The Invention Support Environment

Where do we go from here?

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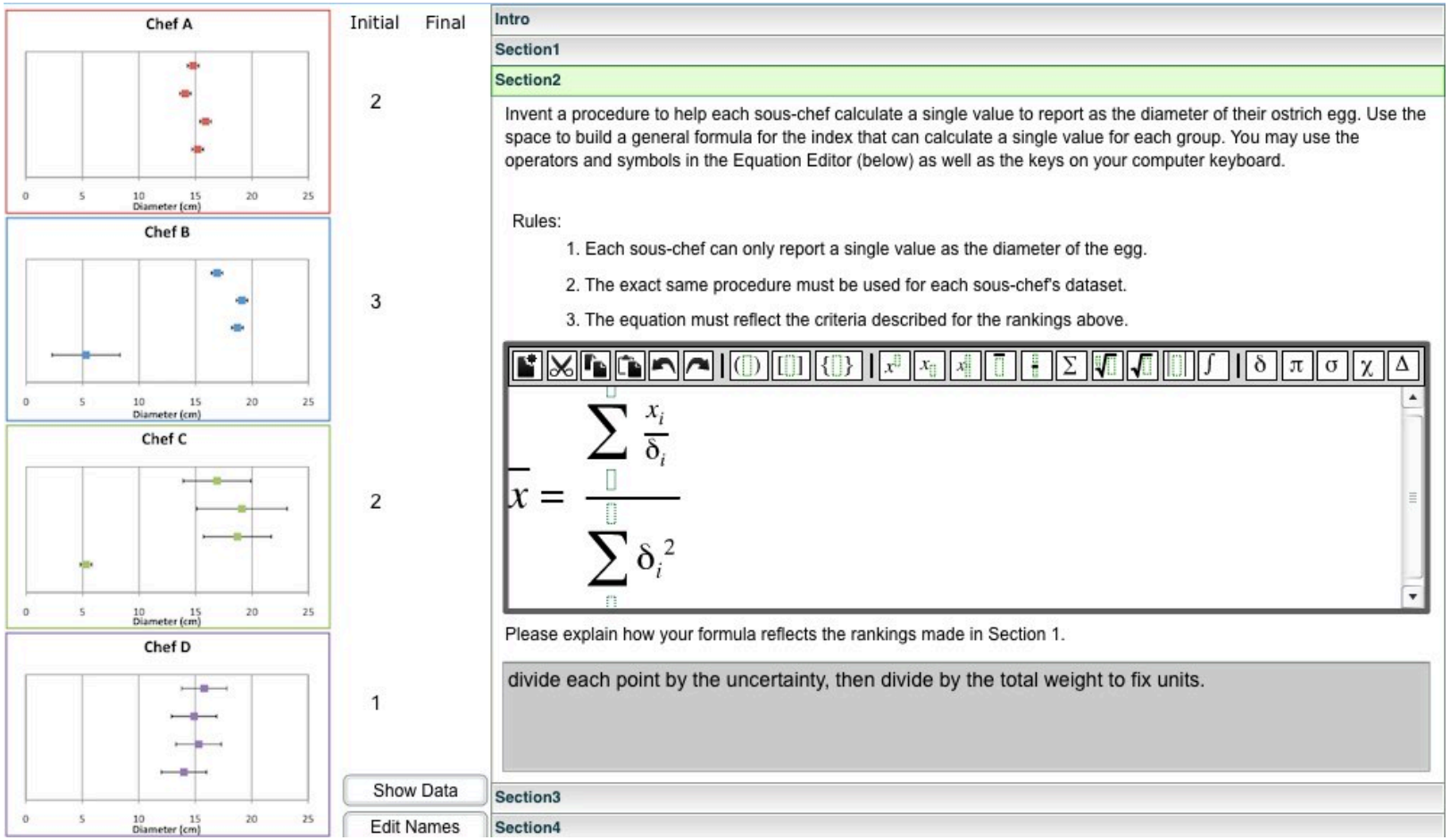
Context

- Invention Activities
  - Activities where students are asked to invent a method to solve a problem before being taught the domain
    - Least-squares fitting
    - Weighted Average
    - Weighted Least-squares fitting
    - Slope Uncertainty with fixed intercept
    - T-test
- Invention Support Environment
  - Computer-based learning environment built to support invention activities (Holmes, N. 2011)

