The eLearning Instructional Design symposium

Session

1

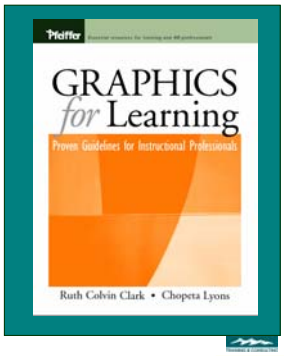
More than a Pretty Picture: Evidence-based Guidelines for Effective Instructional Visuals

Ruth Clark

President, Clark Training & Consulting

This event produced by

Graphics for Learning

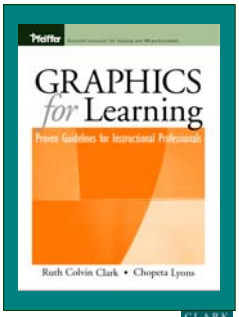


Ruth Clark

www.clarktraining.com

Do Graphics Help?

- Do Graphics Improve Performance and Learning?
- Are All Graphics Equal?
- 3 Views of Graphics:
  - Surface Features
  - Communication Functions
  - Psychological Functions



How Much Did We Spend?

The Power of Graphics

Attention

Emotion

Distract

Disrupt

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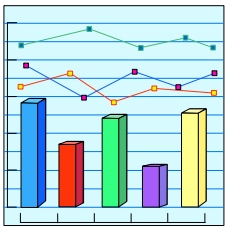
Evidence-Based Practice

Scientifically-Based Research

"The application of rigorous, systematic, and objective procedures to obtain reliable and valid knowledge relevant to education activities and programs".

- No Child Left Behind Act Section 9101



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Which Is Better...

This? Or This??

A B

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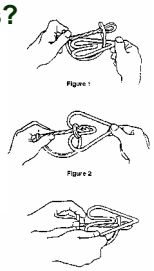
Which Is Better...

This?



A

Or This??

1.To remove heart, start by holding heart by pointed end, horizontally and parallel to twisted bar. Draw indented part of heart, from inside to outside, through eye of curved bar.

2. Position eye of twisted bar so that it can be dropped downward through the indented part of the heart.

3. With twisted bar now below the heart, draw indented part back through the eye of the curved bar. The heart is now free.

B

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Which Is Better...

This?

A

Or This??

B

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Heart Breaker Demonstration

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Performance Vs. Learning

Performance: Doing the job better as a result of help available while doing the work. Will not necessarily reside in memory.

Learning: Doing the job better as a result of acquiring new knowledge and skills in memory.

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Performance Vs. Learning

Performance: Doing the job better as a result of help available while doing the work. Will not necessarily reside in memory.

Learning: Doing the job better as a result of acquiring new knowledge and skills in memory.

Which was the heart-breaker puzzle demo?

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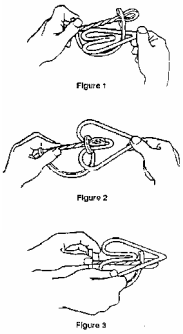
Do Graphics Improve Performance?



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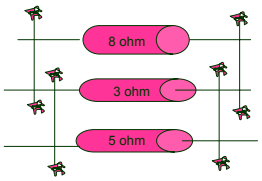
Do Graphics Improve Performance? Research

Text Format:

Using the resistors supplied, make the following connections:

- Connect one end of an 8 ohm resistor to one end of a 3 ohm resistor, and connect the other end of the 8 ohm resistor to the other end of the 3 ohm resistor.
- Connect one end of the 3 ohm resistor to one end of a 5 ohm resistor, and connect the other end of the 3 ohm resistor to the other end of the 5 ohm resistor

Diagram Format:



Marcus et al, 1996

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Do Graphics Improve Performance? Research

Data = Seconds to solution

Mode	Single Series (Easy)	Multiple Series (Moderate)	Parallel (Difficult)
Diagram	59.93	63.13	65.60
Text	85.73	91.00	176.73

Marcus et al, 1996

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Do Graphics Improve Learning? Research

Words Only:
How the bicycle pump works

"As the rod is pulled out, air passes through the piston and fills the area between the piston and the outlet valve. As the rod is pushed in, the inlet valve closes and the piston forces air through the outlet valve."

