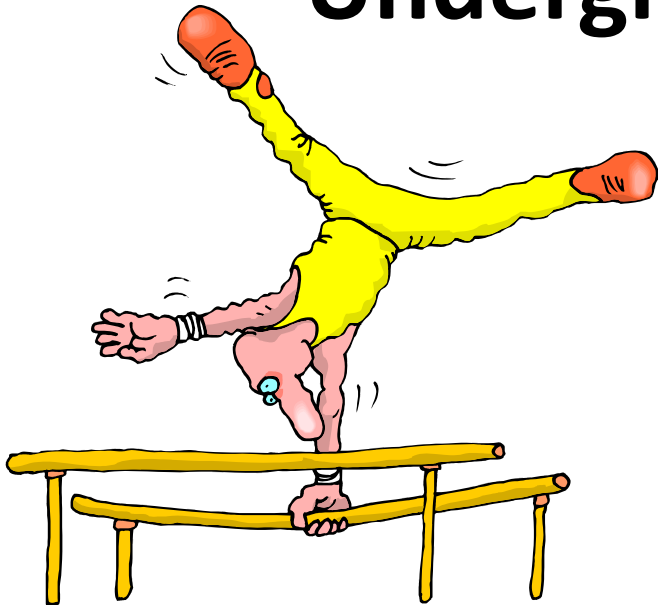


Parallels in Research Design and Computer Programming Skills Development for Beginning Undergraduate Researchers



Terri Lenox

Devon Struthers

Sandra K. Webster

Values

Research Design

- Curiosity,
- Organization,
- Empiricism,
- Causality

Computer Programming

- Accuracy
- Effectiveness and Efficiency
- Timeliness
- Usability



Skills

Experimental Design

- Problem solving
 - Hypothetico–deductive method,
 - Canons of Proof
- Operational Definitions
 - Measurement
 - Manipulation
 - Control
- Statistical Inference
- Application

Programming

- Problem solving
 - Inductive Reasoning
 - Decomposition
 - Testing
 - Logic
- Programming Constructs
 - Sequence
 - Decisions
 - Iteration
- Language



Experimental Design

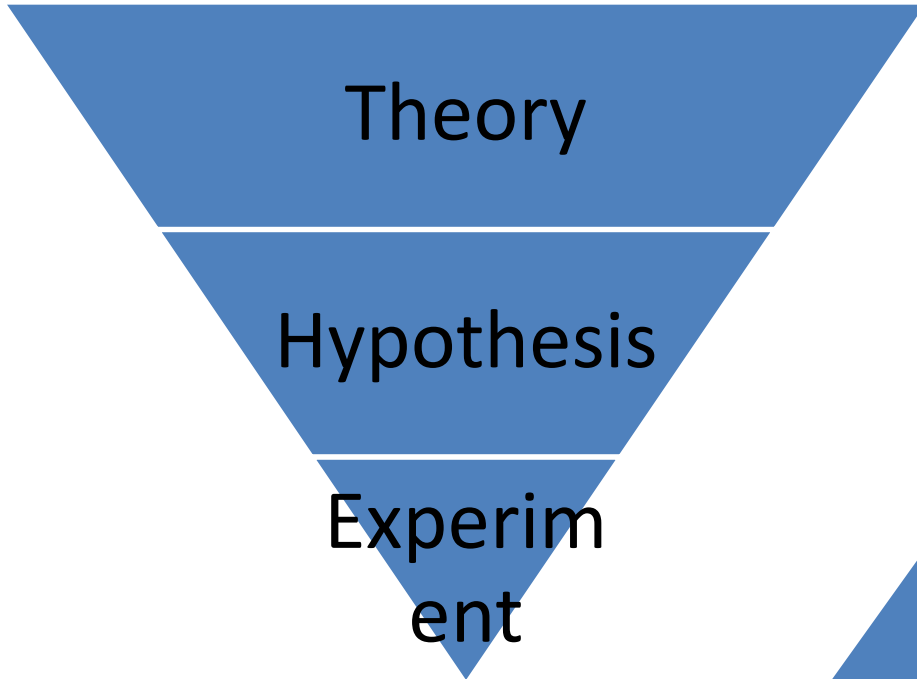
- Precise control of experimental stimuli
 - Visual
 - Textual
 - Audio
- Precise measurement of response
 - Correct Response
 - Actual Response
 - Reaction Time
- Control of trials
 - Randomized blocks
 - Sequential delivery
 - Logical and nested trials
- Data merging, cleaning and preliminary analysis