ISE: Weighted Average



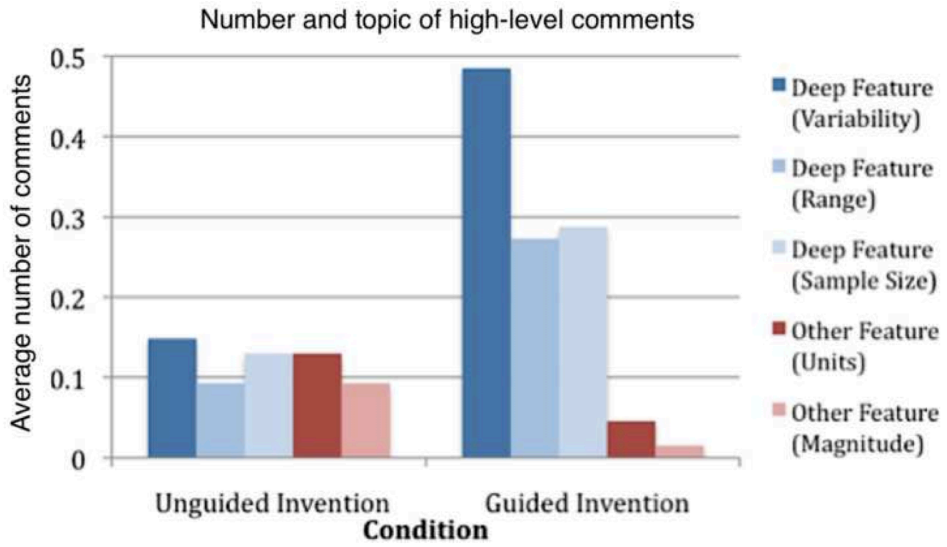
Experimental conditions

Scaffolding stages*	Treatment Group	Control Group
Exploratory analysis	▪Pairwise Comparisons ▪Ranking ▪Self-explanation	
Planning and design	▪Build Equation ▪Self-explanation	▪Build equation
Implementation	▪Apply equation ▪Ranking datasets	▪Apply equation
Evaluation	▪Self-explanation	

*Roll, Holmes, Day & Bonn (2012) Using metacognitive scaffolding to improve the inquiry process and its outcomes in guided invention activities

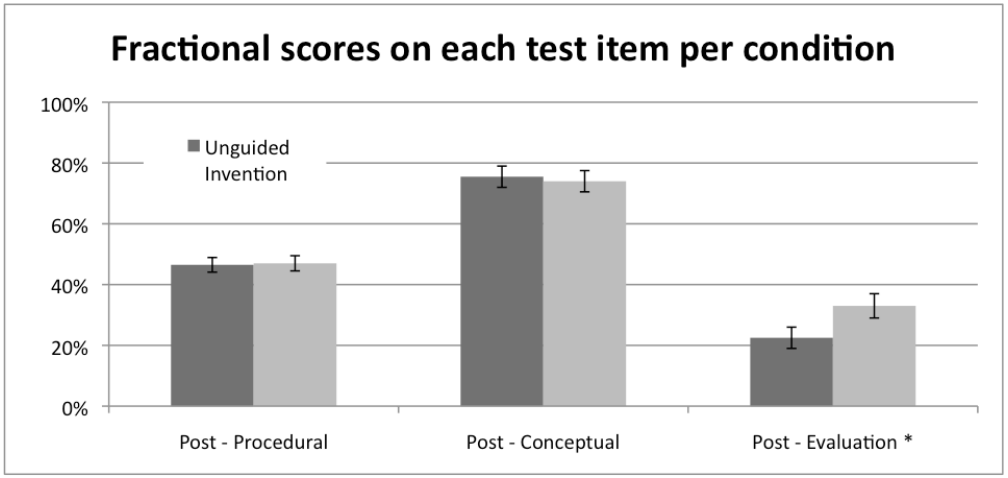
Quality of Inventions

- Individual invention activities (Roll, et al. 2012)
  - Quality of inventions
  - Quality and quantity of self-explanations
- Slope Uncertainty/Fuel Consumption
  - Analyzed this activity in 2010, 2011



Domain Learning

- Pre- and post-study statistics test
  - 5 domains
  - 3 question types:
    - Conceptual
    - Evaluation
    - Transfer