Clark & Mayer, 2002

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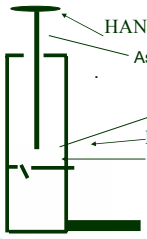
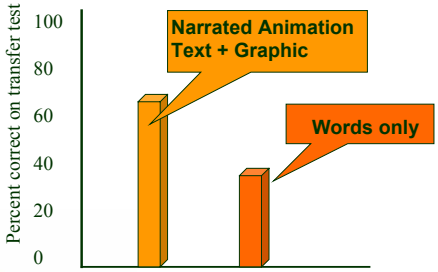
Do Graphics Improve Learning? Research

Words + Graphic:
How the bicycle pump works:



Clark & Mayer 2002

Do Graphics Improve Learning? Research



Clark & Mayer 2002

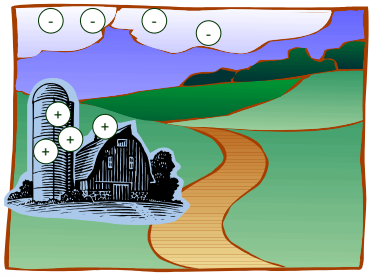
Do Graphics Improve Learning? Research

9 Experiments comparing words only to words and graphics found an average **gain of 89%** on transfer tests for combination of words + graphics

Are All Graphics Equal?

Base Text and Graphic

Lightning results from the difference in electrical charges between cloud and ground.



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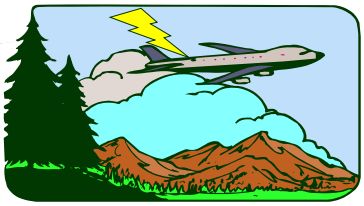
Are All Graphics Equal?

Seductive Text and Graphics Added to Base

Metal airplanes conduct lightning very well, but they sustain little damage because the bolt passes right through.

Harp & Mayer, 1998



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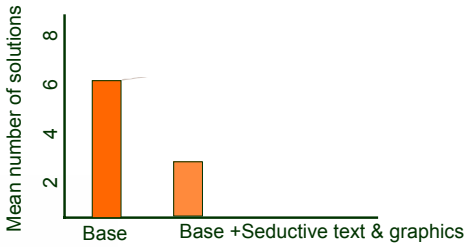
Are All Graphics Equal?



Harp & Mayer, 1998

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Three Views of Instructional Graphics

- Surface Features
- Communication Function
- Psychological Functions

See Appendix

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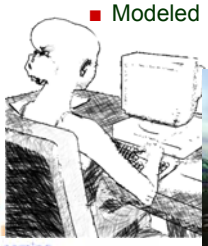
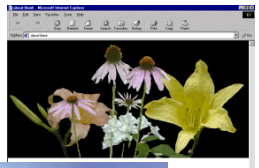
View 1: Surface Features Static

- Illustration
- Photograph
- Modeled





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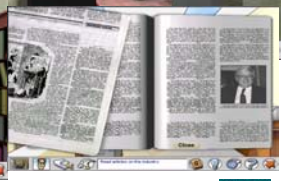
View 1: Surface Features Dynamic

- Animation
- Video
- Virtual Reality



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View 2: Communication Functions

- Decorative
- Representational
- Mnemonic
- Organizational
- Relational
- Transformational
- Interpretive

Carney and Levin, 1981, 2002

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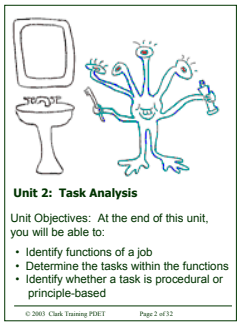
Decorative

