**Computational Modeling in Physics First with Bootstrap**

**July 9-20, 2018 Chicago, IL**

**Workshop Agenda**

**Monday 7/9**

* Workshop logistics/housekeeping
  + Logistics - Matt
  + Housekeeping - Rebecca, Colleen
  + Introductions - whiteboarding
  + Workshop Lead Introductions
    - Set Modeling workshop culture
    - Overview of what to expect
  + Surveys - Force Concept Inventory, ICTPS, PCA
* Unit 1 - Qualitative Energy
  + Introduction to Energy
    - Activity: Observation Stations
  + Defining and representing systems
    - Defining systems
    - ~~Representations of energy storage~~
  + Extended learning: Finish WS1, Reading 1

**Tuesday 7/10**

* Housekeeping - Rebecca (consent forms on tables, hand out roster), Colleen (FCI question), Leads (comfort with programming, 1 to 5, with name on a post-it
* Norms - reminder of time, student/teacher modes
* Unit 1 - Qualitative Energy
  + Defining and representing systems
    - Representations of energy storage (pie charts) - WB WS2, reading suggested as follow-up
    - WS3 - in teams, no WB
  + Energy storage
    - Activity: Tell an Energy Story
    - Activity: Exploring Energy Storage in Springs - DEMO in Teacher Mode
  + Defining and representing systems
    - Representations of energy storage (bar charts) - WB WS5 (dueling WBs), reading suggested as follow-up
  + Modeling change over time
    - Activity: Flipbook - on WB as storyboard, explain this could be expanded to physical flipbook
    - Activity: Computationally Modeling Change Over Time - PROJECT
  + The Model So Far
* Unit 1.5 - Introduction to Functions
  + Working with expressions, functions and images
    - Lab: Temperature scales
* Extended learning: Finish WS2

**Wednesday 7/11**

* Housekeeping - lunch w/energy discussion, tonight’s outing (Jazz at the Shedd)
* Unit 1.5 - Introduction to Functions
  + Working with expressions, functions and images
    - WB WS2 - focus on feedback
    - WB WS3 - functions - focus on design recipe and reading
      * Have participants write this in glossary
* Teacher Mode discussion
* Unit 1.5 - Introduction to Functions
  + Working with expressions, functions and images
    - Activity: Temp Converter Program - teacher mode
    - Images - teacher mode
* Unit 2 - Constant Velocity
  + Building differential representations for motion
    - Lab: Buggy Lab
      * Collect data, WB (establish scribe and team debrief)
* Extended learning: Fahrenheit to Celsius converter program in Pyret, create thermometer image program

**Thursday 7/12**

* Teacher Mode: Share out completed f-to-c, thermometer programs
* Unit 2 - Constant Velocity
  + Building differential representations for motion
    - Activity: Simulating Motion - build on Wed’s discussion (next x is x + delta-x already established verbally, scaffold function as a large group; include starting position and direction of motion); use “Where’d you get that?” to defend design recipe (each S fills out blank DR, partners w/ S outside their team, focus on reading the function aloud)
    - Activity: Simulating Boats - Josh will lead Hi Rebecca!
  + Motion mapping - emphasis on the written form using WBs, create and pass to next team, next team creates an additional representation for this motion map

Extended learning: Activity 3, non-Pyret-using portions of Activity 4

**Friday 7/13**

* Unit 2 - Constant Velocity
  + Teacher Mode - clarify changes to sequence and scaffolding of concepts; state that there will be some changes to curricular resources for this unit, these will be added to shared folder; assume that Ss would have graphed buggy lab data vs simulation data, reinforces “best-fit line”
  + Graphical representations
    - Lab: Graph Matching with Motion Detectors
    - Multiple Objects - function with new signature
    - Teacher Mode - v-t graphs (area is displacement); distance vs displacement; average speed vs average velocity
  + Multiple representations for motion - WB Telephone (4 motions, slip of paper like Pictionary) - 1. position and velocity graphs 2. Motion maps 3. Design recipe 4. Written description
* Unit 3 - Uniform Acceleration
  + Using graphical models to represent accelerated motion
    - Lab: Inclined rail motion
    - Approximations using velocity
    - Lab extension: Speeding up and slowing down
  + Determining displacement graphically
  + Extended learning:

**Monday 7/16**

* Think Tank - foreseeable issues, concerns
* Unit 3 - Uniform Acceleration
  + Simulating accelerated motion
    - Activity: Programming Non-Constant Velocity Motion
    - Activity: Highway Hazards
    - Activity: Miniature Golf
  + Kinematic equations

**Tuesday 7/17**

* Unit 4 - Balanced Forces
  + Forces and changes in velocity
    - Activity: Broom Ball
  + Force diagrams
  + Conditionals and functions
    - Activity: Air Hockey Table
  + Pairs of forces
    - Activity: Pairs of Forces Stations
  + Mass vs. weight
    - Lab: Mass vs. Weight
* Extended learning:

**Wednesday 7/18**

* Unit 4 - Balanced Forces
  + Fields and forces
    - Activity: Gravity on Different Planets
    - Activity: Millikan Oil Drop
  + Forces in equilibrium
* Unit 5 - Unbalanced Forces
  + Force, mass and acceleration
    - Lab: Modified Atwood’s Machine
* Extended learning:

**Thursday 7/19**

* Unit 5 - Unbalanced Forces
  + Forces and data analysis
    - Activity: Forces during an elevator ride
  + Unbalanced forces and changes in motion
    - Lab: Friction
    - Lab: Air Resistance
    - Activity: Drag Race
* Extended learning:

**Friday 7/20**

* Workshop logistics/housekeeping
  + Post-surveys - Force Concept Inventory