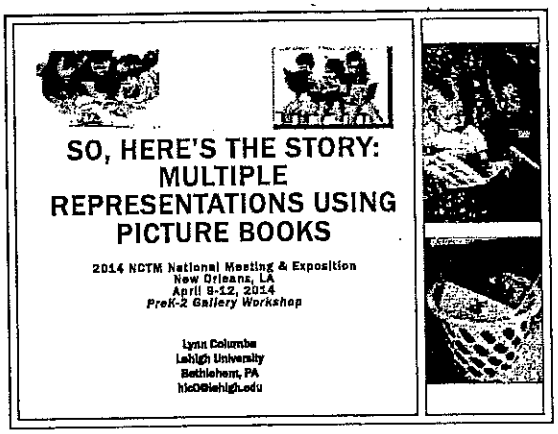
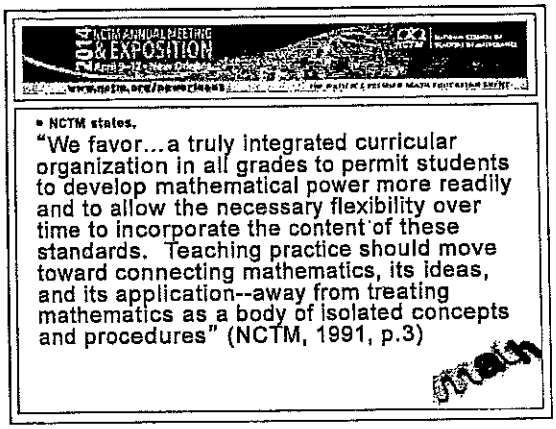
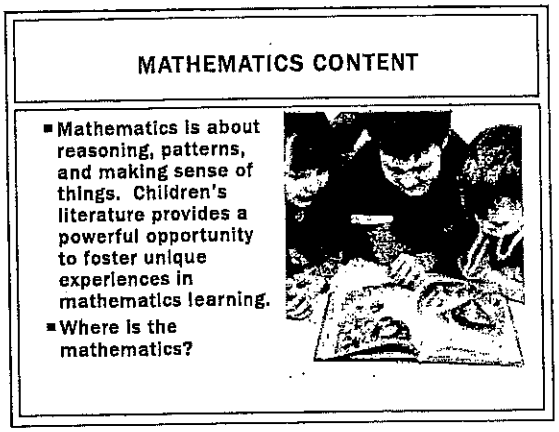
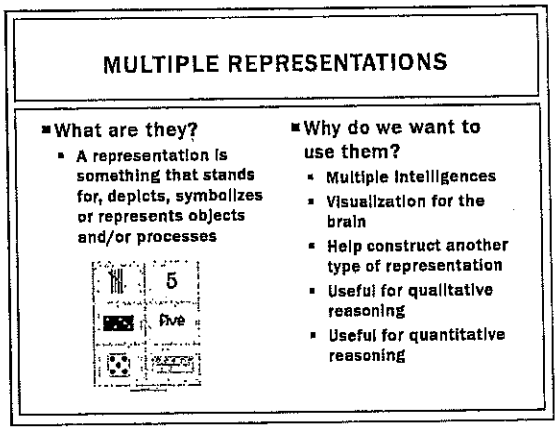
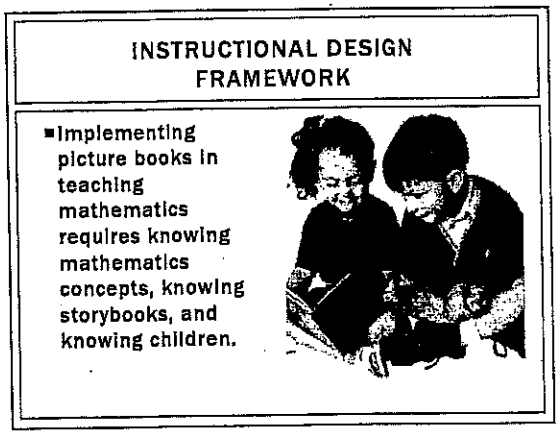
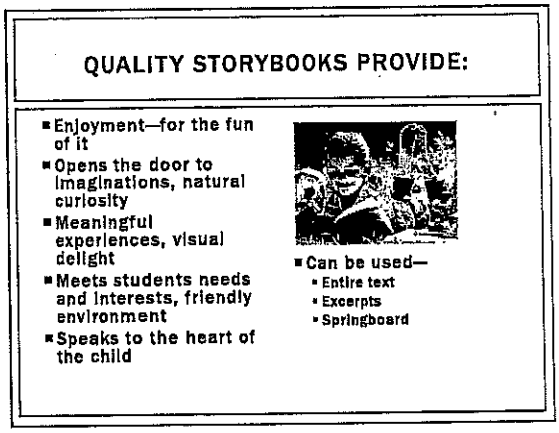