Aesthetic purposes



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Representational

Represents object

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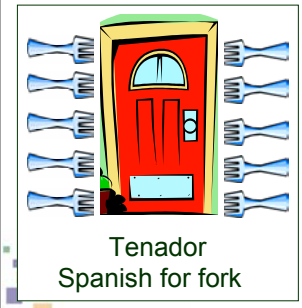
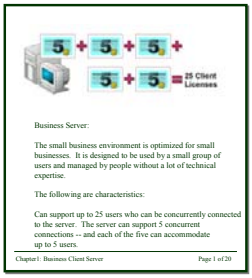
Mnemonic

Memory support





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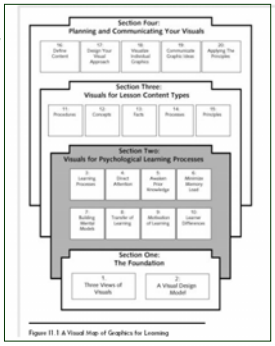
Organizational

Qualitative relationships among content



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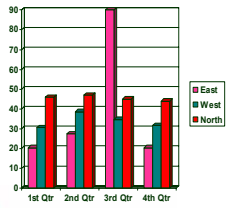
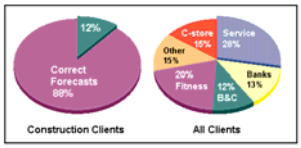
Relational

Quantitative relationships





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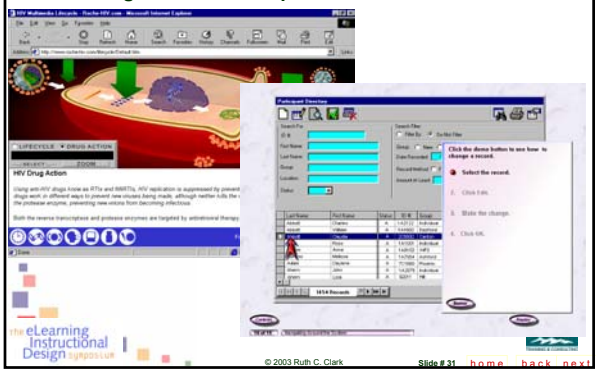
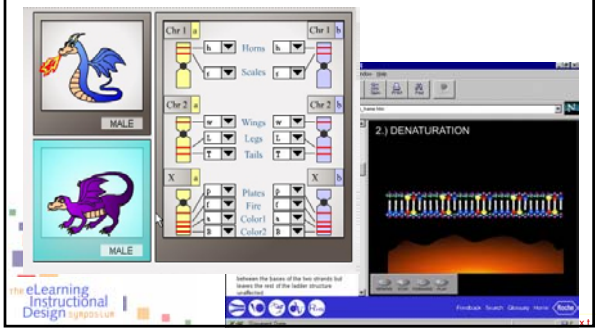
Transformational

Change over time or space



Interpretive

Models theory or principles; Makes concrete the abstract



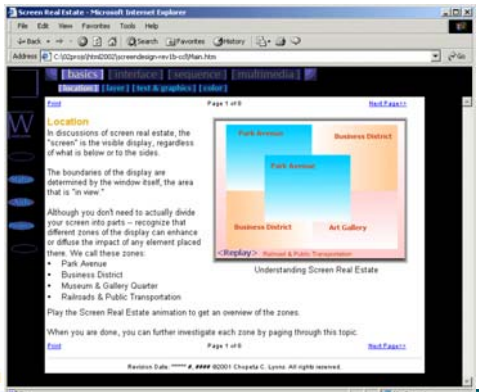
Activity

Consider a sample instructional graphic and determine its:

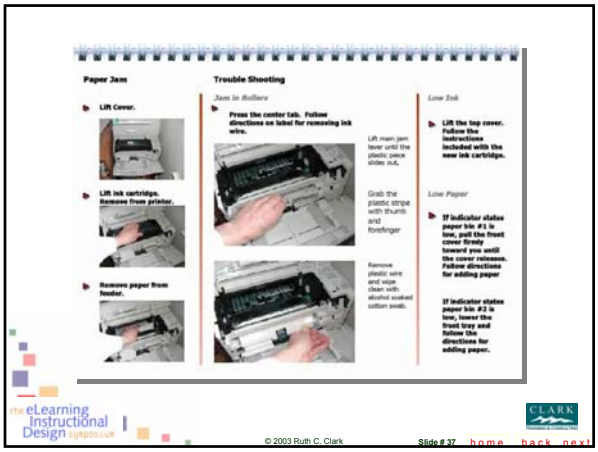
- Surface features
- Communication function (s)

Tip: Use job aid tables in your handout


Becoming Human: Paleoanthropology, Evolution and Human Origins - Microsoft Internet Explorer
BECOMING HUMAN
CONTENTS
NEWS & VIEWS
LEARNING CENTER
RESOURCES
SITE CREDITS
Homo sapiens
Internet


Screen Real Estate - Microsoft Internet Explorer
Location
Park Avenue
Business District
Art Gallery
Understanding Screen Real Estate
Museum & Gallery Quarter
Railroads & Public Transportation
Play the Screen Real Estate animation to get an overview of the zones.
When you are done, you can further investigate each zone by paging through this topic.


FUJITSU
HAVE YOU CHECKED YOUR MESSAGES?


Paper Jam
Trouble Shooting
Lift Cover.
Lift ink cartridge. Remove from printer.
Remove paper from feeder.
Jam in Rollers
Press the center tab. Follow directions on label for removing ink wire.
Low Ink
Lift the top cover. Follow the instructions included with the new ink cartridge.
Low Paper
If indicator states paper bin #1 is low, pull the front cover firmly toward you until the cover releases. Follow directions for adding paper
If indicator states paper bin #2 is low, lower the front tray and follow the directions for adding paper.
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Methods for Treating Wastewaters from Industry
Biological Methods of Wastewater Treatment: Activated Sludge
BIOLOGICAL METHOD OF WASTEWATER TREATMENT
Aerobic
Anaerobic
Suspended Growth
Attached Growth
Suspended Growth
Attached Growth
Activated Sludge
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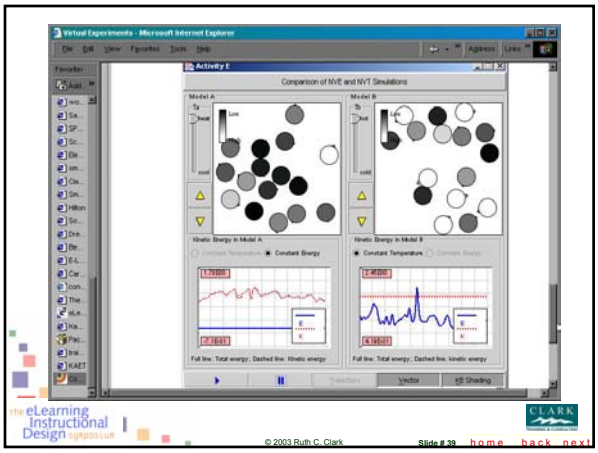
Virtual Experiments - Microsoft Internet Explorer
Activity E
Comparison of NVE and NVT Simulations
the eLearning Instructional Design symposium
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Surface Features vs Communication Functions

A. Text by itself
B. Line drawing by itself
C. Line drawing with text
D. Line drawing with arrows
E. Video

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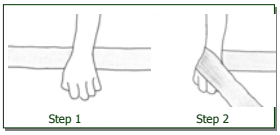
Step 1: The hand is in a fist with the palm facing downward. The centre of the bandage is under the wrist.

Step 2: One end of the bandage lies diagonally over the back of the hand.

A. Text alone



B. Line drawings

Step 1: The hand is in a fist with the palm facing downward. The centre of the bandage is under the wrist.

Step 2: One end of the bandage lies diagonally over the back of the hand.