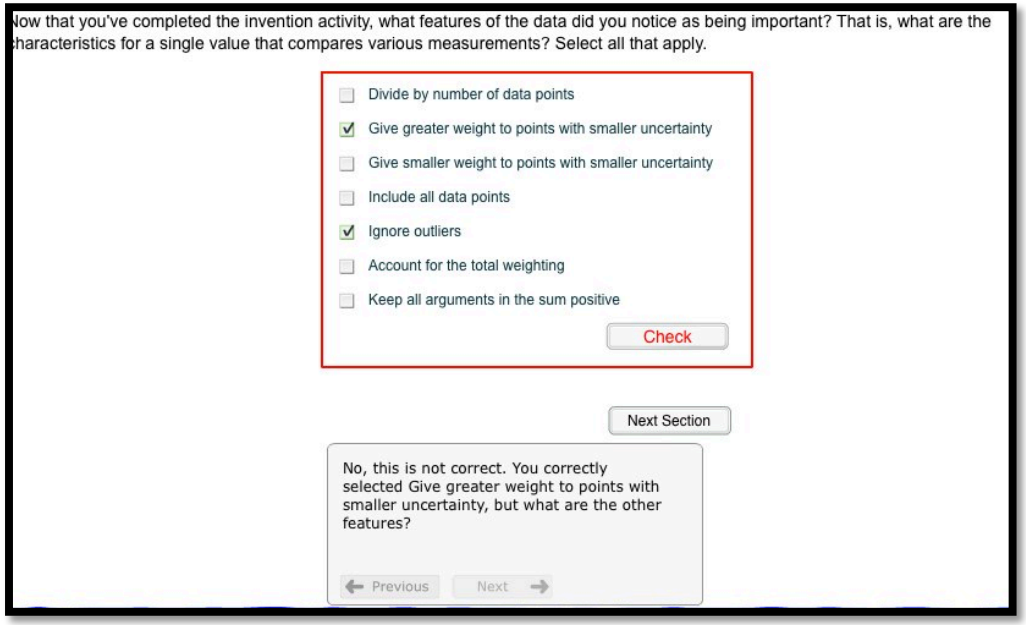
- Previous found that metacognitive scaffolding improves performance on evaluation questions but has no effect on conceptual or procedural questions.*

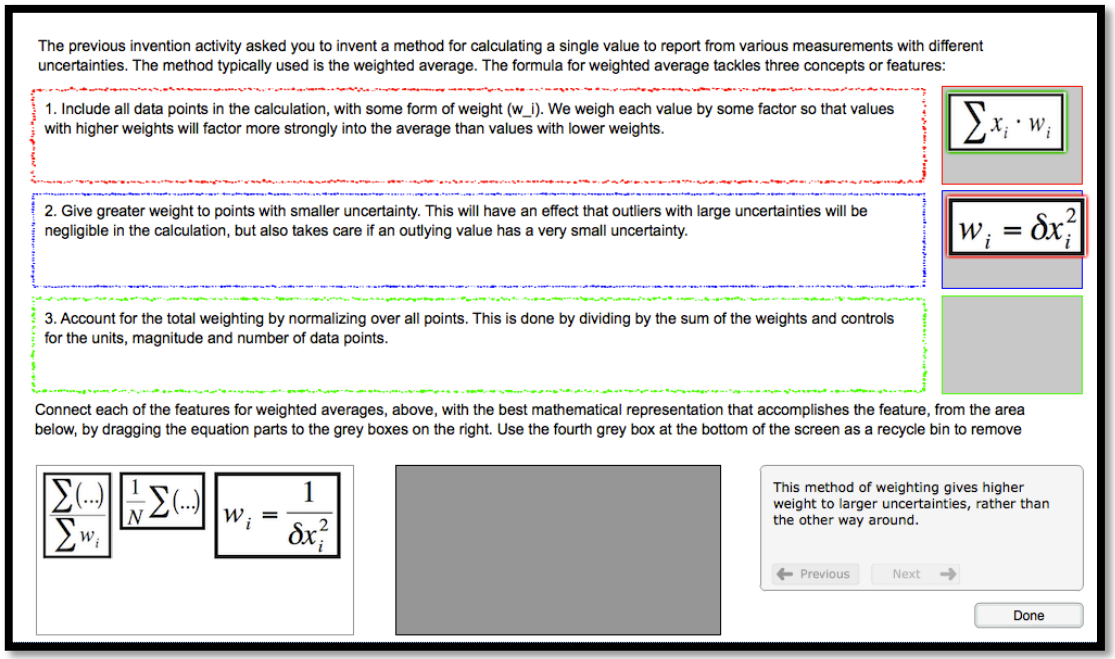
*Holmes, N. (2011) The Invention Support Environment: Using metacognitive scaffolding and interactive learning environments to improve learning from invention. MSc. Thesis, *University of British Columbia*

