

Modeling Paradigm Labs



Wisconsin Association of Physics Teachers (Fall 2020)

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What is a modeling paradigm lab?



Who am I?

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Next Generation Modeling Courses for Teachers

(www.uwosh.edu/phys/ngmc)



Who are you?

Introduce yourself!

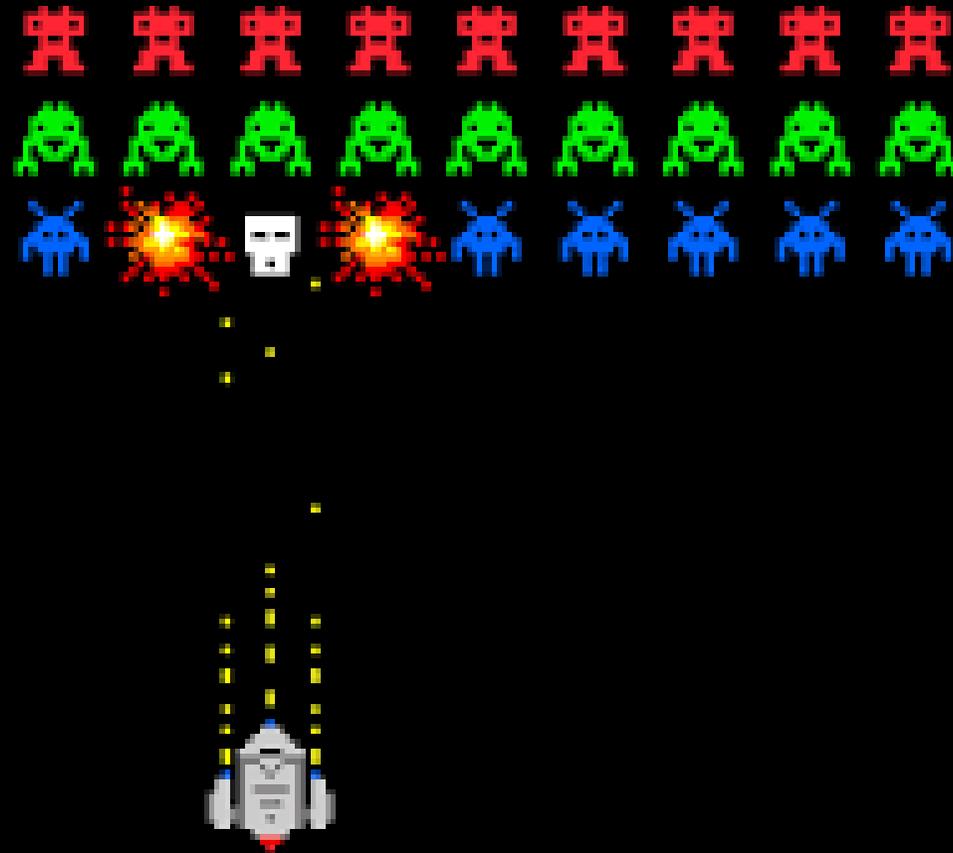


References



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100-180 minute-workshop with Pivot Interactives: www.pivotinteractives.com



What is modeling?

Modeling vs.
traditional instruction



Scientific Models

Informally, the goal of science is to understand how the universe works. Scientists pursue this end through the formation and development of *scientific models*. We adopt the following working definition:

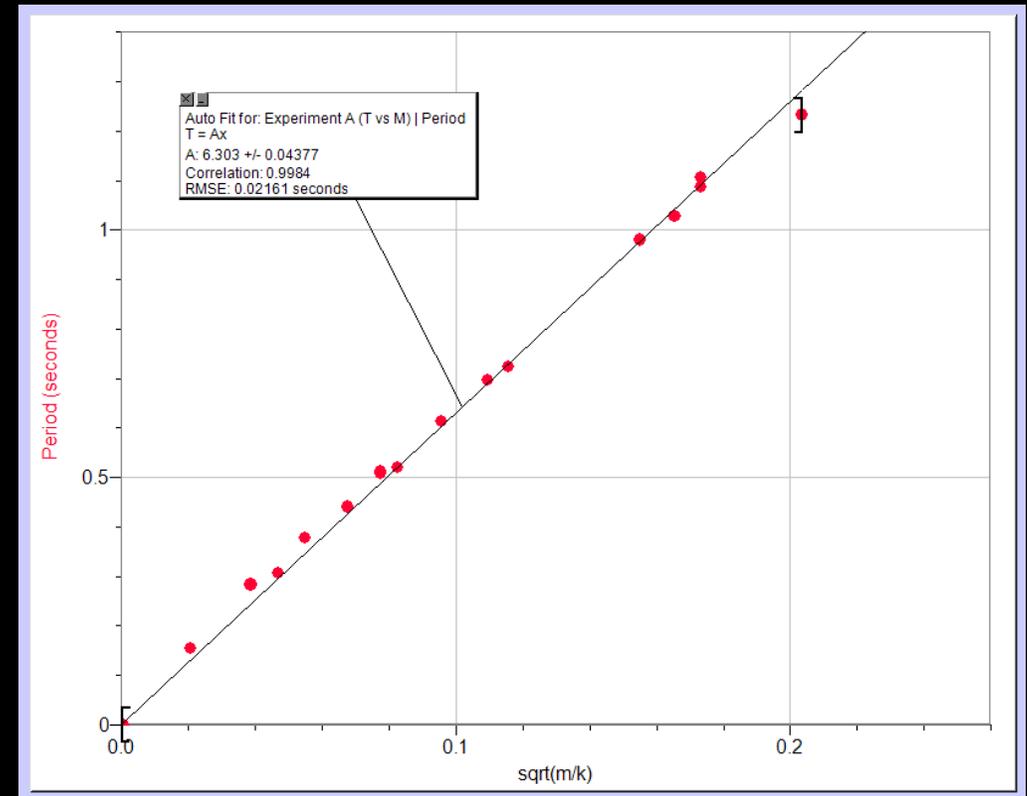
A scientific model is an imperfect *representation* of a physical system.