C. Line drawings with text

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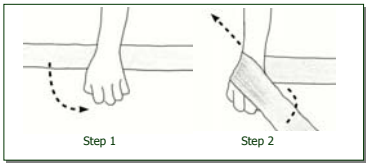

D. Line drawings with arrows

E. Video

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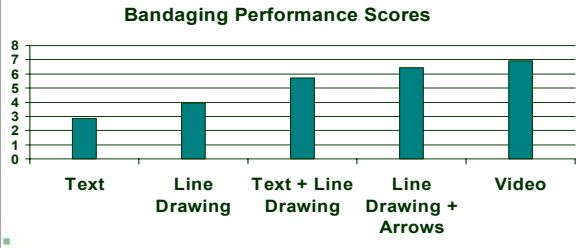
How well did they promote learning?



Text + line drawings, line drawing with arrows, and video better than text alone and line drawing alone.

Michas and Berry, 1999

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View 3: Psychological Functions

- Support Attention
- Activate Prior Knowledge
- Manage Load
- Build Mental Models
- Support Transfer
- Motivate Learning

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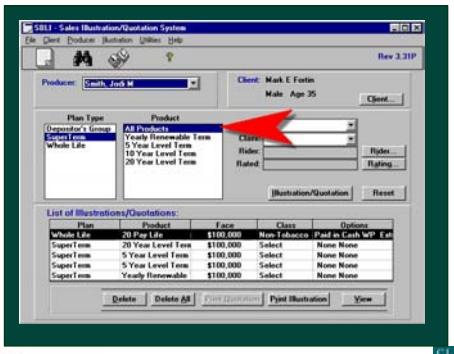
Focus Attention



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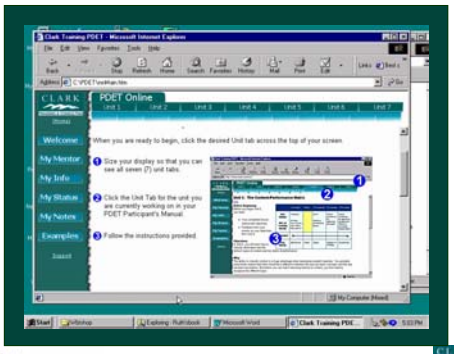
Avoid Divided Attention



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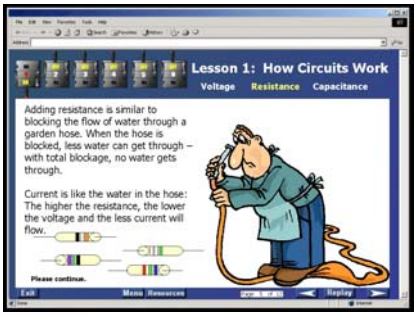
Activate Prior Knowledge



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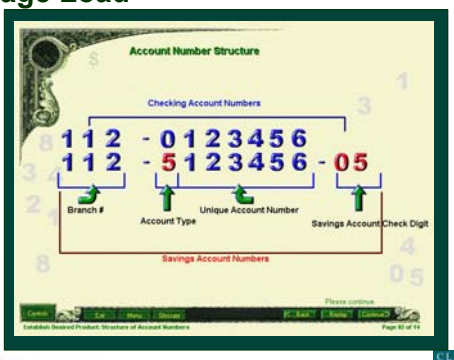
Manage Load



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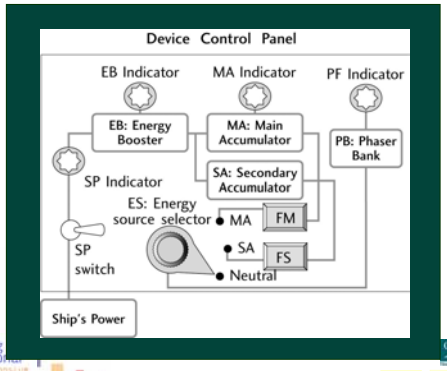
Build Mental Models



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Support Transfer

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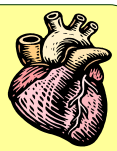
Motivate Learning: Interest