SO, HERE'S THE STORY:
MULTIPLE REPRESENTATIONS USING PICTURE BOOKS
2014 NCTM National Meeting & Exposition
New Orleans, LA
April 9-12, 2014
PreK-2 Gallery Workshop
Lynn Columba
Lehigh University
Bethlehem, PA
lkc0@lehigh.edu


2014 NCTM ANNUAL MEETING & EXPOSITION
NCTM states,
"We favor...a truly integrated curricular organization in all grades to permit students to develop mathematical power more readily and to allow the necessary flexibility over time to incorporate the content of these standards. Teaching practice should move toward connecting mathematics, its ideas, and its application--away from treating mathematics as a body of isolated concepts and procedures" (NCTM, 1991, p.3)


MATHEMATICS CONTENT
Mathematics is about reasoning, patterns, and making sense of things. Children's literature provides a powerful opportunity to foster unique experiences in mathematics learning.
Where is the mathematics?

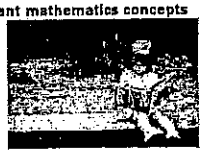

MULTIPLE REPRESENTATIONS
What are they?
A representation is something that stands for, depicts, symbolizes or represents objects and/or processes
5
Five
Why do we want to use them?
Multiple intelligences
Visualization for the brain
Help construct another type of representation
Useful for qualitative reasoning
Useful for quantitative reasoning


INSTRUCTIONAL DESIGN FRAMEWORK
Implementing picture books in teaching mathematics requires knowing mathematics concepts, knowing storybooks, and knowing children.


QUALITY STORYBOOKS PROVIDE:
Enjoyment—for the fun of it
Opens the door to imaginations, natural curiosity
Meaningful experiences, visual delight
Meets students needs and interests, friendly environment
Speaks to the heart of the child
Can be used—
Entire text
Excerpts
Springboard

WHAT IS A QUALITY PICTURE BOOK?

- Complex question—varies by what is engaging, relevant, and appropriate
- Criteria for workshop:
  - Engaging to the reader
  - Age appropriate
  - Balance of the collection—variety
  - Meaning and relevant mathematics concepts

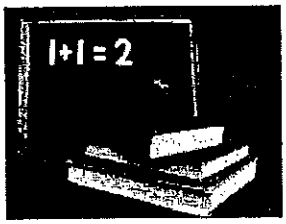


Quality children's literature—*intentionally selected to promote student learning of mathematics*—can lead to the joy of learning through experiencing books

CATEGORIES OF BOOKS

Different ways mathematics content is presented—

Content Explicit
Content Implicit
Content Invisible

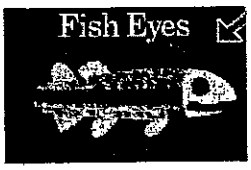


Columba, L., Kim, C. Y., & Moe, A. J. (2009). *The power of picture books to promote young math, science, and social studies: Grades PreK-2* (2nd ed.). Scottsdale, AZ: Holcomb Hathaway.

MATHEMATICS CONTENT

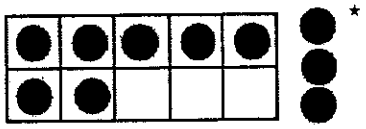
- Discovering patterns and relationships
  - *Fish Eyes*, Ehlert,—one more than
  - *Pattern Fish*, Harris—ABAB, ABCABC
- Solving problems, inquiry approach
  - *12 Ways to Get to 11*, Merriam—associative property
  - *The Water Hole*, Base—groups of ten
- Connecting to real-life situations, authentic problems
  - *Barn Savers*, High—triangles
  - *Tally O'Malley*, Stuart—hash marks, data collection
- Reasoning skills
  - *Actual Size*, Jenkins—estimating area of hand
  - *How Big is a Foot?*, Myller—size of foot, thumb—create a graph

