

Programming Graphics

Programming Through the Arts: Supporting Girls in Computer Science

National AP Conference

July 18, 2004

Pre-AP Strategies in Computer Science and Math

Karen North, Westside High School

Pamela Ossorio, The Rice School

Houston ISD, Houston, Texas

Technology Teachers

Programming Graphics

Pre-AP CS Vertical Team...

KAREN NORTH

- Technology Systems Teacher, Westside High School
- Certified in Math, CS, Business, Campus Educational Technologist
- Experience teaching Algebra, Geometry, pre-AP CS, AP CS, Business

PAMELA OSSORIO

- Technology Teacher, The Rice School
- Certified in Grades 1-8 Math, BBA Finance
- Experience teaching Tech Applications, Yearbook, Robotics

Programming Graphics

Pre-AP CS Vertical Team...

Art Classes

Math Classes

Technology Classes

5th - 9th Grade Teachers

.....and you.....

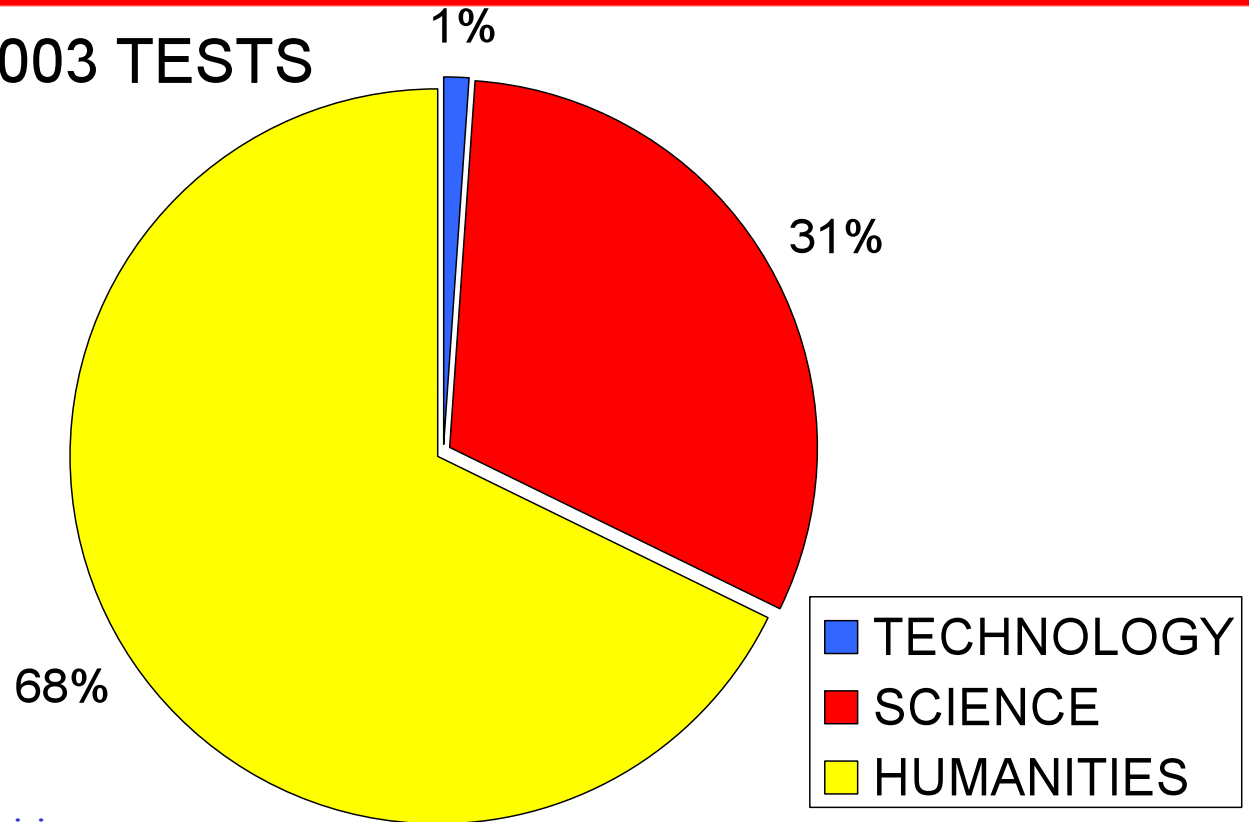
Programming Graphics

1. Problems - Solutions
2. Programmed Graphics Video
3. Teacher Guided Lessons
4. Independent Study Modules
5. Programming Environment
6. Design Recipe
7. Aesthetic Benefits
8. The Future

Source: The College Board, NY,NY
Advanced Placement Program,
National Summary Reports 2003

