Effects of a Prior Virtual Experience on Students' Interpretations of Real Data Jacquelyn J. Chini¹, Adrian Carmichael¹, Elizabeth Gire¹, N. Sanjay Rebello¹ and Sadhana Puntambekar² SUPER ¹Department of Physics, Kansas State University; ²Dept. of Educational Psychology, Univ. of Wisconsin

Introduction

- Students who used a computer simulation scored better on conceptual test questions related to work than students who performed a physical experiment (Gire *et al.*, 2010)
- May be related to "messy" and ambiguous data in physical experiment
- Research question: Does the sequence in which students perform physical and virtual experiments affect how they interpret data about work from the physical experiment?

Methodology

- Participants: Students in conceptual-based physics laboratory
- Students completed similar activities about pulleys and inclined planes with physical and virtual manipulatives and answered analysis questions

Analysis: Inclined Plane Questions

•Students responded to the question "How does the work (input) needed to move the load change as the length of the ramp increases?"

VP PV



	Pulley Activity	Inclined Plane Activity
Physical-Virtual (PV) Sequence	N= 67	N=53
Virtual-Physical (VP) Sequence	N=58	N=57

• Worksheet responses about work and potential energy in the physical experiment were coded and analyzed with chi-square test



Theoretical Framework

•Students responded to the question "How do the work (input) and potential energy compare when there is friction?"

■ VP ■ PV



• Chinn and Brewer (1993) described the possible stances toward anomalous data: *ignore* data, *reject* data, *exclude* data, hold data in *abeyance*, *reinterpret* data while maintaining theory, make *peripheral theory change, change theory*

•Data viewed as not credible can be easily *rejected*

•Ambiguous data can be easily *reinterpreted*

Analysis: Pulley Questions

• Students responded to the question "Based on your data, when you changed the pulley setup, how did it affect the work required to lift the object?" VP PV



• χ^2 (4, N=121)=59.2, p<.001, V=.699

* *Circled categories indicate adjusted residuals greater than 1.96**

Number of Students

• Students responded to the question "Based on your data, how does work compare to potential energy for a given pulley system?"



Discussion & Conclusions

•Students in the VP sequence were more likely to interpret physical data to indicate work was constant or nearly constant across machines.

- •Virtual activity produces data that is easily interpreted to indicate work does not vary across machines.
- •Physical activity produces ambiguous data, which Chinn and Brewer's framework suggests may be easily reinterpreted.
- •Students also trust the simulation over the physical experiment (Chini et al., 2010) which may lead to rejection of the physical data.
- •Students in the PV sequence were more likely to talk about work and potential energy separately while students in the VP sequence were more likely to make comparisons.

•It appears a prior virtual experience prepares students to make more productive interpretations of physical data.

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