FISH EYES

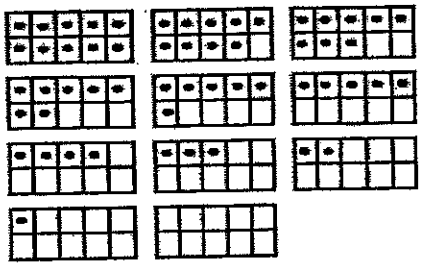


- Vibrant fish have cutout eyes to draw the reader into the journey through rivers and seas...
- A small, dark fish says "Follow me" to create the "one more than" strategy of counting on 1 to find sums
- **Ten Frames—1more than**

LARGE TEN FRAME TEMPLATE



TEN FRAMES



EGG CARTON TEN FRAMES

PATTERN FISH

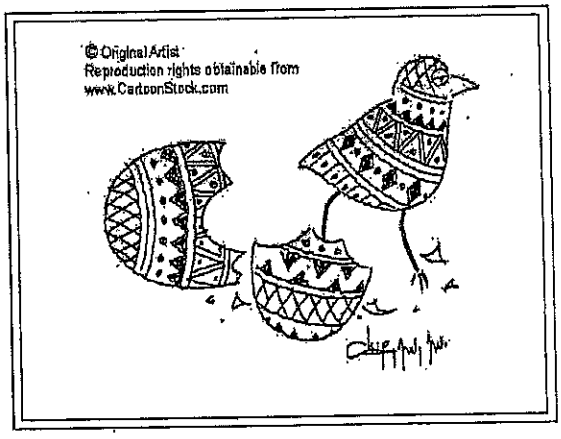
- Repeating patterns all around us
- Labeling patterns—ababab
- Growing patterns—abaabaaab
- **Tiles to create patterns**

PATTERNS AND RELATIONSHIPS

- Mathematics –the science of patterns
  - Logical patterns exist and are a regular occurrence in mathematics
  - Both words & symbols
  - Physical, geometric situations, & numbers
  - Identifying and extending patterns is an important process in algebraic thinking
- Where do we find patterns?

PATTERNS AND BEYOND

- Clements and Sarama (2009) view patterning as "the search for mathematical regularities and structures" (p. 190), which extends beyond the repetitive pattern of ABAB.
- **Clapping, snapping patterns**
- "Stripe-dot-dot, stripe-dot-dot."
- Connecting cubes
- "Oom-pa-pa, oom-pa-pa."
- Represent with letters

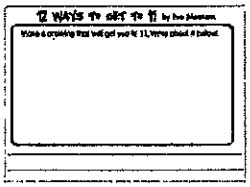


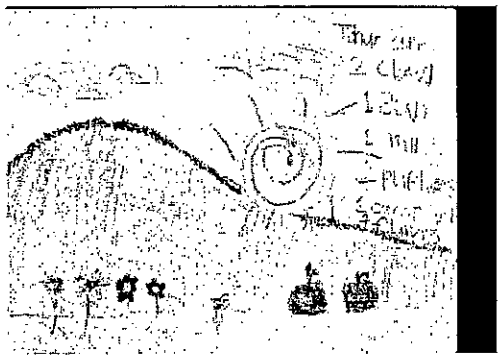
12 WAYS TO GET TO 11

- Associative Property- the order of the addends does not change the sum—the Turnarounds
- A variety of addends to total 11
- Express numbers in a variety of equations

CREATE A CLASS BOOK

- All Our Ways to Get to 11



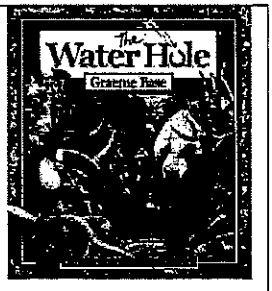


CONNECTING TO REPRESENT 12 WAYS TO GET TO 11

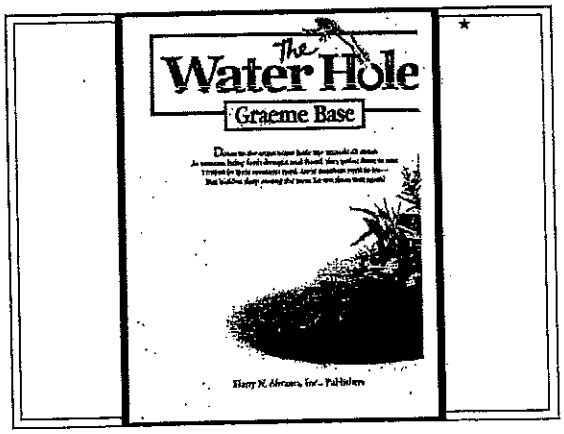
- My number is ____.
- Here are three ways to write my number—
  - ___ + ___ + ___ = ___
  - ___ + ___ + ___ + ___ = ___
  - ___ + ___ = ___