Problems

AP 2003 TESTS



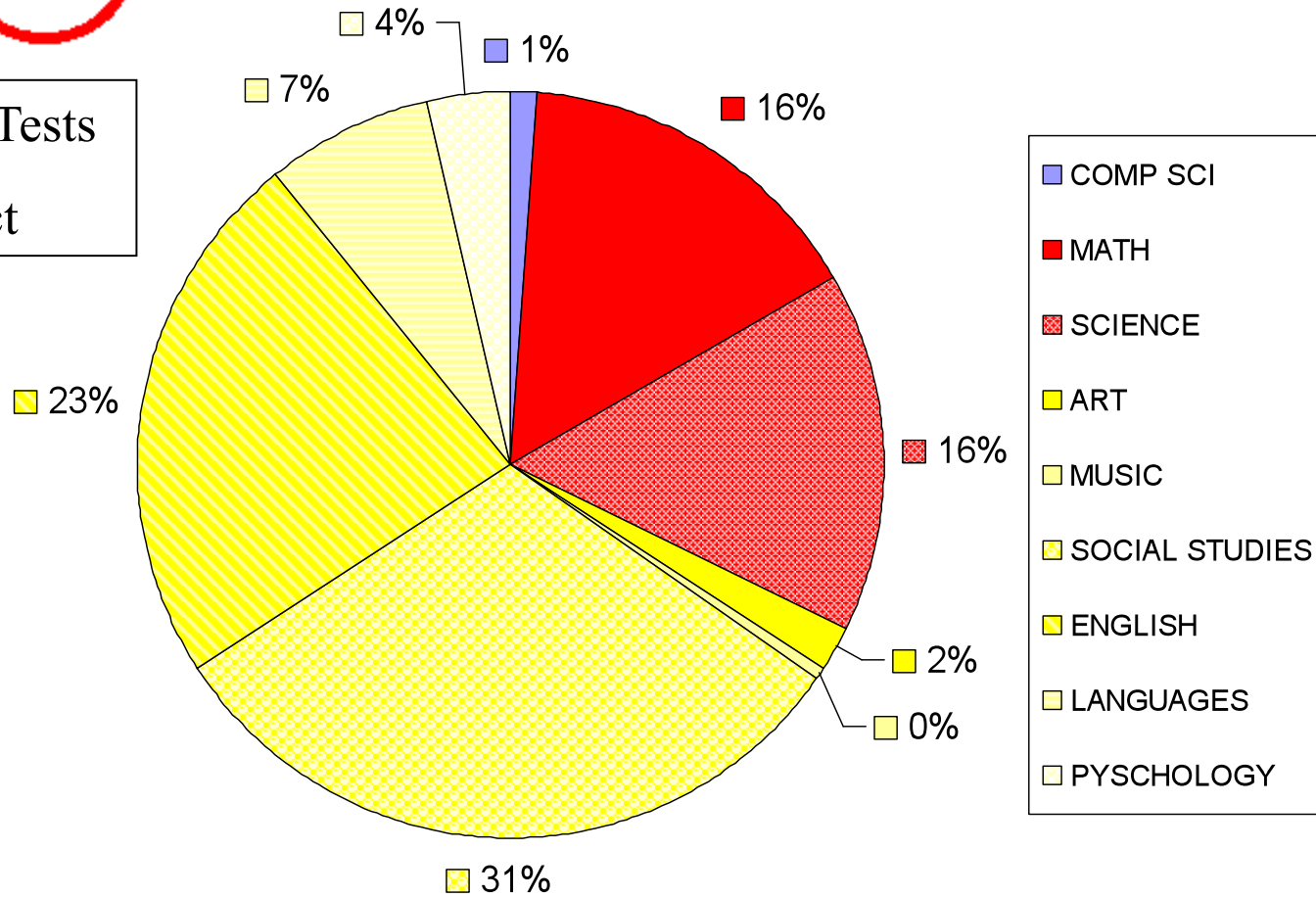
Increase interest through Humanities...

Communicating with the computer is a study of a language with vocabulary and syntax connections....

Source: The College Board, NY,NY
Advanced Placement Program,
National Summary Reports 2003

