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Abacus Bees, Mental Math, and Mathematical Thinking

Why We Teach This Way and Why It Matters

Who This Presentation Is For

- Teachers of the Visually Impaired
- Abacus instructors
- Abacus Bee hosts and judges

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Session Goals

- Why people use the abacus
- Why blind students use the abacus
- Research supporting abacus instruction
- Why abacus bee problems are written the way they are
- What mental math is and is not
- How abacus use leads to mental math

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Learning Objectives

- Participants will identify and explain at least three reasons the abacus is used for mathematical calculation, including its benefits for blind and low vision students.
- Participants will analyze Abacus Bee problem structure and correctly explain at least two design features (such as horizontal layout or multiple operations) and their instructional purpose.
- Participants will distinguish mental math from related concepts and describe at least three stages in the progression from abacus use to mental math.

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“Why don’t students just use calculators?”

Calculators vs. Abacus

- Calculators give answers.
- The abacus builds understanding.

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The Abacus Is Not Obsolete

- Used for thousands of years
- Found across cultures
- Still used in education and commerce today

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The Abacus as a “Primary Tool”

- Like the wheel or lever
- Simple and efficient
- Independent of technology

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The Abacus Makes Place Value Physical

- Place value
- Grouping
- Quantity
- Complementary numbers

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Calculation Happens During Entry

- No separate “working out” step
- Rules drive accuracy
- Thinking and doing happen together

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“Isn’t abacus instruction outdated?”

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Abacus Instruction Is Research-Based

- The abacus remains one of the most effective tools for teaching number sense, especially for blind students.
- It is supported by decades of educational research and practice.

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Accessibility Is Not the Only Reason

- Not just a paper replacement
- A developmental tool
- Builds internal number concepts

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Tactile, Consistent, Stable

- Fixed layout
- Tactile feedback
- One-to-one correspondence

Supports Independence

- Faster than braille for computation
- Reduces reliance on others
- Encourages self-correction

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Cognitive Benefits

- Working memory
- Attention
- Sequencing
- Bilateral coordination

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“Why can’t students do mental math instead?”

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Mental Math Comes Later

- Mental math is the goal—but it comes later.
- The abacus builds the internal structures students need to succeed mentally and independently.

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The Abacus Is a Bridge

- Concrete → representational → abstract
- Not an endpoint
- Leads toward mental math

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What Research Shows

- Higher math achievement
- Stronger memory
- Improved reasoning
- Transfer to other subjects

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Abacus Mental Arithmetic Studies

- Higher averages
- Higher excellence rates
- Better retention

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Why This Matters for TVIs

- Blind students often get less computation practice
- Abacus restores rigor
- Ensures equal expectations

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Developmental Alignment

- Action-based learning
- Image-based thinking
- Abstract reasoning

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Common Bee Features

- Horizontal layout
- Multiple steps
- Long problem strings

C. 727 – 433 + 523 – 412 + 446 + 939 =

D. 201 + 961 + 157 – 153 + 546 + 546 =

E. 306 + 847 + 363 – 325 + 233 + 696 =

F. 178 – 102 + 883 – 867 + 848 + 102 =

G. 752 + 309 + 521 + 609 + 151 + 387 =

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“Why are the problems so long?”

This Design Is Intentional

- Not random
- Not just about speed
- Focused on process

A. $449 \times 54 =$

B. $878 \times 98 =$

C. $230 \times 31 =$

D. $733 \times 26 =$

E. $730 \times 54 =$

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Horizontal Layout Matters

- Mirrors oral math
- Removes visual alignment advantage
- Levels the field

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Multiple Steps Test Control

- Working memory
- Place value management
- Complement use

C. $9 + 5 + 4 - 2 =$

D. $6 + 4 + 1 + 0 =$

E. $8 + 1 + 7 + 9 =$

F. $7 + 5 + 7 + 4 =$

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Complementary Numbers Are Central

- 5-complements
- 10-complements
- Efficient computation

Guessing Does Not Survive

- Memorization fails
- Tricks fail
- Method succeeds

Bees Are Diagnostic

- Reveal misconceptions
- Identify weak skills
- Guide instruction

“Isn’t this too stressful?”

“Isn’t this too stressful?”