Computer Programming

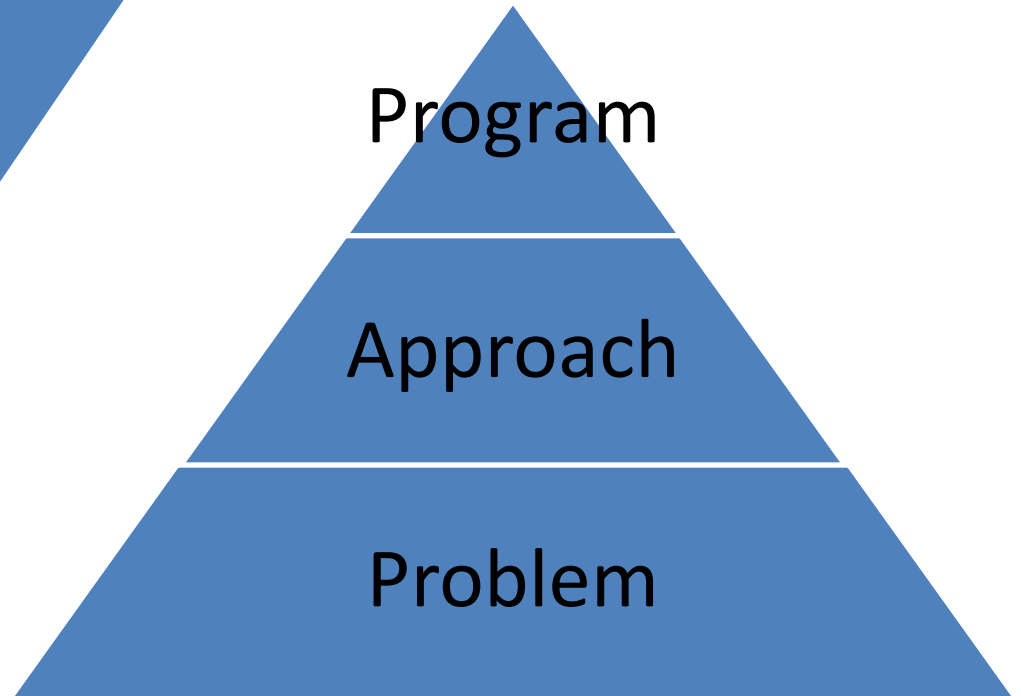
- Object oriented
- Drop and drag interface
- Script objects
- Visual Basic foundation