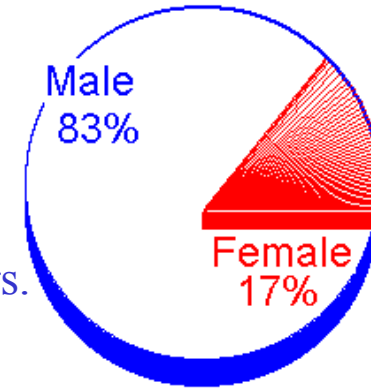
Problems

AP 2003 Tests
by Subject

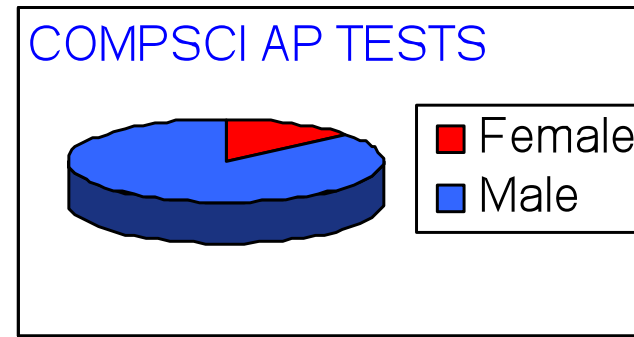
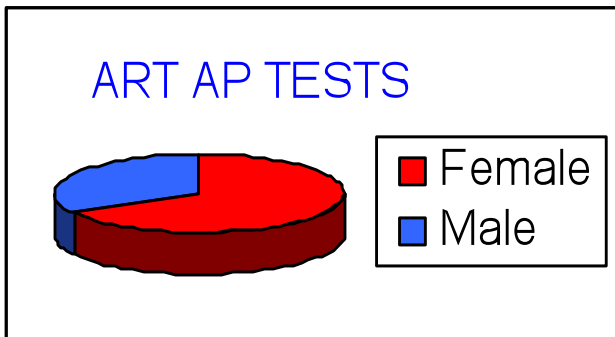
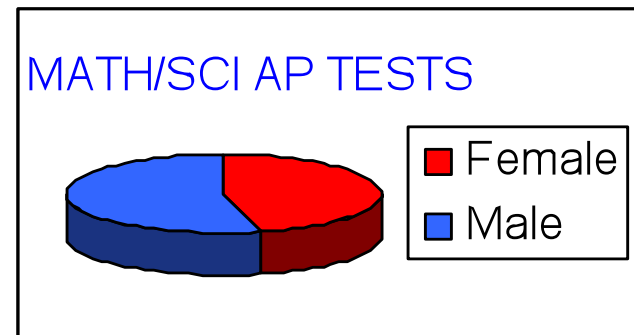
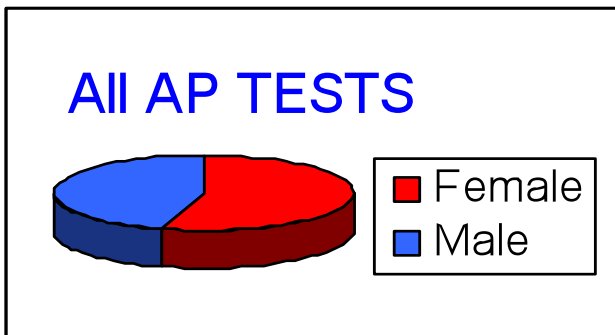


Advanced Placement Computer Science Exam

Problems

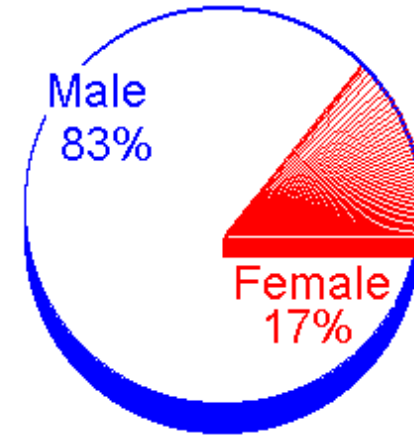


Number students taking AP test has doubled in the last 10 years.
1,705,207 took test in 2003.



Problems

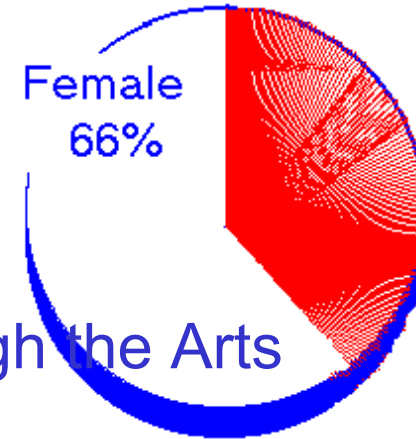
Advanced Placement
Computer Science Exam



- Students, especially girls, avoid computer science
- Low algebraic, abstract, critical thinking skills
- Partial attention to details
- Implementing solutions before planning and organizing data