Data or empirical model

Data models, or *empirical models*, are developed through an inductive process; i.e., a process that proceeds from specific measurements to a general mathematical pattern. Deductive processes are also important in science, which we discuss later.

Going forward, we will use the term *empirical model* in lieu of *data model*.



Modeling Method of Instruction

Brewe 2008; Brewe et al. 2010; Hestenes 1987, 1997; Desbien 2002; FIU, 2016; Hestenes & Jackson 1997; Jackson, Dukerich, & Hestenes 2018; Wells, Hestenes, & Swackhamer 1995).

- engage students in understanding the physical world through scientific models and modeling
- foster student skills in the use of multiple representations of knowledge, such as diagrams, graphs, charts, maps, and written descriptions
- familiarize students with basic models that represent the core of scientific knowledge
- develop insight into the structure of scientific knowledge
- immerse students in an authentic experience of science that addresses the questions: “Why do we believe?” and “How do we know?”

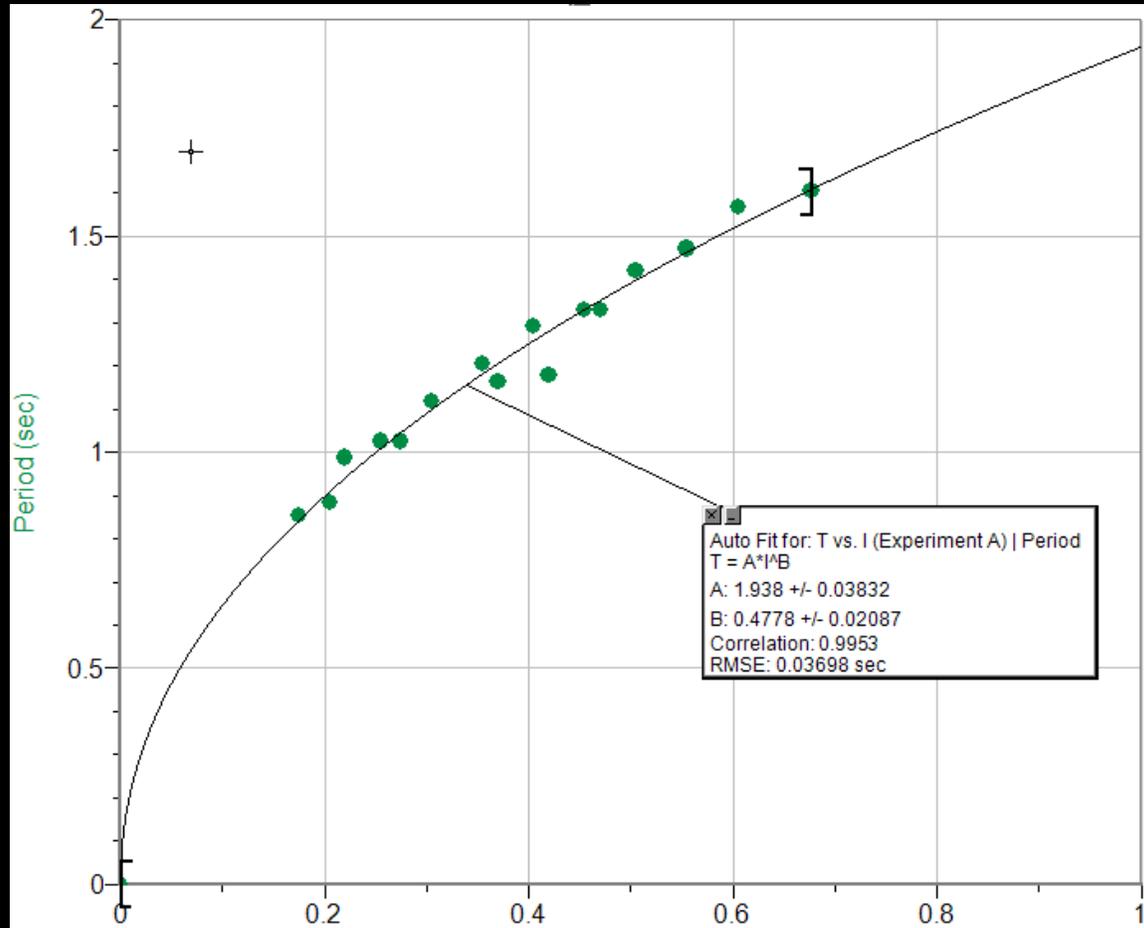
Modeling Paradigm Lab

The main goal of this experiment is to shape a student's understanding of the nature of science. Modeling paradigm labs are intended to:

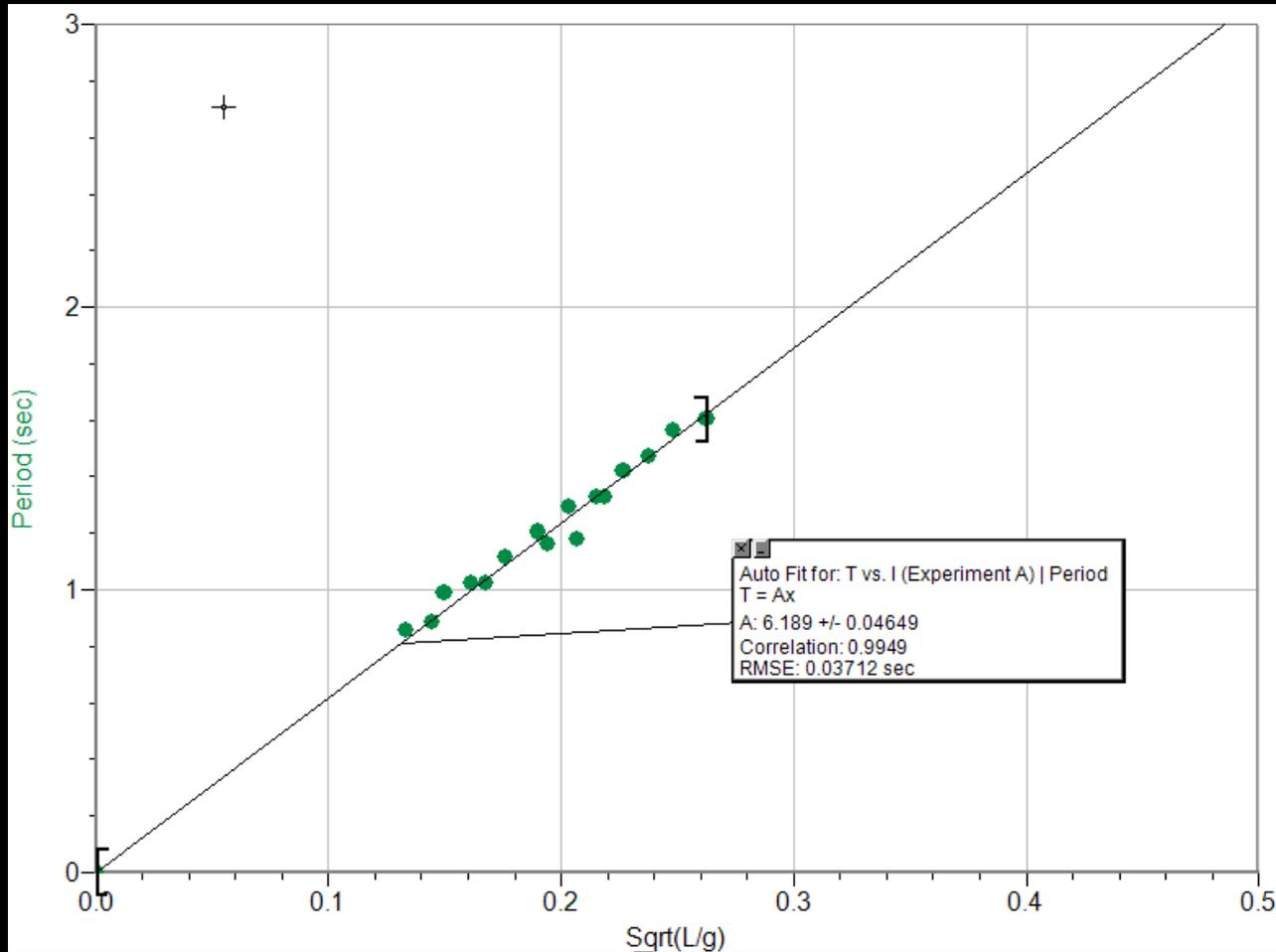
- highlight *most* aspects of the scientific modeling process
- present a thorough introduction to a particular scientific idea or model



Pendulum Results



Pendulum Results



Conclusion:



Modeling Paradigm Lab Summary

- Initial observation of a key physical phenomenon
- Pre-laboratory concept map (plan of investigation)
- Experimental predictions
- Data collection (execution of the plan)
- Data analysis
 - Evaluation of errors and uncertainties*
 - Line straightening and/or curve fitting*
 - Extraction of mathematical patterns*
 - Comparison of model predictions and data results*

- Data interpretation
 - Physical interpretation of terms and factors*
 - Comparison with literally similar*
 - Comparisons with analogous systems*
- Future research
 - New research questions*
 - New predictions*

GAME OVER



LEVEL UP!

OK!