THE WATER HOLE

- Why is the water hole getting smaller?
- Look closely at the habitats.
- Look closely at the border on each two-page spread.
- Illustrate a habitat with animals from 39-100.
- **Groups of ten—place value**

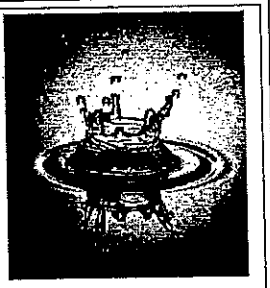


- Connections: Life science and environmental science
- Verbal problems for the number of animals at the waterhole—represent with "groupable" materials, e.g. base-10 pieces



SOLVING PROBLEMS, INQUIRY APPROACH

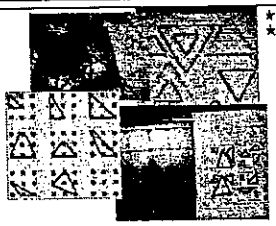
- Investigating the meaning of operations
- The inquiry approach is more focused on using and learning content as a means to develop information-processing and problem-solving skills
- More student centered, with the teacher as a facilitator of learning.
- More emphasis on "how we come to know" and less on "what we know."
- Students are more involved in the construction of knowledge through active involvement.
- Environmental questions and issues



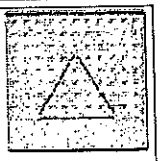
BARN SAVERS

- The celebration of something new something old.
- Recycling
- Architecture
- Barns in the community
- Geoboards-triangles

MULTIPLE REPRESENTATIONS OF TRIANGLES



Physical and virtual geoboards-http://nlvm.usu.edu/



Rotate 90° with students' eyes closed, open, "is the same triangle?" Repeat 3 more times.

TALLY O'MALLEY

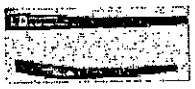
- Collecting data using tally marks
- Pizza Survey
- Multiple Representations

Eric, Nell, & Bridget

CONNECTING TO REAL-LIFE, AUTHENTIC PROBLEMS

- Problems Solving—Number One Strand in the *Standards*
- Approaches to investigate and understand mathematics content
- Focus on ways to equip students with an ability to learn things that no one yet knows

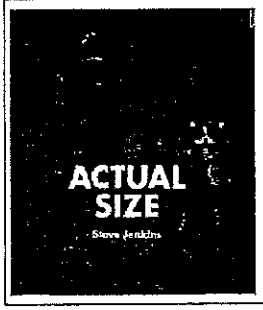
- Tally Sticks—historical artifacts



Ishango Bone marking lunar cycles

Upper Paleolithic Era

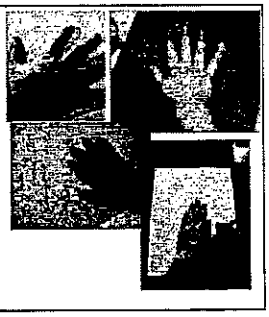
ACTUAL SIZE



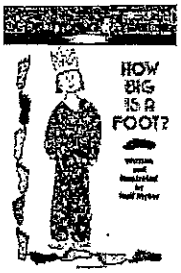
- Visually stunning—sometimes facts and figures do not tell the whole story .
- Comparing sizes
- Ordering by size
- Vocabulary development for small and large- "humongous"
- Discourse-continuous questioning
- **Estimating area of hand**

- Trace your hand
- Estimate the area
- How many tiles/ counters to cover the space?

- Compare to the gorilla or other objects



HOW BIG IS A FOOT?

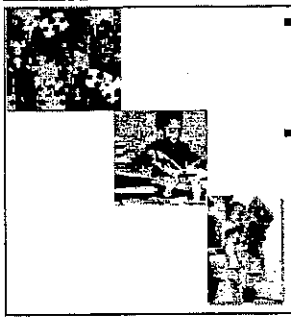


- Measurement, graph of thumb
- Need for standard units of measure
- applying the measuring process to everyday life
- measuring objects with foot size
- http://illuminations.nctm.org/LessonDetail.aspx?ID=L205

MEASURING, CREATING GRAPHS

- Measure thumb, hand span, big toe, foot, thumb
- Create a representation of the data collected, such as a graph

REASONING AND MULTIPLE REPRESENTATIONS



- Through the use of reasoning and multiple representations, students learn that mathematics makes sense.
- Multiple representations must be a consistent part of student's mathematical experiences in prekindergarten through grade 12.