Solutions

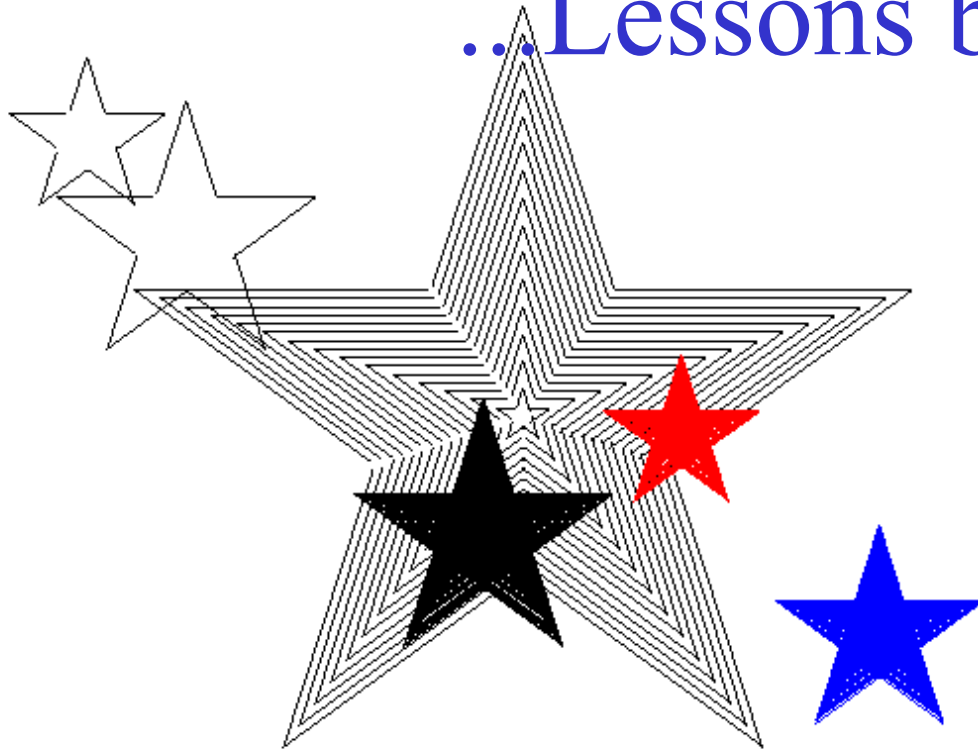
Advanced Placement Art Exams



- Introduce Girls to Programming through the Arts
- Use a program language that is easy to code and debug.
- Build CS domain knowledge skills:
 - Algebraic Computation
 - Data Analysis and Problem Solving Design
 - Attention to Details
 - Motivation to Work Ethically and Perseverance

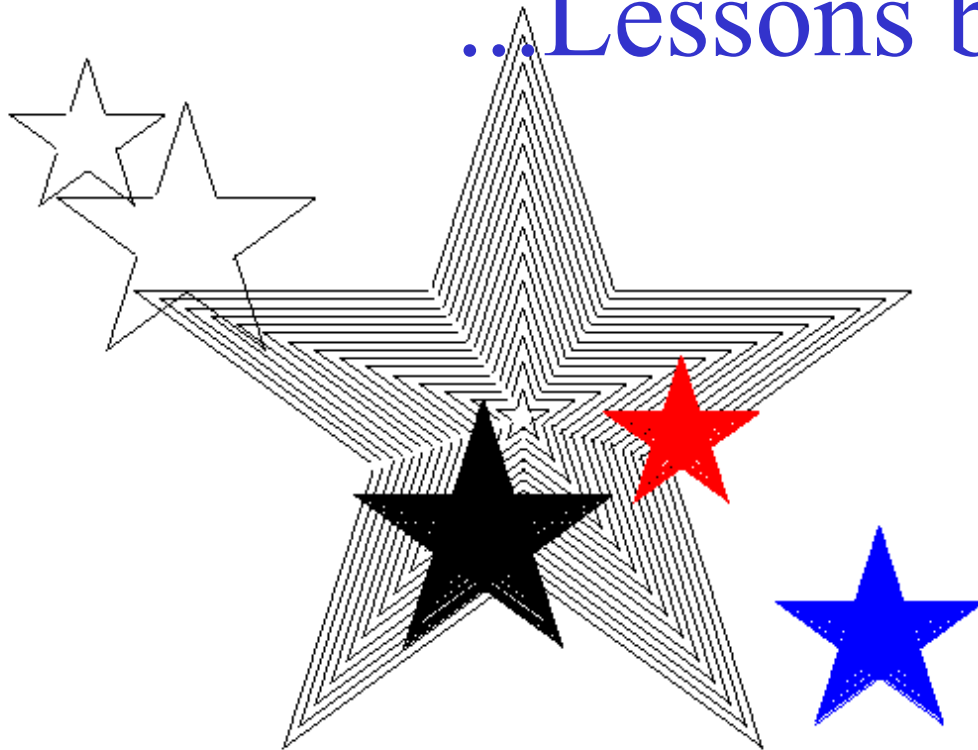
Solutions

...Lessons based on Art ...



Solutions

...Lessons based on Art ...



Graphic Lessons

Scheme Files

PROGRAMMING ENVIRONMENT



© DrScheme, like LOGO, is a subset of LISP, a language used for Artificial Intelligence.

© Girls like Scheme over other high level languages.

© All languages have VERBS (*actions ..*) and NOUNS (*.. what is used in the action*)

© Algebra uses variable letters to represent data; programs are formulated with WORDS.

© Level of commands and error messages can be set for a BEGINNER.

© Limited syntax and rules ... (action data), I/O & Memory Management automatic.



box.scm - DrScheme

File Edit Windows Show Language Scheme Help

box.scm

(define ...)

