimals and Money*
- Fractions and Ratios*
- Percent*
- Greatest Common Factor
- Square Roots that don’t result in decimals*
- Adding and Subtracting Integers
- Prime Factorization

**Abacus Made Easy* and *Use of the Cranmer Abacus*

Prime Factorization

- Prime Factorization 1: includes setting numbers
  - http://www.youtube.com/watch?v=UiZZ1urGPg0
- Prime Factorization 2: includes setting numbers
  - http://www.youtube.com/watch?v=CduyrvUj1e4&feature=related

APH Position Paper: Appendix D: Use of an abacus in test-taking situations

"Whenever a test-taker is allowed to use a pencil and paper for working calculations, an abacus should be considered an equivalent substitution."

https://sites.aph.org/accessible-tests/position-papers/abacus-in-test-taking/