NCTM'S *PRINCIPLES AND STANDARDS*

Content	Process
Number and Operations	Problem solving
Algebra	Communication
Geometry	Reasoning
Measurement	Connections
Data and Probability	Representation

STANDARDS BY DOMAIN-CCSSM

- Counting & Cardinality ✔
- Operations & Algebraic Thinking ✔
- Number & Operations in Base Ten ✔
- Number & Operations—Fractions
- Measurement & Data ✔
- Geometry ✔
- Ratios & Proportional Relationships ✔
- The Number System
- Expressions & Equations
- Functions
- Statistics & Probability

COMMON CORE

NCTM'S *FOCAL POINTS* PURPOSE

- To build students' strength in the use of mathematical processes, instruction in the content areas should incorporate:
  - The use of mathematics to solve problems
  - An application of logical reasoning to justify procedures and solutions
  - An involvement in the design and analysis of multiple representations to learn, make connections among, and communicate about the ideas within and outside of mathematics

Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics, NCTM, 2006

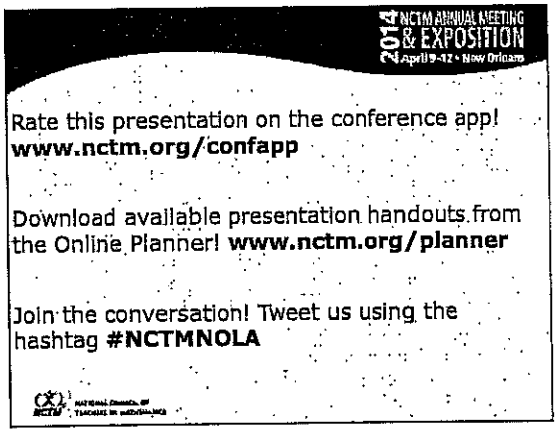
COMMON CORE STATE STANDARDS IN MATHEMATICS-MATHEMATICAL PRACTICES

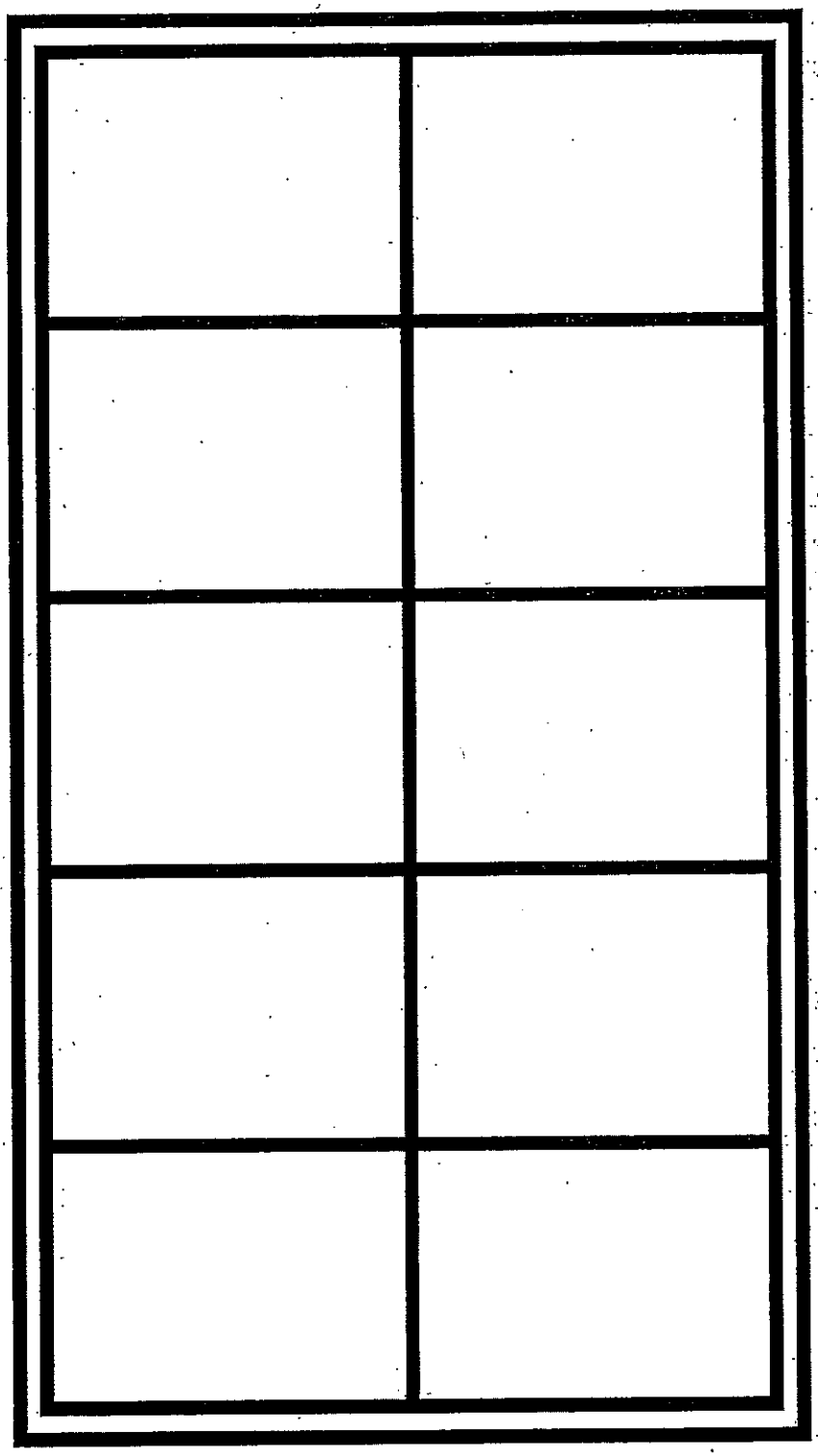
1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. ✔ Model with mathematics.
5. ✔ Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