(start 500 200)

Definition Window

```
;;Box: posn -> true
;;Draw a box for Systems Model
(define (Box P)
  (and
    (draw-solid-rect P 180 70 RED)
    (draw-solid-rect (make-posn (+ 3 (posn-x P)) (+ 3 (posn-y P))) 174 64 WHITE)))

(Box (make-posn 25 50))
(Box (make-posn 310 50))
```


Welcome to [DrScheme](#), version 102.
Language: **Beginning Student**.
Teachpack: [C:\Program Files\PLT\teachpack\htdp\draw.ss](#).

true
true
>

Interaction Window

Canvas

Drawing Canvas



Unlocked not running

The image shows a screenshot of the DrScheme software interface. The top window is titled 'box.scm - DrScheme' and contains a menu bar (File, Edit, Windows, Show, Language, Scheme, Help) and a toolbar with buttons for 'Check Syntax', 'Step', 'Execute', and 'Break'. The main text area shows a Scheme code snippet defining a 'Box' procedure and calling it with two different positions. The bottom window is titled 'Interaction Window' and displays the output of the code execution, showing 'true' for both calls. A 'Canvas' window is also visible, showing two red-outlined rectangles on a white background. The status bar at the bottom right indicates 'Unlocked' and 'not running'.

DrSCHEME DRAWING TOOLS



start : number number -> void

Function name *Parameters, arguments*

(*start* 640 480)

Data Types

draw-solid-disk: *posn number color* -> true

(draw-solid-disk (make-posn 50 50) 40 'red)