Instruction Tasks

- What matters

  Identify features from multiple choice list



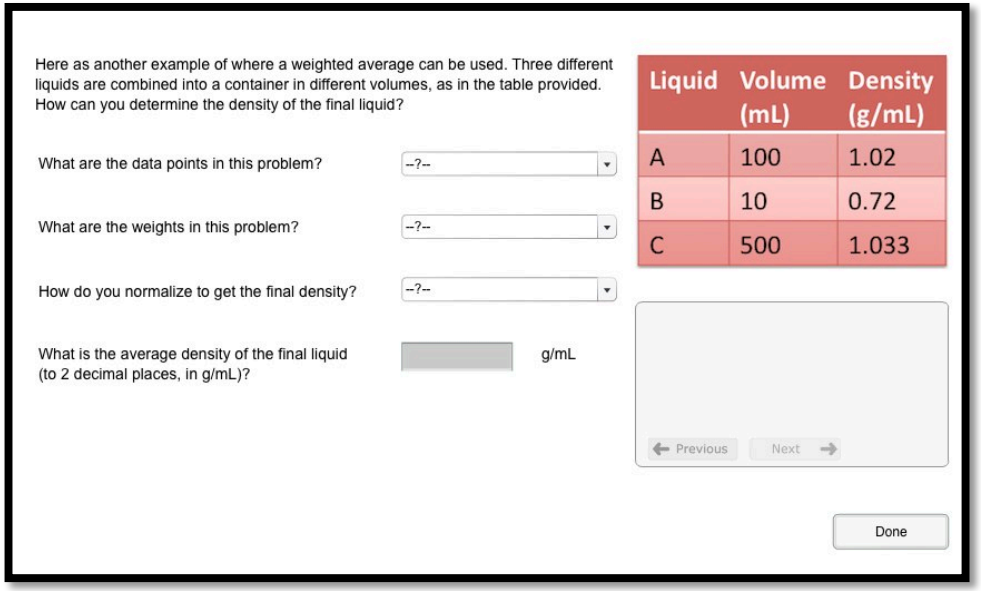


- Drag and drop

  Connect features to mathematical representations

Practice Tasks

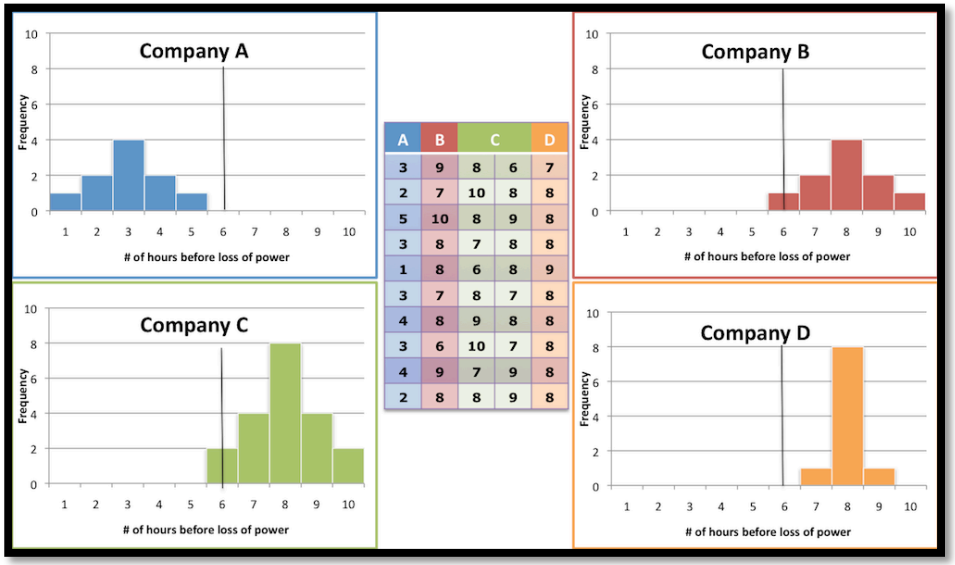
- Procedural
  - *Calculate the index for different data sets*
  - *Self-explanations*