IN CONCLUSION

"I hope these books unlock the power of learning for the young mathematicians, readers, and writers in your classrooms....

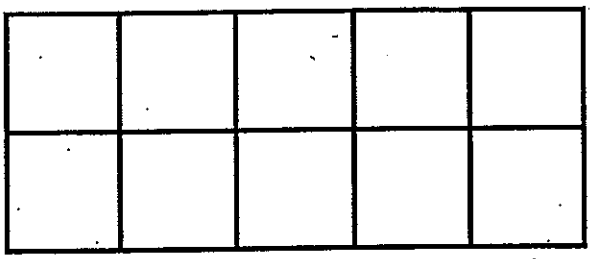
Wishing you good teaching and a terrific NCTM conference!"

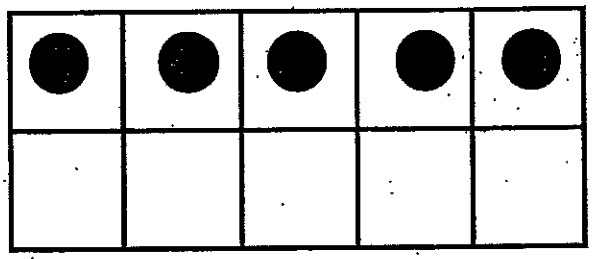


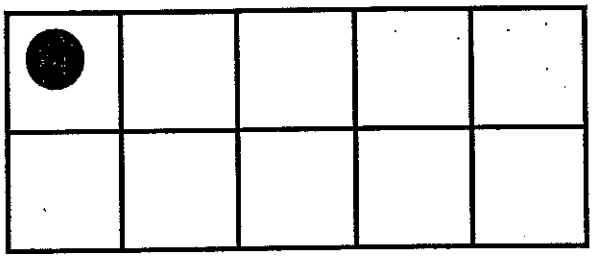


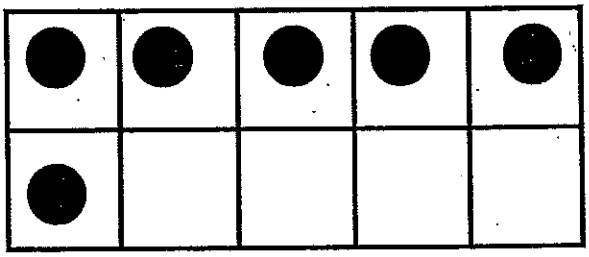
BLM 1—Ten-frame

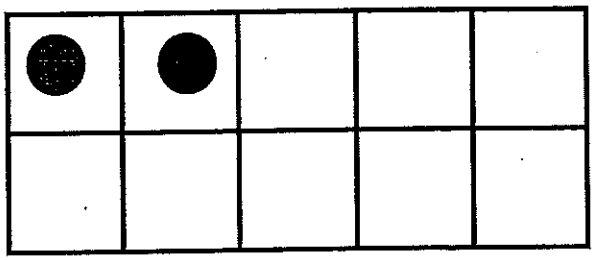