draw-circle: *posn number color* -> true

draw-solid-rect: *posn number number color* -> true

draw-solid-line: *posn posn color* -> true

predefined colors: 'white 'yellow 'red 'blue 'green 'black



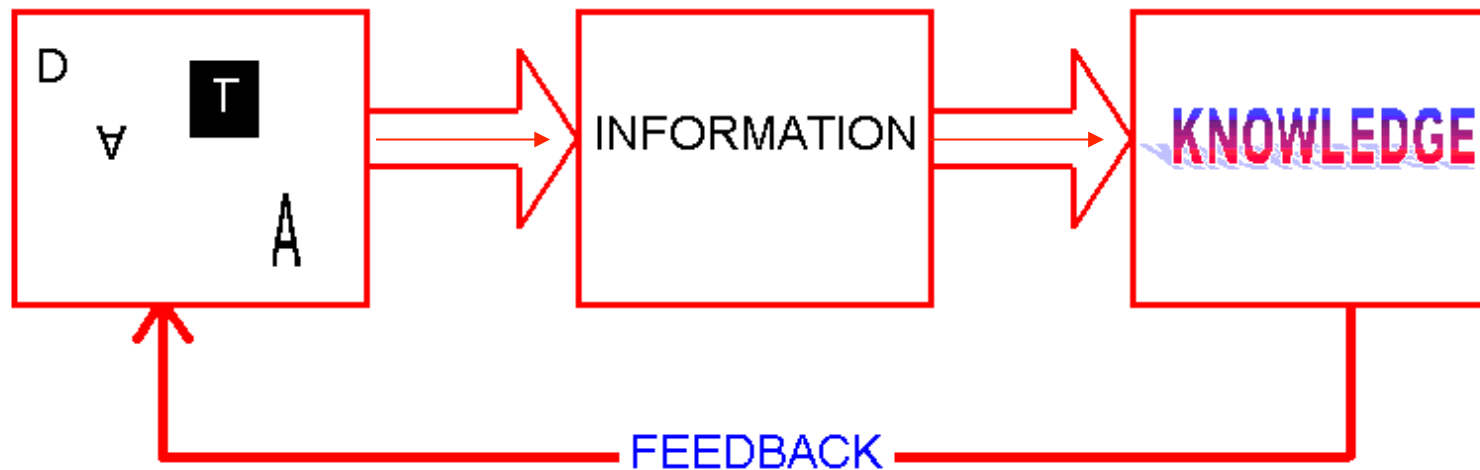
ANALYTICAL PRACTICE



INPUT

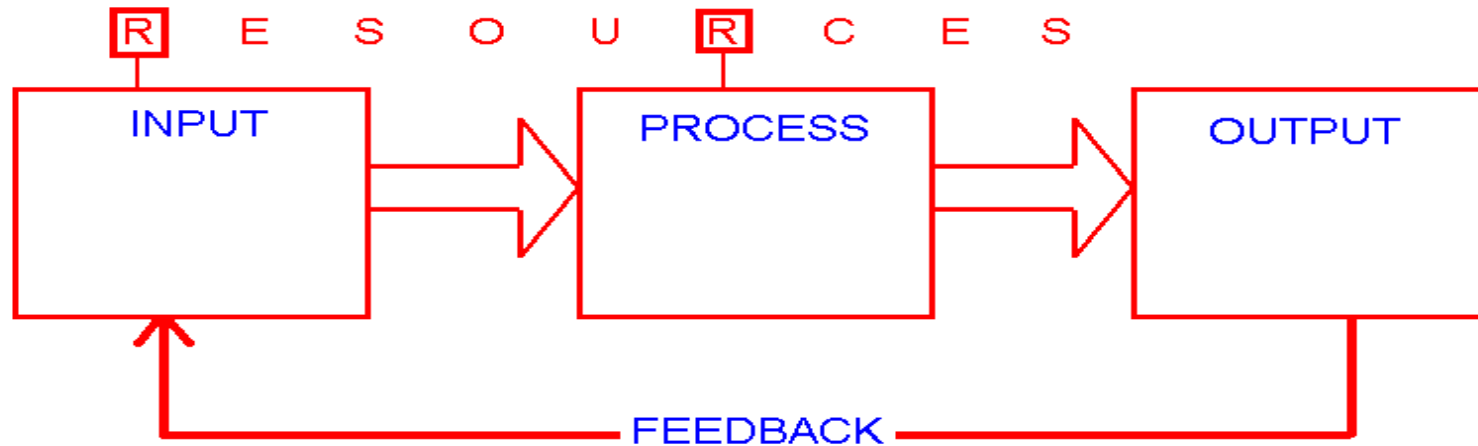
Computers must be fed information
before it can PROCESS it.

OUTPUT



ANALYTICAL PRACTICE

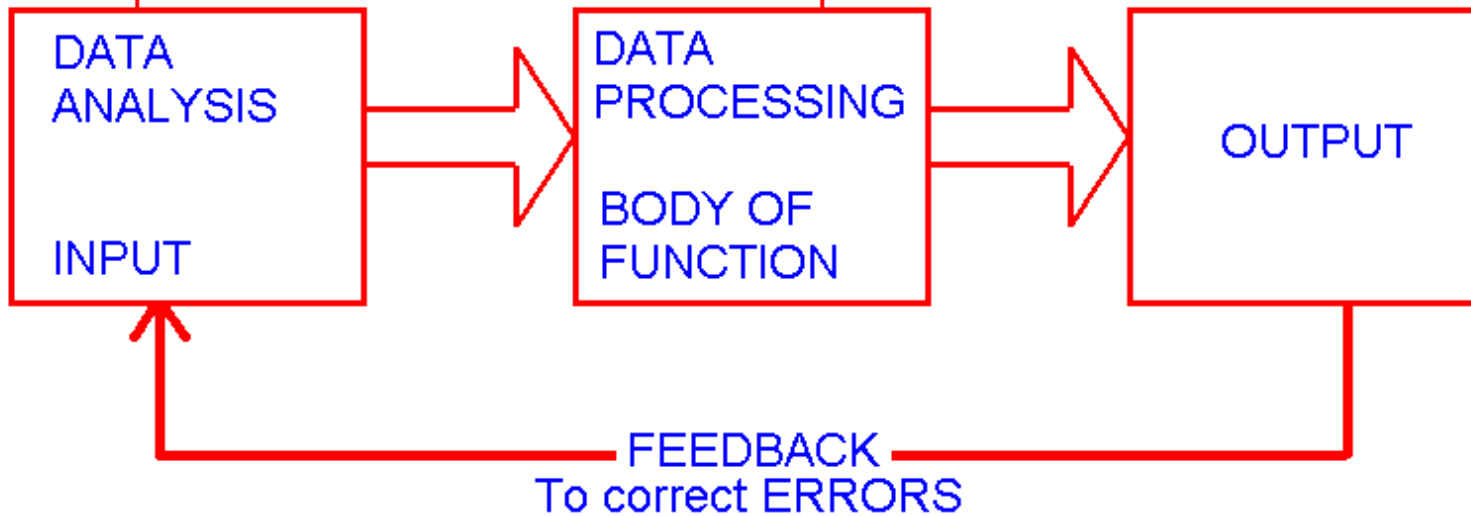
TECHNOLOGY SYSTEMS
MODEL



ANALYTICAL PRACTICE


COMPUTER SCIENCE
DESIGN RECIPE

E X A M P L **E** S



Programs relate inputs to outputs.
The Evaluation substitutes concrete values for names.

AESTHETIC BENEFITS

- 
- Creative and Fun...
 - Sport that exercises the BRAIN and builds dendrites - connections...
 - Requires thinking differently...
 - Requires teaching differently...
 - Different from other applications...

A student must want to learn
Before he can learn.