- Transfer
  - *Evaluate a variation on the formula*
  - *Apply to a new situation*

Transfer activities

- T-test invention activity
  - *Both in low scaffolding*
  - *Quality of inventions*
  - *Quality of self-explanations*



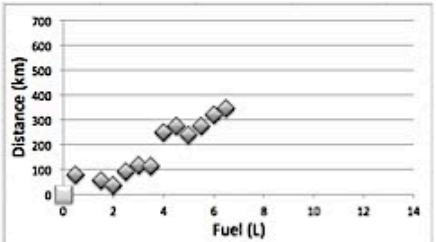
A	B	C	D
3	9	8	6	7
2	7	10	8	8
5	10	8	9	8
3	8	7	8	8
1	8	6	8	9
3	7	8	7	8
4	8	9	8	8
3	6	10	7	8
4	9	7	9	8
2	8	8	9	8

- Recall data and equation
  - *Which of the following graphs were used last week?*
  - *What was the equation from last week?*
  - *What were the features?*

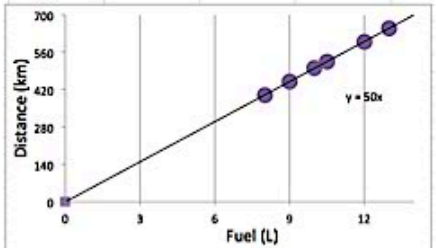
Last week we asked you to use four graphs to invent a method for finding the uncertainty in the slope of an unweighted best-fitting line with a fixed intercept at the origin. Before we discuss slope uncertainty in a more general form, we would like to spend a minute recalling some of the information presented last week.

Done

Given that the first graph (below) was one of the four given last week, which of the remaining graphs show the same data that was presented to you last week? Please check all that apply.



Same data as last week.



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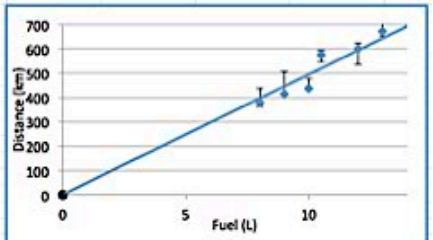

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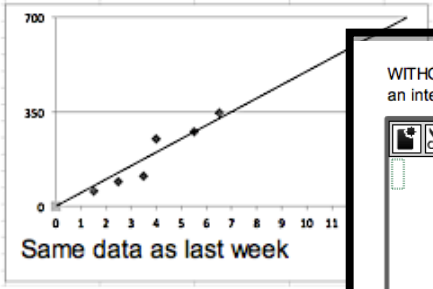

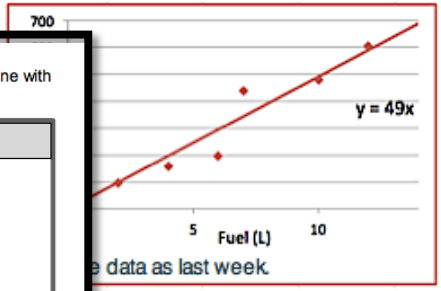

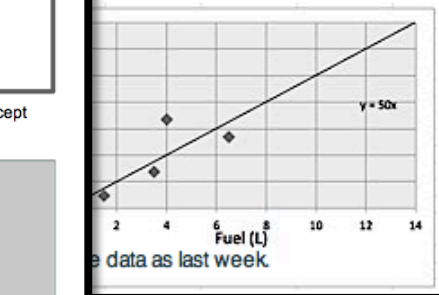

WITHOUT looking in your books, what was the formula for calculating the uncertainty in the slope of an unweighted best fitting line with an intercept fixed at zero? Please use the equation editor below to recreate the equation to the best of your ability.

What were the three features involved in determining the uncertainty in the slope of an unweighted best fitting line with an intercept fixed at zero?

Done

Behaviours

- Log files of student actions throughout invention process
  - Where do they spend their time during invention activities?
  - How many solutions do they create?
  - How much evaluating are they doing?
  - Other questions I can't even think of?

Next round of research questions?

- Motivation orientation
  - Does motivation correlate to invention performance?
  - How do invention activities affect motivation over the year?
- Case-studies
  - How do students use invention activities?
  - What self-regulated learning strategies are they using on their own?
  - What SRL strategies do we support?
  - What SRL strategies should we be supporting?