Small Ten Frame Cards

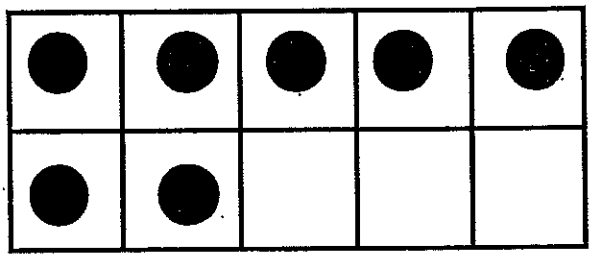


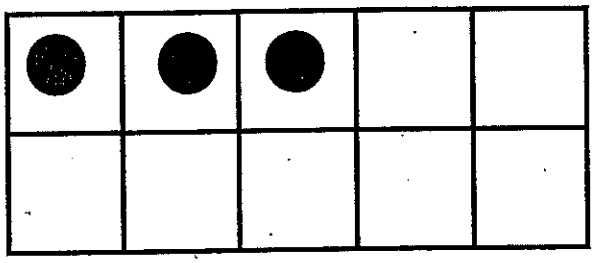


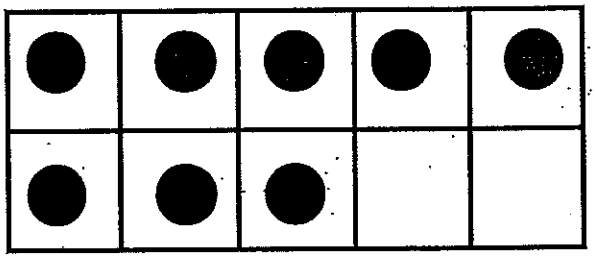


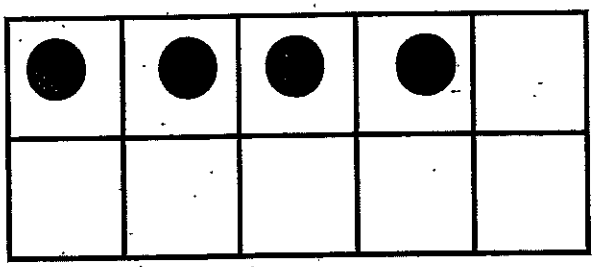


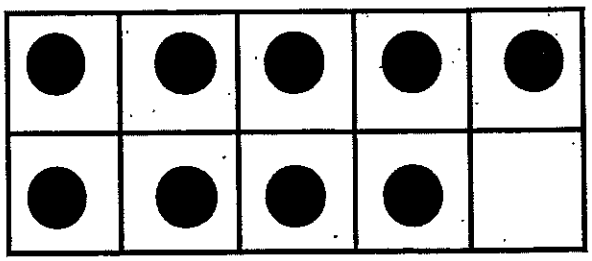












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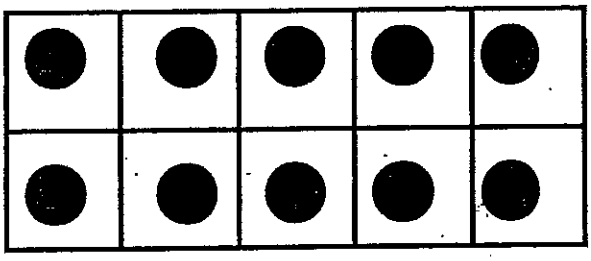
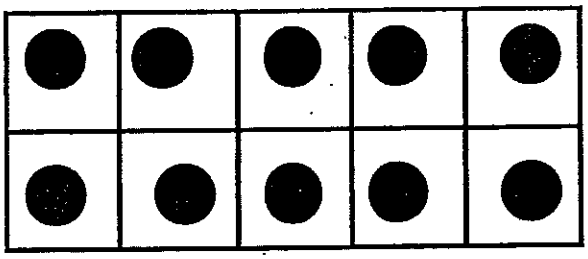