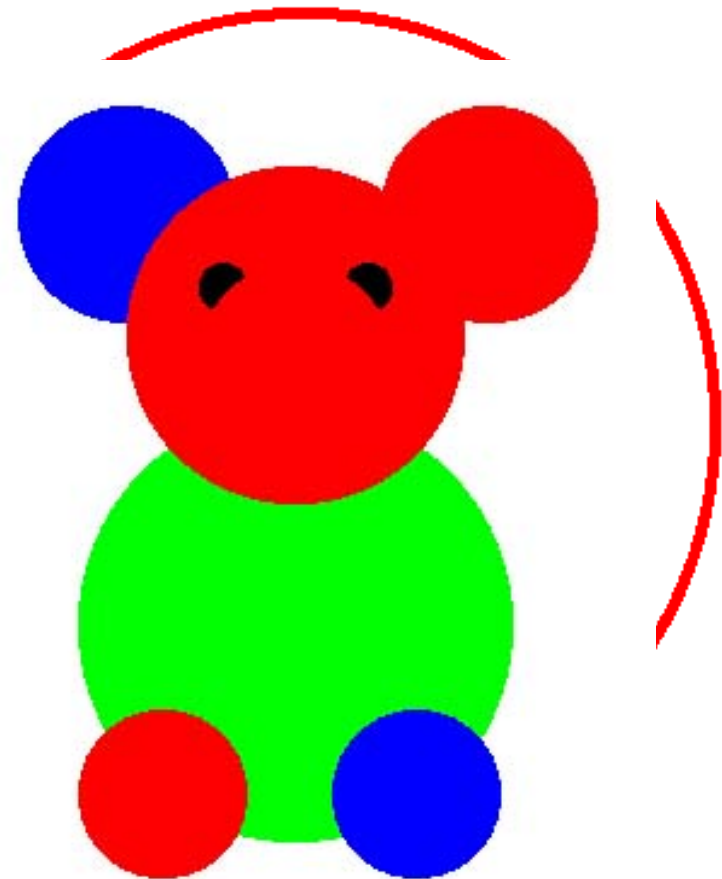
Marcus Quintillion

What we have to learn to do,
We learn by doing.

Aristotle

People rarely succeed unless they
Have fun in what they are
Doing.