- Build confidence through preparation
- Reward growth and effort
- Normalize complex thinking
- Supportive instruction reduces anxiety.

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What Mental Math IS

- Internal number manipulation
- Structured reasoning
- No external tools

What Mental Math Is NOT

- Guessing
- Speed without accuracy
- Tricks without understanding

Abacus ≠ Cheating

- Scaffolded cognition
- Like training wheels
- Temporary support

Why Mental Math Is the Goal

- Independence
- Confidence
- Real-world math use

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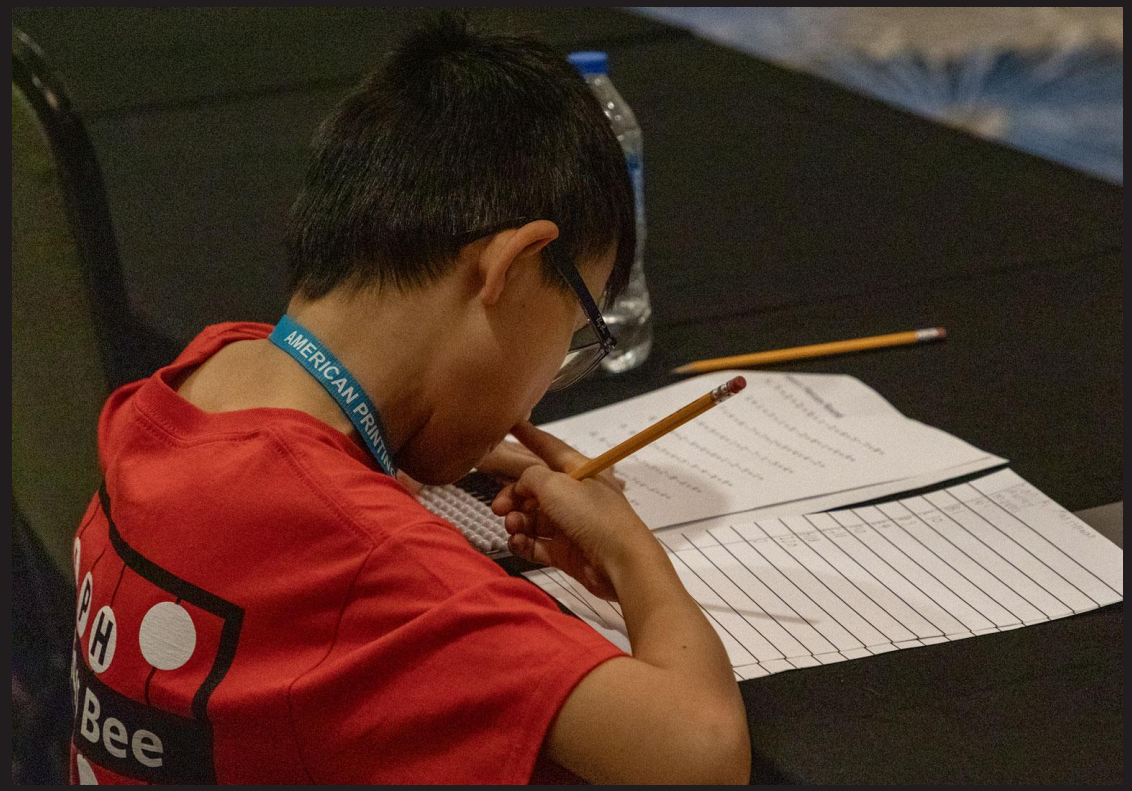
Abacus Builds Mental Images



- Beads become imagined
- Movements internalized
- Structure remains

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Mental Abacus Is Not Separate

- Same rules
- Same structure
- Same thinking

Physical Mastery Comes First

- Prevents fragile strategies
- Ensures accuracy
- Builds confidence

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A Common Mistake

- Pushing mental math too early
- Leads to errors and anxiety

Abacus Bees Support Transition

- Reward fluency
- Normalize complexity
- Encourage endurance

Key Takeaways

- Abacus use is intentional
- Research supports its value
- Bee design is purposeful
- Mental math is the goal

Reframing the Abacus Bee

- Not just speed
- Not just competition
- A celebration of thinking

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“The abacus is not about beads — it is about how students learn to think about numbers.”

Tom Sato, Educational Specialist at The Soroban School, New York, New York