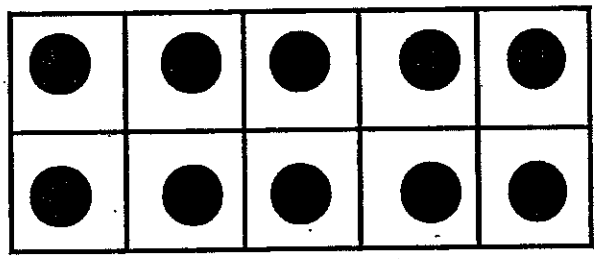
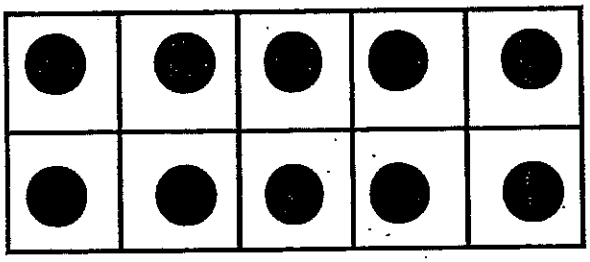
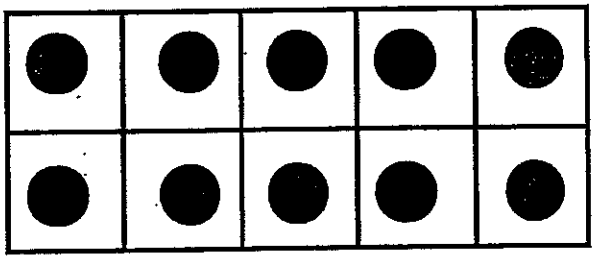
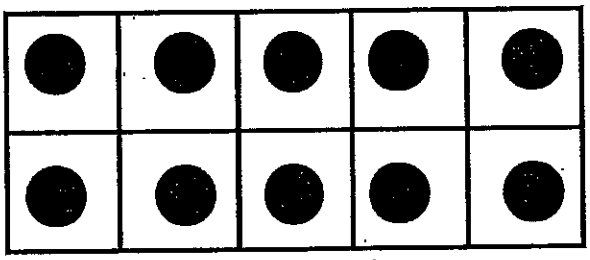
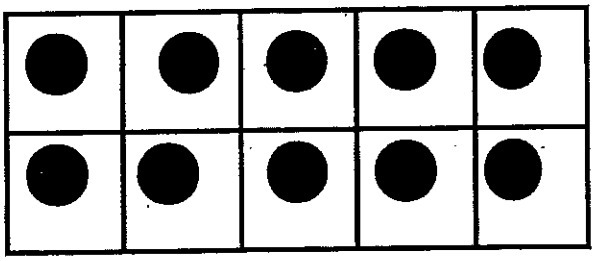
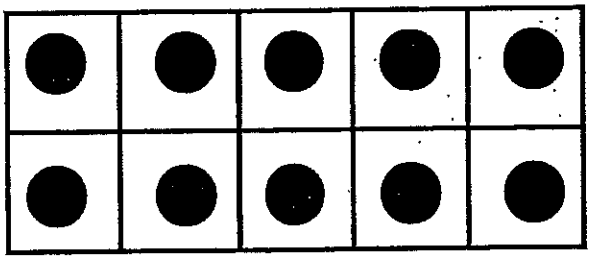
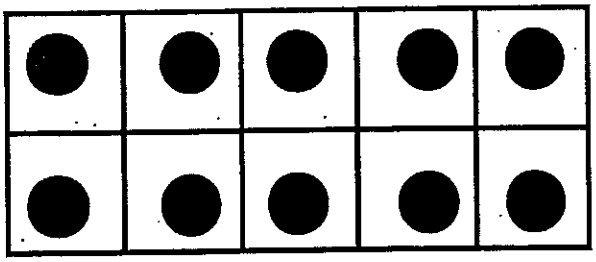
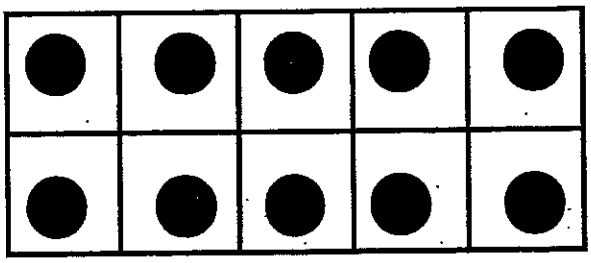

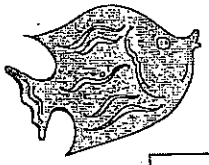

Goldfish Graph

RED	Orange	Green	Purple	Yellow

Name_____