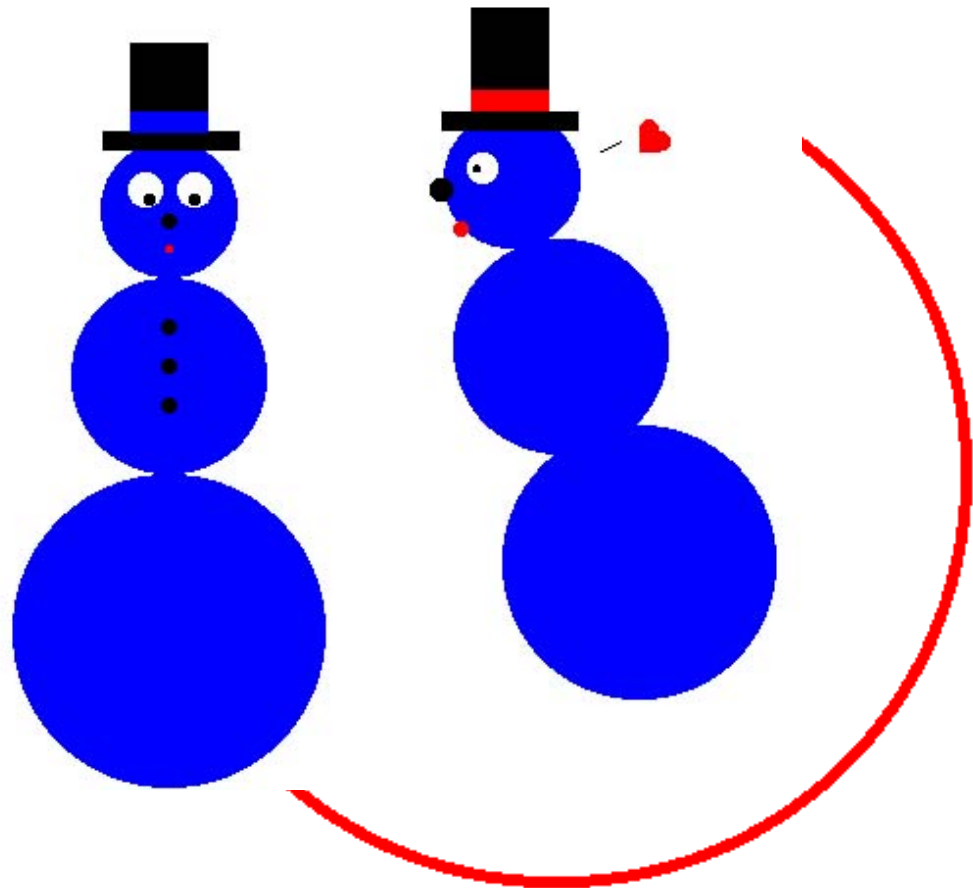
Dale Carnegie

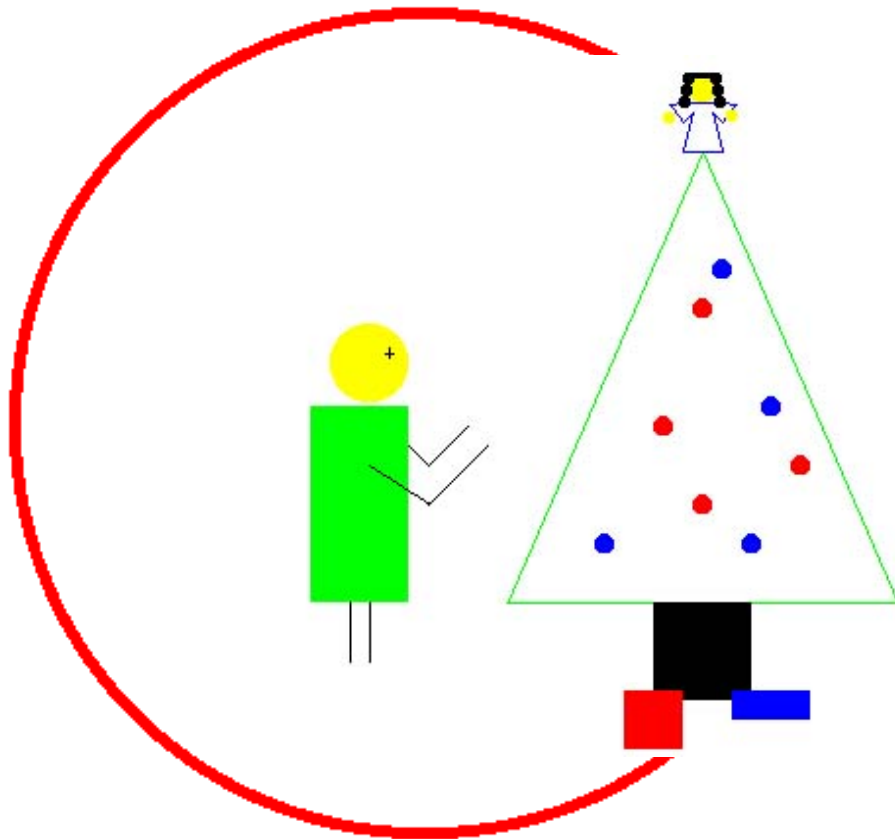


Knowledge is
Answers to questions.
Socrates

Before you can love it,
you have to learn it.
Before you can learn it,
you have to love it.

Which is it?

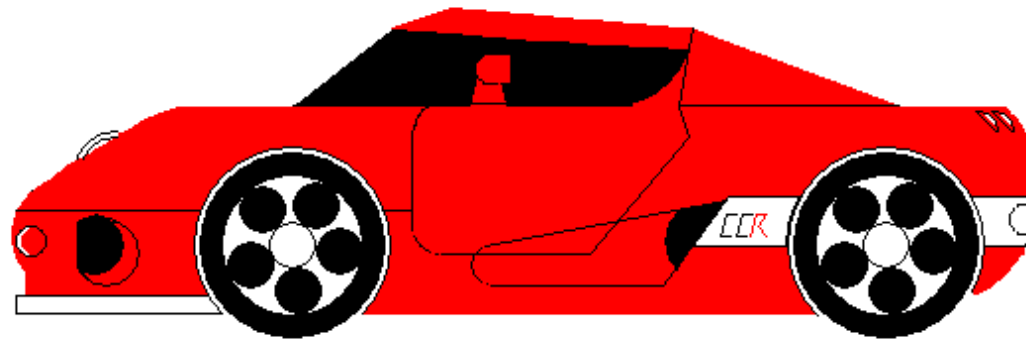


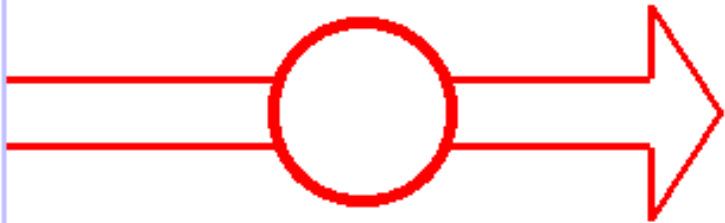


To learn it, teach it.
To *really* learn it,
Teach it to a *computer*.

EVERYONE should learn
How to design programs.
Matthias Felleisen

**Invention is 10% inspiration and 90% Perspiration.
LEARNING is 10% instruction and 90% Practice.
PROGRAMMING motivates PRACTICE.**





THE FUTURE

- ⑧ What do you see in the FUTURE classroom?
- ⑧ Are you excited about adding GRAPHICS to your curriculum?
- ⑧ Are you ready to help build a vertical team for CS and share your tools and lesson ideas?
- ⑧ Would you like to write a grant to fund your work?

Please email your ideas, lesson links or just your name to join our research team.



FUTURE Technologists





CREDITS

- ★ **Graphics by Alief Elsik, Westside High School**
- ★ **and Rice Middle School Students**
- ★ **Background graphics created in DrScheme**
- ★ **Rice University DrScheme Software**
- ★ **TeachScheme! Training Workshops**
- ★ **How To Design Programs - Dr. Felleisen**

PROGRAMMING GRAPHICS

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