Physiology Students

Statistics Students

How the Heart Functions
A. Low Interest
B. High Interest



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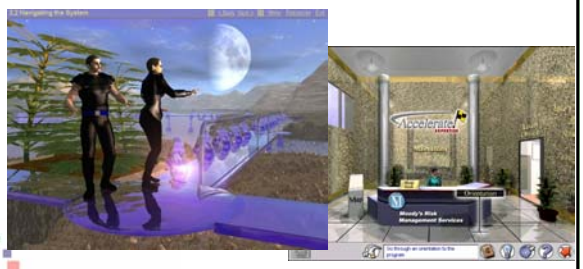
Motivate Learning

Materials Interest

Personal Interest

	HIGH Stories, Visuals	LOW Text Facts
HIGH Physiology	43.6	48.0
LOW Statistics	40.2	25.7

Motivate Learning: Interest



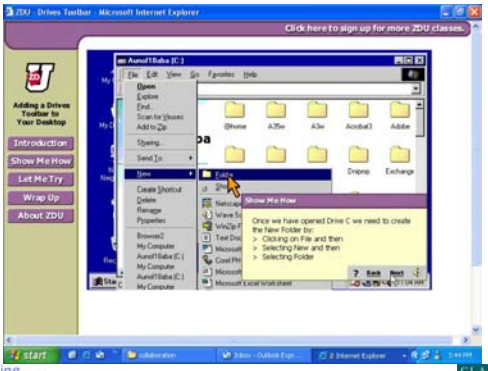
Emotional

Cognitive

Activity

Evaluate a sample instructional graphic based on its psychological function.

Hint: Use job aid table in your handout



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Audio: *You are on the phone with Susan and an important call comes in.*

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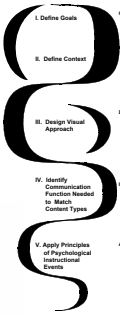
Section 4: A Visual Design Model



Define Goals

Define Content

Design Visual Approach

ID Communication Function matched to Content

Apply Psychological Principles

If learners low in personal motivation
Then apply motivational visual principles

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Which Is Better...

This? Or This??

A B

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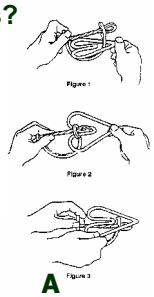
Which Is Better...

This?



Or This??

1.To remove heart, start by holding heart by pointed end, horizontally and parallel to twisted bar. Draw indented part of heart, from inside to outside, through eye of curved bar.

2. Position eye of twisted bar so that it can be dropped downward through the indented part of the heart.

3. With twisted bar now below the heart, draw indented part back through the eye of the curved bar. The heart is now free.

A B

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Which Is Better...

This? Or This??

A B

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Summary

- Relevant graphics improve performance & learning
- Effective graphics must be designed based on their functionality – not just surface features
- Communication functions: **Decorative, Representational, Mnemonic, Organizational, Relational, Transformational, Interpretive**
- Psychological Functions **(Cognitive Events of Instruction): Focus Attention, Activate Prior Knowledge, Manage Load, Build Mental Models, Support Transfer, Motivate Learning**

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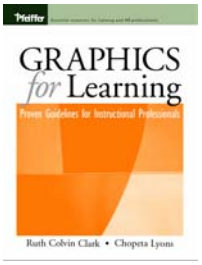

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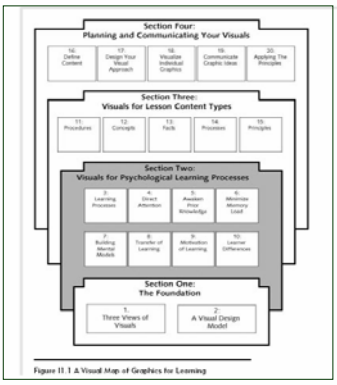

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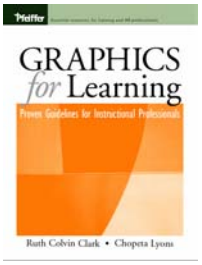

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July 27-28: Denver
September 22-23: DC

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