The Processes

Top Down

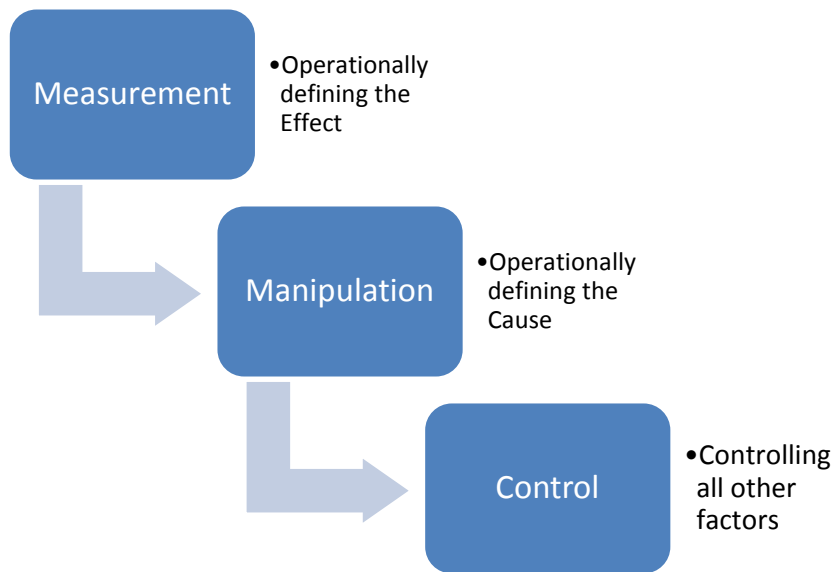


Bottom Up

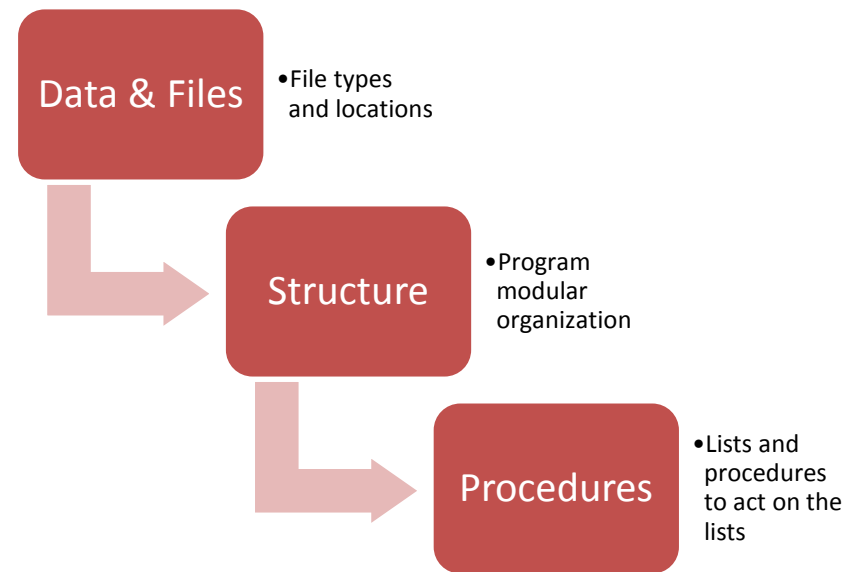


Learning Sequence

Experimental Design



Computer Programming



Rock Paper Scissors



- With your team make a program to play the game against a computer.
- Inputs :Rock, Paper, Scissors
- Outputs: Win, Lose, Draw
- Vocabulary: If, Then, Else
- <http://www.youtube.com/watch?v=iapcKVn7DdY>

Sequencing

Experimental Design

1. Values in Science
2. Research Ethics
3. Hypothetic Deductive Method
4. Operational Definitions- Effects
5. Operational Definition – Cause
6. Replicate published experiment
7. Produce hypothesis, test it and analyze data

E-Prime Programming

1. Sample Experiment
2. File & Program Structure
3. Use logic to alter E-Prime list to present stimuli
4. Use E-Merge to get data from altered program
5. Use E-Prime Procs to vary stimuli
6. Use E-Prime to produce program as described
7. Program E-Prime for term project

Potential Pitfalls

Research Design

- Passive thought processes
- Quasi-logical students
- Stereotype threat
- Lack of support resources
- “The Computer Hates Me” syndrome
- Method > End
- Lost in the data

Computer Programming

- “The Computer Hates Me” syndrome
- Quasi-logical students
- I can play video games, why can't I program (why should I work on my homework)
- Afraid of the Math

Potential Benefits

Research Design

- Promotes curiosity about current scientific problems
- Provides a tool and a respect for precise measurement and display control
- Familiarity with large data sets, data cleaning and reduction
- Generalization of logic and organizations across domains

Computer Programming

- Logical thinking
- Approaches to problem solving
- Attention to details
- Mental ruggedness



Thanks

- For more information:
 - Terri Lenox, Professor of Computer Science, Westminster College, lenoxtl@westminster.edu
 - Devon Struthers, Technical Consultant, Psychology Software Tools, devon.struthers@pstnet.com
 - Sandra K. Webster, Professor of Psychology, Westminster College, websters@westminster.edu